FINAL EVALUATION REPORT

BERLIN

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Abbreviations

AG	Aktiengesellschaft
CNG	Compressed Natural Gas
CO	Carbon monoxide
CO_2	Carbon dioxide
CTS	Centre for Technology and Society
BEHALA	Berliner Hafen- und Lagerhausgesellschaft mbH
BVG	Berliner Verkehrsbetriebe
Daisy	Dynamisches Auskunfts- und Informationssystem
DB	Deutsche Bahn
DIFU	Deutsches Institut für Urbanistik (German Institute of Urban Affairs)
DKB	Deutsche Kreditbank
DOW	Description of Work
EEV	Enhanced Environmentally Friendly Vehicle
e.g.	exempli gratia
EU	European Union
FAV	Forschungs- und Anwendungsverbund Verkehrssystemtechnik
GASAG	Berliner Gaswerke Aktiengesellschaft
GmbH	Gesellschaft mit beschränkter Haftung
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communication
GVWR	Gross Vehicle Weight Rating
HDV	Heavy Duty Vehicle
i.e.	id est
IT	Information Technology
ITEMS	Integrated Transport Effects Modelling System
IVP	Integrierte Verkehrsplanung (Integrated Transportation Planning)
kg	kilogramme
km	kilometer
kW/h	kilowatt hour
LEM	Local Evaluation Manager(s)
MAESTRO	Monitoring Assessment and Evaluation of Transport Policy Option in Europe
METEOR	Monitoring and Evaluation of Transport and Energy Oriented Radical strategies for clean urban transport
MFC	Metropolitan Fleet Car
n.a.	not applicable
NG	Natural Gas

NO	Nitrogen Monoxide
NOx	Nitrogen Oxide
NVP	Nahverkehrsplan (Local Public Transport Plan)
ÖPNV	Öffentlicher Personennahverkehr
PDA	Personal Digital Assistant
P.O.P.	Partnerschaftsgesellschaft für Organisations- und Personalentwicklung
PM	Particulate Matter
PT	Public Transport
RBL	Rechnergestütztes Betriebsleitsystem
SMS	Short Message Service
StEP	Stadtentwicklungsplan Verkehr (Integrated Transport Plan)
StVO	Straßenverkehrsordnung
t	ton
tkm	tonkilometres
TELLUS	Transport & Environment aLLiance for Urban Sustainability
TEP	TELLUS Evaluation Plan
TPS	Tele Parking System
TUT	Tausend Umwelt Taxis
UMTS	Universal Mobile Telecommunications Systems
VBB	Verkehrsverbund Berlin Brandenburg
WAP	Wireless Application Protocol
WP	Work Package
WZB	Wissenschaftszentrum Berlin für Sozialforschung (Social Science Research Centre Berlin)

A INTRODUCTION

A.1 General Remarks

The Final Evaluation Report provides an overview of the evaluation activities carried out in the course of the TELLUS project in Berlin. These activities were based on the methodology stated in the Local Evaluation Plan Berlin[1] and processed information derived from TELLUS reporting, regular meetings and interviews with the demonstrators, as well as data collected by means of surveys and measurements.

The Final Evaluation Report will provide information on:

- The implementation process of the measures,
- the framework conditions that promoted (drivers) or hindered (barriers) the success of the measure,
- impacts of the measures (as far as available at this stage),
- the development of the TELLUS Key Indicators,
- the grade, to which the stated objectives have been achieved.

The report is divided into five parts plus ANNEX: Part A “Introduction”, Part B “Evaluation on demonstration measure level”, Part C “Evaluation on city level” and Part D “Final Conclusions”.

Part A introduces the TELLUS landscape in Berlin, the types and strategies of the demonstration measures and the thematic clusters covered by the ten demonstration measures. Furthermore it is explained how the measures fit in with the overall transport strategy of the city. Part A is completed by a brief introduction of the different actors constituting the local evaluation team.

The following Part B contains the evaluation on measure level.

The evaluation on city level (Part C) contains the TELLUS Key Indicators and their respective measurements. Furthermore, Part C also contains a comprehensive overview of the activities carried out with regard to the participatory evaluation.

Part D summarises the lessons learned and results of the TELLUS project in Berlin in form of final conclusions.

[1] TELLUS Local Evaluation Plan Berlin, issued in June 2003

A.2 TELLUS landscape in Berlin

1 Demonstration measures

1.1 Status and type

The Berlin part of the TELLUS project consisted of 10 demonstration measures, which differed widely regarding contents, type and underlying policies.

While the majority of the demonstration measures dealt with the implementation of technical innovations, the Berlin part of the TELLUS project also put emphasis on measures that focussed on the development and implementation of social and organisational innovations.

Table 1 provides an overview of the different TELLUS measures in Berlin, their type, underlying strategy and policy.

Table 1: TELLUS Demonstration measures in Berlin[2]

Name of demonstration measure	Type of demonstration measure	Strategy	Policy
6.4 Mobile Parking	Concept development and implementation	On-street parking management with time adjusted pricing, parking enforcement	Increase cost efficiency
6.5 Road Network and Concept for HD Vehicles Road Pricing	Concept development	Emission-based road-pricing for HDV-traffic	Internalise external costs of transport
7.5 Future Management of Urban Public Transport	Concept development	New concepts for public transport under competition	Changing modal split towards Public Urban Transport by increasing service quality
8.4 Metropolitan Fleet Car	Concept development with Implementation	Provision of vehicle fleets for private use through car-sharing	Optimising capacity-utilisation
8.5 Car Modal	Concept development with Implementation	Provision of CharterCab in peripheral areas with low public transport service	Reduction of private car use and single occupancy by offering alternative solutions for mobility (flexible PT service), enhance PT access
9.3 Inner City Logistics Centre	Implementation	Supporting measures for tri-modal inner city logistics centre, promotion of clean vehicles, intermodal freight transport	Changing modal split in freight transport towards sustainable modes, improving intermodal co-ordination
9.4 New Forms of Financing-Contracts for HG Vehicles	Concept development with Implementation	New concepts for leasing	Encouraging the use of clean vehicles
10.4 Customer and User Participation	Implementation	User oriented approach	Increasing public participation in the field of transport
11.6 Dynamic Real-Time Passenger Information for Trams and Buses	Implementation	Dynamic real-time passenger information for PT	Changing the modal split towards Public Transport by improving the quality of passenger information
12.6 Introduction of CNG-powered Vehicles	Implementation	Promotion and Incentives for CNG-vehicles	Encouraging the use of clean vehicles

Out of the ten measures, two focussed on concept development, four were concerned with the development and later implementation of a concept or technology respectively, and another four of the demonstration measures started directly with implementation.

[2] TELLUS Local Evaluation Plan Berlin, issued in June 2003

1.2 Geographical context

The demonstration measures also took place in different geographical contexts. The differences in spatial contexts of the measures are relevant for the reference area of the impact-related evaluation. Taking the different geographical foci into account is important for both, the impact evaluation on measure and on city level.

What is more, some of the measures (6.5, 7.5, 9.4, 10.4) did not have a distinct geographical focus at all but adressed either the city as a whole, or else they were concerned with processes and structures (conceptual measures), which can not be spatially located.

Furthermore, the geographical context influences the potential for interaction between the different measures as well as the grade of possible synergy effects.

The potential for interactions between the demonstration measures in Berlin was somewhat limited due to their geographical isolation and the dimension of the measures. Most of the measures were rather small scale and geographically separated from other demonstration areas. Consequently, the impacts on city level were rather low, thus the focus of the evaluation lies on demonstration measure level.

2 Thematic clusters

The demonstration measures can be clustered according to the thematic field they address. The clustering allows the comparison of the demonstration measures, their implementation and outcome as well as their evaluation results with measures of the same cluster carried out in the different TELLUS cities.

Regarding the thematic clusters agreed upon with the other TELLUS project cities, TELLUS Berlin covers all but three of the classified thematic areas (Table 2). Four out of the 10 measures can not be clustered, which is due to the distinct character of these projects. Both, measure 6.5 and 7.5 are conceptual studies, which, while being thematically associated with the other clusters, in regard to their impacts do not strictly belong to these. Demonstration measure 9.3 performed only partly, so that no allocation to a specific cluster is possible. Additionally, measure 10.4 is a horizontal measure associated with different thematic areas.

Table 2: Thematic clusters covered by TELLUS Berlin

Demonstration measure	Promotion of clean vehicles	Pricing strategies	Increasing attractiveness of PT	Distribution of goods	Innovative mobility services	Access restrictions	Parking management	Others
6.4 Mobile Parking							■	
6.5 Concept for HD vehicles road pricing								■
7.5 Future Management of urban public transport								■
8.4 Metropolitan Fleet Car –business/private shared use of fleet cars					■			
8.5 Car Modal –new service for organised passenger transport in private cars					■			
9.3 Inner-city logistics centre								■
9.4 New forms of financing-contract for NG vehicles	■							
10.4 Customer and user participation								■
11.6 Dynamic real-time passenger information for trams and buses			■					
12.6 Introduction of CNG-powered vehicles	■							

3 Integration into local transport policy

The TELLUS demonstration measures in Berlin were not an isolated attempt to organise urban transport in a more sustainable way, but instead they are related to the city's integrated local transport policy.

Since 2000, an Integrated Transport Plan (Stadtentwicklungsplan Verkehr, StEP)[3] has been developed and implemented by the Berlin Senate Department of Urban Development. The StEP is a strategic plan proposing a bundle of 60 measures to be implemented within the next decade. The focus of the plan is not, as it had been in previous years, the further extension and improvement of infrastructure, but its intelligent use. Thus, pricing and organisational measures, strategies addressing the political framework and soft policies are all of major importance. The StEP outlines social, environmental and economic objectives for the development of urban transport and shows integrated strategies to attain these goals.

[3] Senatsverwaltung für Stadtentwicklung (ed.) (2003)

Several of these objectives, which were identified to be important for the further development of the urban transport in Berlin, correspond with the TELLUS quantified objectives; or rather the latter were directly derived from the former. These include:

- Reduction of traffic related CO_2 emissions
- Reduction of air pollution
- Reduction of noise
- Reduction of NO_2
- Reduction of PM_{10}

The Berlin TELLUS measures are integrated in the strategies and measures of the StEP. For instance, the demonstration measures “Dynamic Real-Time Passenger Information for Trams and Buses“ and “Car Modal“ are modules of the modal shift strategy favouring public transport. Likewise, the stimulation of the use of “CNG-powered vehicles” is an important module of the strategy aiming at clean urban freight transport. “Future Management of Public Urban Transport” is integrated in the category of pricing and regulatory measures, and furthermore it supports StEP measures of the organisational category.

4 Actors of evaluation

The evaluation in Berlin was carried out by various actors – the Evaluation Consortium, the Local Evaluation Manager (IVP TU Berlin) and the demonstrators.

The Evaluation Consortium consisted of representatives providing environmental (Öko-Institut e.V.), social (WZB Social Science Research Center Berlin) and transport expertise (IVP Department of Integrated Transport Planning TU Berlin) supported by representatives of the Participatory Evaluation (CTS Centre for Technology and Society TU Berlin) and members of the Berlin Senate Department of Urban Development.

The integration of the evaluation work done by the Berlin evaluation team into the European TELLUS evaluation context was secured by the regular meetings and exchange with the evaluation managers of the other TELLUS cities. Thereby Berlin having the European Evaluation Manager as a member of the evaluation team played a leading role in the development of the evaluation concept. Furthermore there was a close co-operation and exchange with the METEOR evaluation team and the evaluation managers of the other CIVITAS projects in order to harmonise the evaluation approaches and make the results comparable.

Throughout the life cycle of TELLUS, the consortium had met regularly to discuss issues related to the local evaluation and decide on the procedure to be chosen. The consortium jointly developed proposals for the evaluation of the specific demonstration measures, which were then passed on to and discussed with the demonstrators by the Local Evaluation Manager. Moreover, the consortium offered consultation and support to the demonstration

measures when it came to choosing evaluation and monitoring instruments, design surveys, etc.

However, the demonstration measures themselves were responsible for carrying out monitoring activities as stated in the indicator list. Therefore, close co-operation was needed between the Local Evaluation Manager as a representative of the Consortium on the one hand and the demonstrators on the other to ensure both quality standards of the evaluation and monitoring as well as consideration of the possibilities and needs of the demonstration measures.

An additional component of the evaluation in Berlin was the Participatory Evaluation carried out by the Centre for Technology and Society of the Technical University Berlin.

B EVALUATION ON DEMONSTRATION MEASURE LEVEL

B.1 Approach

1 Overview

Part B contains the evaluation reports on measure level. The introductory part B1 first provides a brief outline of the evaluation criteria, an explanation of the objectives on different levels as well as brief remarks on the various spheres of evaluation (process, concept, impact). The next chapters present the evaluation of the measures itself. In order to provide for comparability, the evaluation of every measure adheres to the same report structure:

1. The **introduction** gives brief reference to the type, strategy and policy context of each measure as well as first information on the demonstrator and, if applicable, modifications to the original plan or strategy.
2. The **description of the demonstration measure** outlines the original demonstration design as stated in the Description of Work (DOW)[4], the transport plan context and the different level objectives as provided in the Evaluation Plan. It concludes with a brief description of the situation before TELLUS and the innovative aspects of the demonstration measure.
3. The third chapter of every report contains the actual **implementation process** of the measure as undertaken throughout its life cycle.
4. Chapter 4 provides **results** of the evaluation, in particular with regard to the impact evaluation. The respective part of the chapter is sub-divided into first, a description of the evaluation methods, and second, the impacts themselves clustered around the evaluation areas that apply to the measure. The impact section also contains information on the effects the measure had on the public awareness regarding TELLUS. By and large, there are three different fields of evaluation considered for this report: the impact / concept related evaluation, the process related evaluation and the objectives-related evaluation.
5. The **conclusion** chapter gives an overall assessment of the demonstration measure. The conclusion of the process evaluation aims at stating drivers and barriers that either promoted or else hindered the implementation and/or success of the measure. The drivers and barriers refer to both, events and circumstances directly related to the measure itself, or else framework conditions, which turned out to play an important role. What is more, this chapter also includes the resume with an overview of the grade of achievement of the objectives.

[4] Description of work, ANNEX A TELLUS Project descriptions, issued 29 October 2001

6. **Scenarios** were developed for some of the measures with the aim of estimating the likely impacts of the measures for the time frame 2006-2015[5] if implemented on a larger scale (contents wise and with regard to geographical context).

2 Types of evaluation

2.1 Impact-related evaluation

The impact-related evaluation is based on the Local Evaluation Plan for Berlin, which presented a detailed outline of the evaluation areas, evaluation categories, impacts and indicators considered relevant for the assessment of each demonstration measure. These were developed on the basis of the MAESTRO guidelines[6] and had been worked out in a discussion process between evaluation consortium and demonstrators.

In total there are five different evaluation areas: transport, society, economy, environment, and energy. Naturally and due to the varying character of the Berlin TELLUS measures, these five areas do not apply to all of the measures to the same extent. Therefore, only the evaluation areas relevant for the individual case have been considered in the course of the evaluation. The impacts-chapter of each individual evaluation report on measure level will thus state these areas and the impacts achieved therein.

The conceptual measures will be evaluated according to the evaluation criteria and objectives stated in the Local Evaluation Plan.

2.2 Process-related evaluation

In the initial evaluation concept the process-related evaluation was concerned with the achievements of the measures regarding the provision of services, products and other planned benefits. However, in the course of the TELLUS project, it turned out that the factors influencing the outcome of the measure, i.e. the drivers of and barriers to success, are of far more importance both, to the demonstrators and to the evaluation team. Especially in cases where the implementation could not be carried out as planned, information on why it did not work out is crucial for follow-up projects. The information needed for the process-related evaluation is mainly derived from interviews with the demonstrators and TELLUS reporting.

[5] This time frame matches the one of the scenarios developed in the context of the Integrated Transport Plan Berlin.

[6] EU-Project under Transport Research 4th Framework Programme MAESTRO *Monitoring Assessment and Evaluation of Transport Policy Options in Europe* (MAESTRO is intended to provide practical advice on the selection, design and evaluation of transport-related pilot and demonstration projects)

2.3 TELLUS objectives-related evaluation

The objective-related evaluation aims at assessing the overall contribution of the measures to the ultimate goal of achieving more sustainable urban transport. Since the quantification of the TELLUS objectives distinguishes between two different time frames (2002-2006 for the intermediate and 2006-2010 for the ultimate objectives), the objectives relevant for the demonstration measures are stated according to this categorisation. The achievement of objectives until 2006 will be assessed in the resume, while the long-term perspective, i.e. the estimation of impacts for the time beyond TELLUS, will be carried out by means of scenario building. Thereby for Berlin the reference time frame for this assessment has been extended to the year 2015 due to the time frame of the Integrated Transport Plan and related data availability issues.

3 Objectives

The objectives of the demonstration measures are divided into three levels.

Immediate objectives (demonstration measure-related objectives)

Immediate objectives are the objectives that are directly related to the implementation of the demonstration measure. They are concerned with the actions to be undertaken during the implementation of the demonstration measure.

These objectives are taken from the Description of Work and are supplemented with information from interviews with the demonstrators. The indicators related to this objectives have been monitored during the life cycle of the demonstration measure in the so-called process-, concept- and impact-related evaluation.

Intermediate objectives

Intermediate objectives relate to the effects that are expected to be generated by the implemented measure. In most cases they are associated with a wider implementation and can serve as a logical link between the demonstration measure-related implementation objectives and the TELLUS objectives on city level.

The intermediate objectives have been worked out by the Local Evaluation Manager and the demonstrators.

A majority of these intermediate objectives could not be monitored formally within TELLUS, since the introduction of the measures beyond mere demonstration was not part of the project life cycle.

Ultimate objectives

The ultimate objectives refer to the desired long-term impacts of the measures. In many cases, these objectives are identical with the TELLUS quantified objectives. Due to the short-term character and the often low level of implementation of the measures these objectives will not be assessed within the TELLUS project life cycle. The estimation of the future impacts of the upscaled measures and the assessment of the related objectives will be carried out by means of scenario building (if applicable) for the time horizon 2006-2015.

4 Scenarios

Often difficult implementation processes led to delays and consequently to the situation that effects of the measures during the project time were not visible and measurable. But this did not mean that there will be no impacts at all. Again, the measures that try to influence long established mobility routines of people or measures that require a change of legal framework in order to be implemented can only be the start of a longer process. Therefore, they can not be finally assessed in this context regarding their benefit in terms of the environmental, social and economical sphere of the city.

In order to nevertheless estimate the potential long-term impacts of the TELLUS measure in Berlin, the results of the measure implementation during the life cycle of TELLUS were used as starting point for further assessment. The experiences made during the implementation were further supplemented with data and information derived from other studies and projects as well as from the Integrated Transport Plan, and assumptions were made as to the possible future outcome of the measures if performed on a larger scale. It has to be noted that the development of the scenarios does not follow the methodology and techniques usually applied to scenario building. For example, instead of developing two extreme scenarios in order to reflect the bandwidth of the possible future developments, the course of the scenarios was determined by the TELLUS objectives. Thereby current and future developments of external factors determining the results of the scenarios were thoroughly considered and taken into account. Thus, the scenarios developed for the purpose of upscaling the TELLUS measures do meet a large number of characteristics generally allocated to methodologically true scenarios, e.g.:

- they are creative-intuitive and combine singly data and determining factors to create descriptive and vivid “pictures of the future”,
- they are transparent in that all of the information used as well as underlying assumptions and hypotheses are presented and explained,
- they are critical, i.e. they also name probably risks and negative effects and consider the likelihood of other than the targeted outcomes,

- they are multidimensional and holistic, since they do consider a multitude of transport and not-transport related effects, thus aiming at including the various spheres of sustainability,
- they are both, practical and normative, i.e. they are based on and targeted at common values of our society and – as outlined above – they do reflect the practically necessary steps that need to be taken in order to achieve the envisaged outcomes.[7]

The projections were made taking the present situation as the base year and the year 2015 as ultimate time horizon. In some cases, this also implies changes in the design and operating conditions of the measure in order to meet future conditions and incorporate the lessons learned in TELLUS.

Four[8] TELLUS measures went to a comprehensive process of upscaling and projecting that involved the following three major steps:

1) The evaluation team took the results of the measures in TELLUS plus additional information and developed assumptions and hypothesis as to the maximum possible scale of implementation, the necessary framework conditions and likely line of developments including outcomes on city level. While the main emphasis was put on the potential environmental impacts, other aspects relating to the TELLUS evaluation areas were also considered.
2) The thus developed story lines were presented to a number of selected experts during a workshop hosted by the evaluation team on 2nd June 2005. The workshop consisted of two thematically clustered parts “New mobility services” and “Clean freight transport”. The experts[9] commented on the presentations, the underlying assumptions and the projected outcome, and additionally they identified issues that needed further exploration.
3) The minutes of the workshop were later passed on to the experts again and offered the opportunity of more detailed commenting.

The results of all three steps were then used to finalise the analysis of the future potentials of the measures. The main findings of the projections are presented in the scenario-chapter of each of the respective measures. Additionally, in the case of measure 8.5 Car Modal, an extended scenario version can be found in ANNEX 3.

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[7] List of characteristics based on Gerdes (2005)

[8] For a fifth measure the scenario developed in the local transport plan is included in this report.

[9] Participants were representatives of the following institutions: Daimler Chrysler AG; Federal Environmental Agency (UBA); Freie Universität Berlin, Institute for Geographic Sciences; Nexus GmbH; Senate Department of Urban Development; Social Science Research Center Berlin (WZB); Technical University of Hamburg - Harburg, Research Unit Transportation Systems and Logistics; Traffic-Kontor GmbH; Verkehrsclub Deutschland (VCD)

The structure of each of the scenarios is similar and contains an introduction followed by the description of the measure in 2015 and the framework conditions that need to be fulfilled. The actual analysis is carried out in accordance with the evaluation areas as determined in the Local Evaluation Plan for Berlin.

B.2 Demonstration Measure 6.4 – Tele-Parking System/Mobile Parking

1 Introduction

The demonstration measure "Tele-Parking System/Mobile Parking" belongs to those Berlin measures conceptualising and implementing a technical innovation. A new technology for on-street parking management with time adjusted pricing and eased parking enforcement was to be provided to increase cost efficiency of parking management and to make parking transactions easier for the users.

The consortium consisted of three partners: The system was provided by Teleparking Systems Ltd., Israel (TPS) – later renamed MOBIPOWER Ltd. The Forschungs- und Anwendungsverbund Verkehrssystemtechnik Berlin (FAV, Transport Technology Systems Network Berlin) supported negotiations with local administrative and potential business partners. The Senatsverwaltung für Stadtentwicklung (Senate Department of Urban Development) further supported those processes as well.

In a later phase of the demonstration measure Mobile Parking[10] GmbH, Vienna, replaced MOBIPOWER. The demonstration encountered several problems, which finally let to the engagement of the different system provider Mobile Parking, who applies a different technological concept. This concept is described in Chapter 3.

2 Description of demonstration measure

2.1 Demonstration design[11]

The demonstration measure "Tele-Parking System/Mobile Parking" aimed at introducing a new parking management system in Berlin. This system was supposed to use an innovative technology, which would enable a more flexible and more cost-efficient management of charged parking. Applying special modern mobile communication devices, the system replaces traditional payment, enforcement and fee collection methods. Cars and lorries should be equipped with so called in-board units, which are activated and deactivated for the particular parking process. With its activation the in-car unit would have displayed parking rates and maximum allowed time; with its deactivation it would have displayed the resulting parking charge. Current municipal parking fees and individual parking data would have been transmitted from and to a central computing unit. The user's parking transactions were supposed to be billed monthly.

[10] Mobile Parking was taken over by M-Parking. To keep the report readable we use the initial introduced term "Mobile Parking".

[11] Description of work, ANNEX A TELLUS Project descriptions, issued 29 October 2001

This kind of system would have allowed precise accounting and even an efficient way of dealing with illegal or fraudulent on-street parking. The system should also have enabled more flexibility regarding the application of variable pricing schemes for influencing the parking demand.

The parking system was supposed to be realised in a specified area within the city centre to demonstrate its practical use and acceptance.

As a further part of the demonstration a suitable public-private partnership should have been constituted to prepare the wider introduction after successful demonstration.

2.2 Transport Plan context[12]

Berlin's Integrated Transport Plan refers to on-street parking regulation in manifold ways. It is considered a very important instrument to influence the city's development of traffic conditions. For instance, travel by private car into the city centre should be reduced through establishing and expanding areas with charged parking. Although the Integrated Transport Plan does not mention specific innovative forms of parking management or billing procedures, there are at least two possible positive impacts of such systems which lead administrations to systematically try them out: a) Mobile Parking may ease parking payment and may enable a more just accounting of parking fees (per minutes). Therefore it could enhance the acceptance of regulated parking zones. b) The operating costs of parking management could decrease. Mobile Parking would improve the efficiency of such measures.[13]

2.3 Objectives

In co-operation with the evaluation team the work package set itself objectives on different levels addressing short-term outputs and long-term outcomes as well as intermediate steps. Beside the documentation of the implementation process these objectives form the basis for the evaluation.

The presented objectives were originally developed with TPS but kept their relevance for Mobile Parking despite the target value of the group of test persons. For TPS with 300 persons this was compared with the envisaged potential of 10,000 persons for Mobile Parking a relatively small size. Reason for that was the different system applied. For TPS a special device would have to be acquired for the test persons which would have limited the size of the test group within the demonstration.

[12] Senatsverwaltung für Stadtentwicklung (ed.) (2003)
[13] confer Boltze et al. (2005: 11)

INTERMEDIATE OBJECTIVES

Recruitment of [300] test persons

Implementation of the Tele Parking system in the demonstration area

Making parking management more flexible

Achieve extensive political and public awareness for TELLUS

Improve public-private co-operation

IMMEDIATE OBJECTIVES

Change in legal framework

Full scale implementation in Berlin

Making parking management more cost efficient/convenient

Enhance acceptability of parking management

ULTIMATE OBJECTIVES

Implementation in other German cities

Achieve modal shift by parking management

Reduce car kilometres

2.4 Situation before TELLUS / Innovative aspects

In Berlin, zones with charged parking have existed for some years already, especially in the city centre and in some sub-centres. There is a fixed level of charges; flexible pricing schemes can not be used. The users have to estimate the probable parking time and pay the resulting fare in advance. A large number of on-street parking meters has been installed (and many more are further being installed) for the payment of parking fees using coins. Increasingly new technologies are being employed, which allow at least cashless payment via GeldKarte (an electronic purse system) and support on-line data transmission within the traditional parking management system.

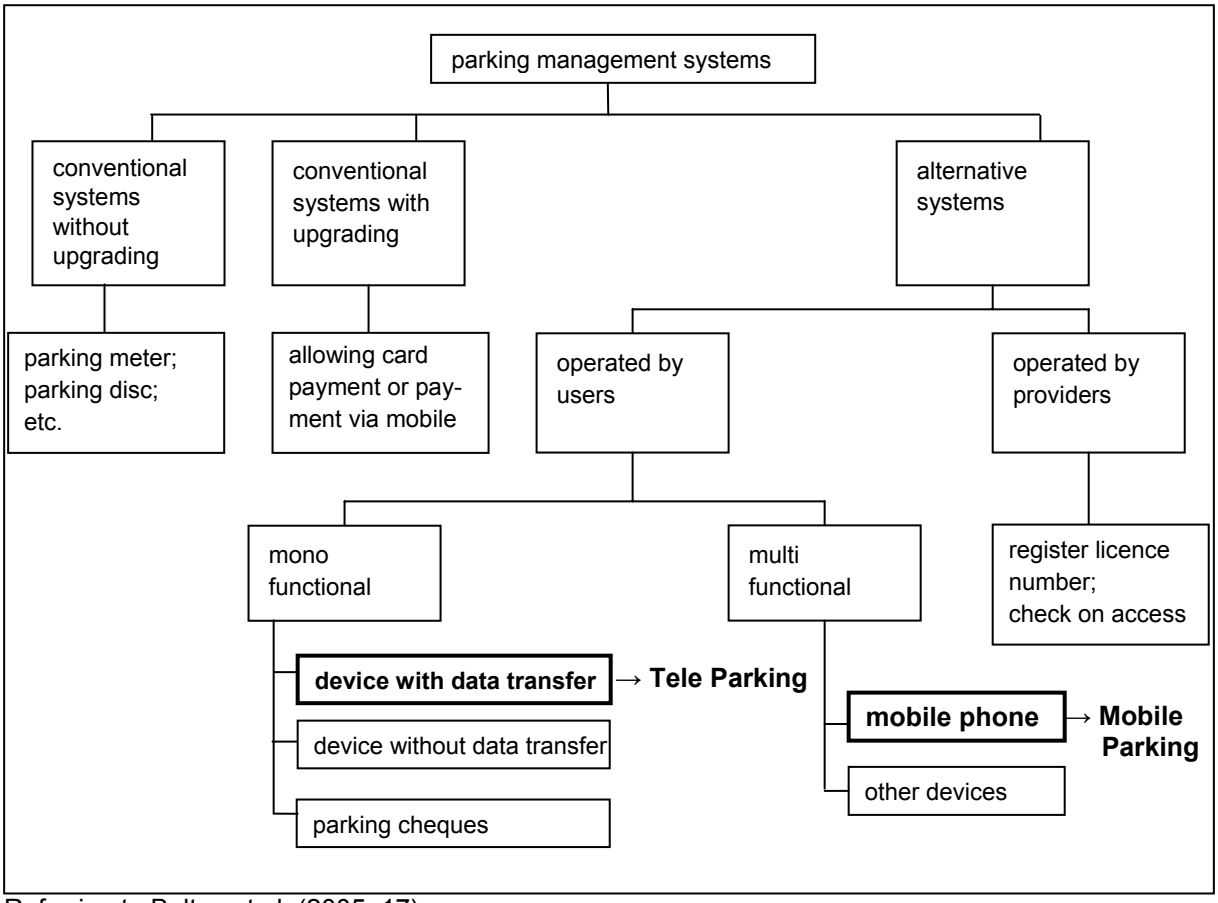
At the beginning of the demonstration the following legal situation applied: The road traffic regulations (Straßenverkehrsordnung, StVO) permitted parking meters and parking permit ticket machines in case of regulated parking. Car owners were required to pay at the beginning of the parking. Therefore they had to estimate the probable parking duration. In any case, a certain minimum (for instance 30 minutes) was effective. The parking ticket had to be placed in the car.

Traditional parking management technologies/systems have some drawbacks regarding e.g. the maintenance effort and the convenience of use. Both TPS and Mobile Parking offered an

innovative technology that was supposed to facilitate an intelligent and cashless parking management. Such systems are able to support principally the implementation of flexible, enforceable and differential parking management policies. Furthermore, the systems can theoretically provide valuable data about parking durations, peak hours, turnover, parking patterns or parking abuse levels. Precondition for the successful running of such a system is the implementation of an intelligent data management system. Furthermore, it must be ensured that the relevant rules for the protection of data privacy do not object to the necessary analysis of parking data.

The following figure shows a parking management system classification where the different approaches of TPS, Mobile Parking and others are methodically introduced. Both of the discussed systems are operated by the users. TPS uses a mono-functional device, whereas Mobile Parking belongs to the alternative systems using a multi-functional device. The figure is based on a contemporary analysis of traditional and alternative parking management systems. Technologies available until September 2003 are taken into account.[14] Most of the alternative technologies at that time were applied in other countries than Germany.

Figure 1: Parking management system classifications



Referring to Boltze et al. (2005: 17)

[14] Boltze et al. (2005: 11)

3 Implementation process

The service

Due to the withdrawal of the main actor, MOBIPOWER, in February 2004, a different parking management system was introduced in February 2005 in two Berlin areas ("City West" and Berlin Mitte District) under the name of "Handy Parken". The new Austrian supplier "Mobile Parking" and its partners offer a technology using mobile phones on the customer side. Users have to register for the service once via the internet. They get a registration certificate, which they display in their cars (vignette). For a particular parking process the user starts with a free phone call using coded numbers for each parking area and ends it again with a phone call. It is also possible to use SMS interaction. Users get charged for parking per every three minutes with rates depending on the particular area (currently between 5 and 15 cents). The resulting fee accounts according to the actual parking duration. Fees get deducted from the customer's account at the end of the month. At first, as in the MOBIPOWER case parking enforcement staff would have had to be equipped with special devices to be able to check legitimate parking of "Mobile Parking"-users. But finally an enforcement technology using normal mobile phones with cameras was introduced. With these devices the user's vignette can be decoded, a data-synchronisation via text-message takes place, and it is possible to determine whether a user actually started the parking procedure and chose the correct rate.

In October 2005 it was decided to expand the service to four additional districts (Steglitz, Friedenau, Friedrichshain and Spandau), therefore now covering all areas under parking management in Berlin.[15]

Influence of potential users

Both suppliers (the initial and the actual one) relied primarily on earlier experiences with similar projects in other countries.

P.O.P. (see demonstration measure 10.4) organised workshops in Berlin where future features of the service were discussed. The participants reflected on the design and content of advertising flyers, which were supposed to accompany the service-introduction. They emphasised a simpler, more user-oriented description of the service that leaves aside confusing technological specifications. As a main result of this co-operation with demonstration measure 10.4 the original service name "Mobile Parking" was adjusted to German language ("Handy Parken").

In addition to that, some sort of “substituted user participation” took place as the FAV strongly promoted a user friendly free call as the standard routine for starting and ending the parking procedure. The default version would have worked with text messages, which can

[15] Project meeting with district representatives and Mr. Tampier from Mobile Parking in Berlin, 18.08.2005

not be offered as a free service. The necessary typing effort would have constituted a certain further barrier. The provider could be convinced to offer the free call arrangement.[16]

Legal situation

The demonstration measure faced a hindering legal situation regarding the administration of on-street parking (federal road traffic regulations – StVO). TPS needed an exceptional permit to legitimate a system using a more flexible parking payment scheme. Also each user would have had to apply for an exceptional permit allowing cashless payment of parking fees. This would have included mandatory undersigning of an acknowledgment about the awareness of getting a penalty if they did not make use of the in-car unit as required by the exceptional permit. In addition to that the demonstration measure had to consider the regulations regarding protection of data privacy.[17]

The exceptional permit for the demonstration measure could be acquired for the limited period of the demonstration. But the fact that only a limited permit could be granted influenced negotiations with mobile network operators and with potential partners for the local TPS service centre negatively.

The system provider was naturally interested in an open-end permit, which would make investments more sensible, negotiations more convincing and would enable an expansion of the service into other parts of Berlin and Germany. For that purpose federal law needed a modification. New legislative rules in favour of more flexible parking regulations were not brought into force before November 2003. Because of the uncertain and disadvantageous legal framework it was agreed that MOBIPOWER would for the time being focus on activities in other countries. Nonetheless, the long period of waiting, costly but fruitless negotiations with potential operators of the local TPS service centre and additional own technological and financial problems created a serious situation for MOBIPOWER. Finally this led to the MOBIPOWER's withdrawal from the project.

Although the new federal law was now advantaging the project's idea, further adjustments of federal state law and accompanying regulations were necessary. This also took a long time and caused severe barriers to the realisation of the demonstration. At the same time Berlin reformed its administrative structure and competences, which required new negotiations with the now responsible representatives of the boroughs. Furthermore, exceptional permits for the individual car owners as users of the new system would be obligatory. This constituted an ongoing serious disadvantage for the demonstration.

[16] Interview evaluation team with FAV, 24.06.05

[17] However, this barrier was overthrown since the new provider was based in a European Union member state. Mobile Parking already fulfilled Austrian data privacy regulations, which allowed for approval in other member states. (Interview evaluation team with FAV, 24.06.05)

Interests

Basically, implementations of alternative systems are driven by the technological providers and not by concerned administrations.[18] Thus, some general conflicts of interests might arise. Regulation of on-street parking is part of the federal and regional administrative competence. Such regulation follows different rules than those for business related activities. The main interest is the legitimate application of related laws. There is no immediate incentive to agree to measures, which make the maintenance of controlled parking zones more efficient or more user-friendly. Even if the local administration is willing to act according to such aims – which was the case in Berlin – there are often only few options due to a legal structure and traditional agreements that make changes very laborious if not impossible.

Regarding cost efficiency the demonstration measure faced for instance the following fact: The Police President was not able to agree to the demonstration until it was ensured that the introduction of the system did not lead to job losses, which was a precondition set by the trade union board.

Further conflict of interests concerned the possibility for the parking system provider to get a share of the earnings. Again the criterion of likely savings of cost and other benefits was not convincing enough.

Those problems are not idiosyncratic ones. Boltze et al. (2005) describe in their basic study about alternative parking management systems in Germany manifold preconditions and necessary adjustments which only allow an implementation of such alternative systems. Legal requirements and a general lack of experiences with those systems make any implementation up to now a certain challenge.

Delayed and altered implementation

Due to the problems mentioned above the implementation of the demonstration was seriously delayed. After two years the initial partner withdrew his commitment due to numerous implementation and own technological/financial problems. Although a new supplier could be found quickly problems with statutory parking maintenance remained. The various changes regarding time schedules, project partners and technical realisation led to the necessity of a contract amendment. The demonstration measure had to await approval of the supposed alterations, which led to further uncertainties regarding necessary funds for the new supplier. Finally all those problems could be resolved, the test trial could start with a technology based on mobile phones and almost immediately numerous interested users could be found. After less than four weeks already 4,000 accounts with 4,807 phones were registered.[19]

[18] confer Boltze et al. (2005: 87)

[19] Mobile Parking information 25.02.2005

Outlook

"Handy Parken" is now available at all areas with parking management. The test phase was prolonged until March 2006, whereby the demonstrator has offered to cover the cost for the period January to March 2006 himself. Furthermore, negotiations between the demonstrator and the Berlin districts are underway with the aim to further extent the availability of the service up to the end of 2007, i.e. as long as the special permit issued by the federal ministry is in force. Berlin's district administrations are so far satisfied with the service and regard it as a future orientated. However, they do need an economic efficiency calculation before they can decide about any further continuation of the service. An empirical study of parking is planned.[20]

4 Results

4.1 Evaluation methods

Some of the data sources initially planned to make use of could not be obtained as intended in the Local Evaluation Plan. Most of the impacts or indicators, which were supposed to be measured using this data, could nevertheless be directly or indirectly derived from other information sources, such as interviews with involved persons, information gained in project and other meetings, literature review, etc. The following Figure 2 presents the alterations in more detail.

Besides, because of the changes in the demonstration design some of the data sources became redundant: In the MOBIPOWER case interested users would have had to buy the additional in-car unit. That might have caused problems with attracting the intended amount of users. It was planned to sell the units at a more or less symbolic price ranging between 20 and 50 Euro. The Mobile Parking system relies instead on the widespread usage of mobile phones. Users do not need an additional one-purpose device. The Mobile Parking design allows drawing direct conclusions about the general user acceptance from the development of registered customers. Linking the registration numbers with the general user acceptance of the service appears to be justified because Mobile Parking relied mainly on word of mouth advertising.

[20] Project meeting with district representatives and Mr. Tampier from Mobile Parking in Berlin, 18.08.2005

Figure 2: Alternated data sources and substitutes

	Planned data sources	*Substitutes*
Society	user acceptance	
	– interviews with participants before the demonstration start	no substitute
	– documentation of offences (police)	project meetings, service provider information (Mobile Parking)
	acceptance by police	
	– interviews with traffic wardens	project meetings, service provider information (Mobile Parking)
	acceptance by public authority	
	– interview with representative	project meetings; actual behaviour regarding service upholding and/or broadening
	quality of service	
	– data from hotline	information project meetings, service provider information (Mobile Parking)
Economy	costs	
	– model calculations	literature

Due to the delayed and altered implementation it was not possible to fulfil the original evaluation plans regarding the analysis of the user behaviour. Parking activities before the introduction of the new system could not be compared with the parking activities after the implementation of the innovative alternative method.

Regular meetings were held with FAV to gain information about the actual situation, barriers and activities to overcome them. The delayed introduction of the system implicated that no systematic questioning of the users, beginning with their registration, could take place. It was agreed that the evaluation should therefore concentrate on the aspect of technical feasibility and general user acceptance. For that purpose the evaluation team developed a questionnaire. Mobile Parking put the questionnaire on its web-site in August 2005. More than 500 users of the service had filled in the questionnaire until the beginning of October 2005. The results of that survey should not be overestimated as the survey has no representative design. Response to the survey was completely voluntary. Yet since the results are in accordance with other service feedbacks and impressions they can be considered as plausible.

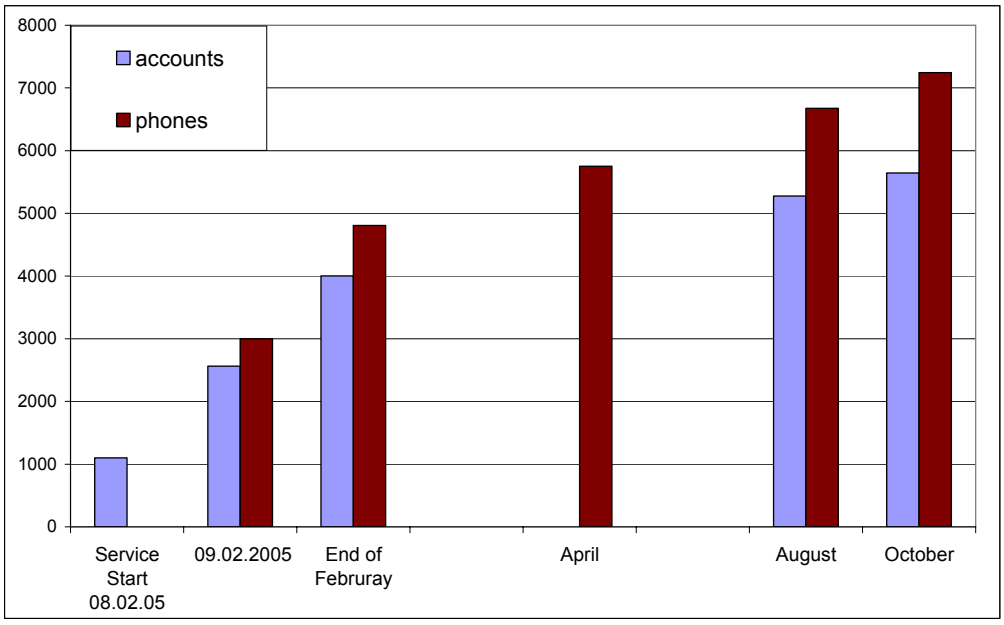
4.2 Impacts

SOCIETY

Customer acceptance

Mobile Parking started the service in the beginning of February 2005 – and from the start it appeared to be self-attractive. Even though no extra marketing measures took place (apart from a press conference that led to several media reports in the local and national press) 1,100 people got registered with the service the very first day of its operation. Two weeks later there were 4,000 registered accounts with even more phones,[21] and approximately 200 parking transactions took place per day via "Handy Parken". In April 2005 already 5,750 phones were registered with 600 parking transactions per day. Additional 25 registrations per day took place. In October there were about 5,600 accounts with about 7,200 phones. The numbers have since continued to rise.

Figure 3: Number of users

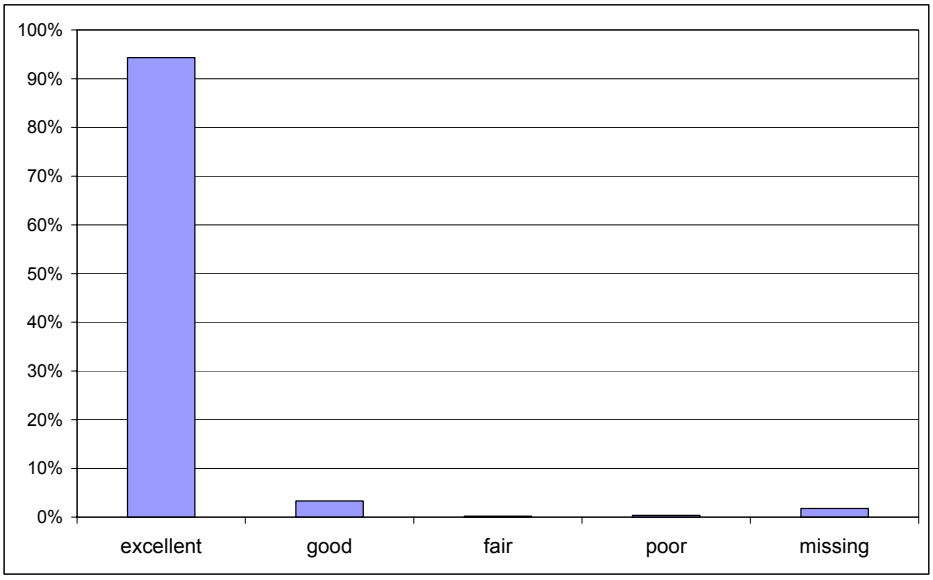


Source: Mobile Parking, analysis evaluation team

In accordance with the constantly rising registration numbers the general approval of the service amongst the survey respondents proved to be very favourable (see Figure 4).

[21] It is possible to assign more than one phone number to one account. Phone numbers can be assigned to a fixed car.

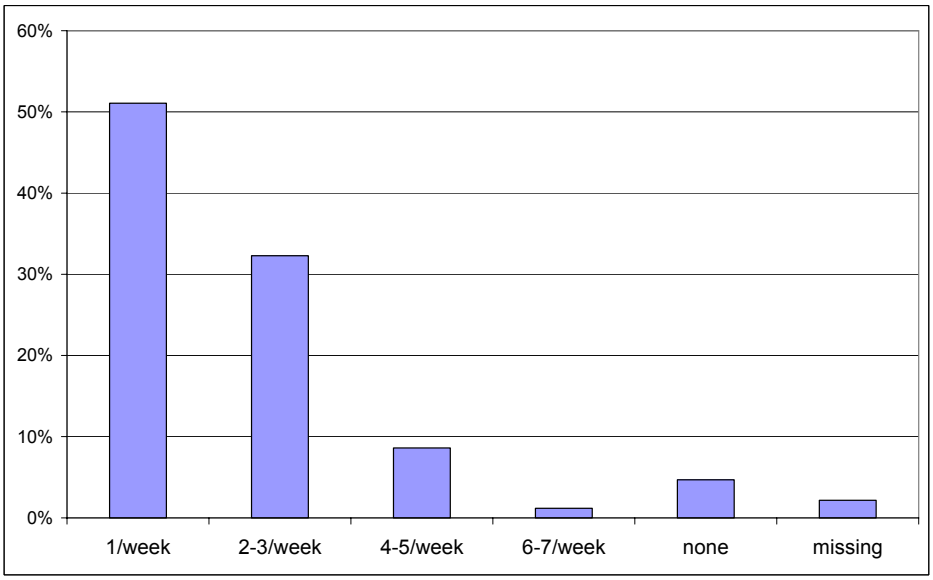
Figure 4: Service acceptance of Handy Parken



Source: Survey evaluation team/Mobile Parking

The survey respondents use "Handy Parken" regularly; mostly 1-3 times a week (see Figure 5). It must be noted however that due to the self-selective character of the survey, i.e. only the user characteristics of those who visited the web-site during the survey period were considered, there might be some differences of the results in comparison with the actual data on parking events and durations as provided in Figure 8.

Figure 5: Distribution of use frequency



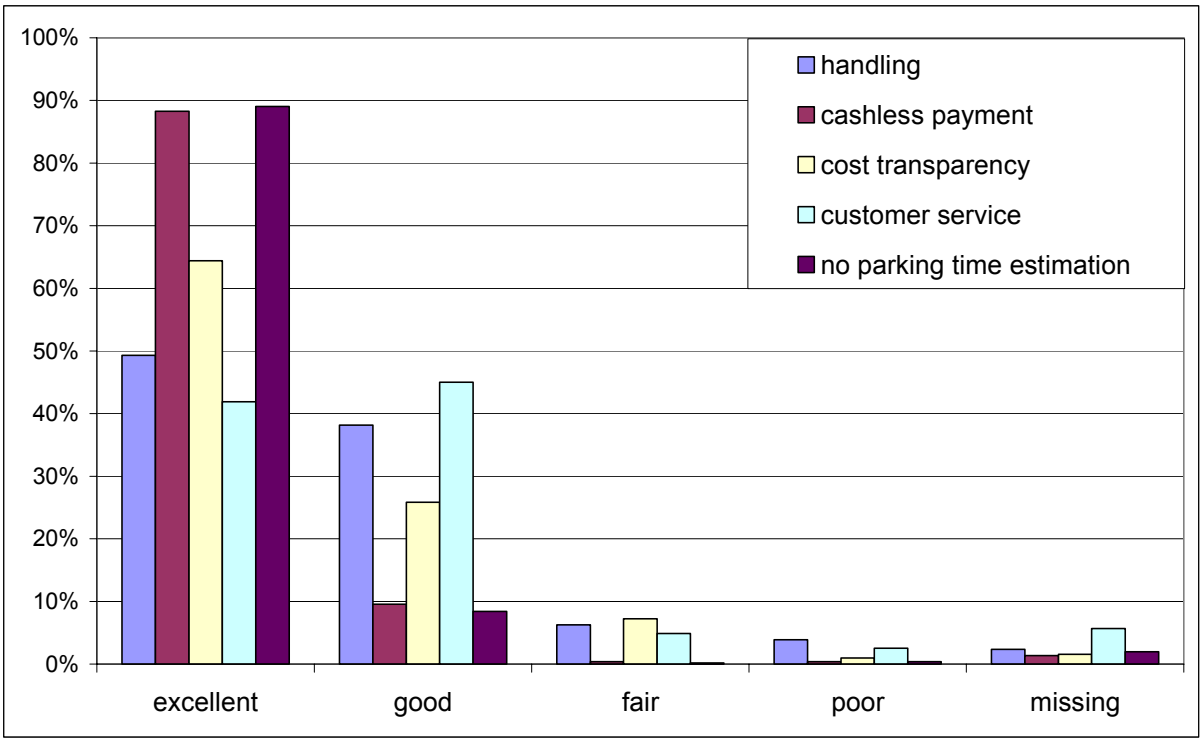
Source: Survey evaluation team/Mobile Parking

Quality of service

In the beginning enforcement problems occurred, which led to high inquiry rates on the help service line. These problems could be solved. Now approximately 20 calls per day come in with inquiries about the billing procedures and the handling of the map, which shows the areas where the service can be used.[22] As the number of the calls is in reasonable proportion to the new customers it stands to reason that the daily service is in reliable function.

In reaction to customer requests the monthly bill was promptly made available as a pdf-file. The operating company has no problems with missing payments. They consider the readiness to pay as extremely high, a phenomenon which again underlines the good service acceptance.[23]

Figure 6: User's view on service features



Source: Survey evaluation team/Mobile Parking

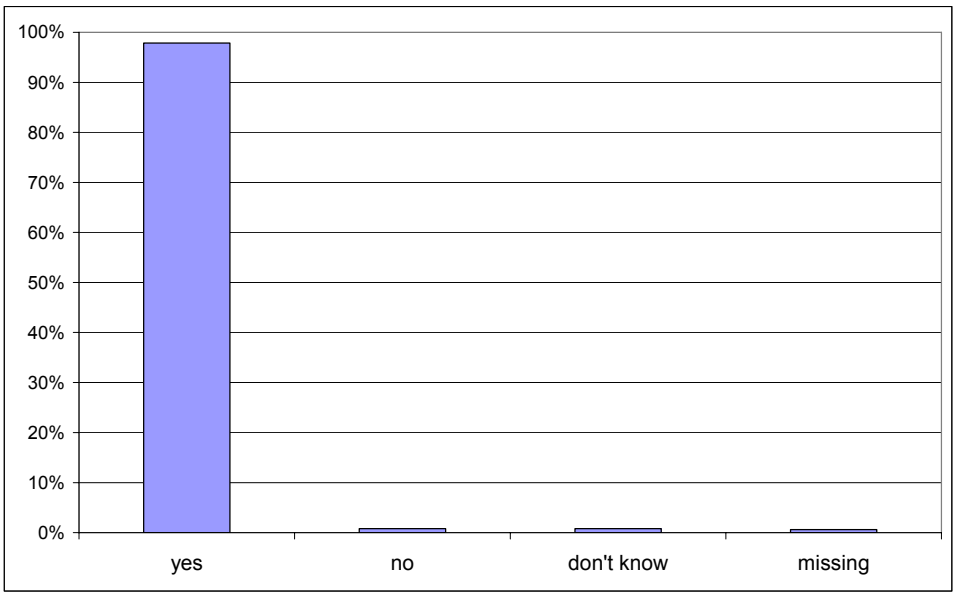
Survey respondents were asked to evaluate some "Handy Parken" service aspects, like the easiness of handling, the possibility of cashless payment, the attained cost transparency, the customer service and the abolition of the necessity to estimate the parking time. The ratings "excellent" and "good" regarding each aspect sum up to almost 90 percent or even more than 90 percent (see Figure 6). Respondents are especially content with the cashless payment and the fact that they do not have to estimate parking time in advance ("excellent":

[22] Project meeting with Mr. Tampier from Mobile Parking in Berlin, 13.04.2005
[23] Project meeting with Mr. Tampier from Mobile Parking in Berlin, 13.04.2005

88 and 89 percent). Thus it appears they appreciate the main intended advantages of the service provider.

As the next figure shows, the agreement to a potential service extension in Berlin is very high as it reaches almost 100 percent.

Figure 7: Agreement to potential service enlargement



Source: Survey evaluation team/Mobile Parking

Legal impacts

New legislative rules in favour of more flexible parking regulations could be achieved. The demonstrator (partner FAV) was actively involved in the lobbying process.

Public-private co-operation

From the beginning the demonstrator discussed the project with several public institutions. The aims of these contacts were to resolve the hindering legal situation, inform about advantages of the new technical solution and necessary changes. An exceptional permit should have been acquired to accomplish the introduction of TPS. Continuous work was necessary to make progress with the implementation as different actors had to be convinced of the service or had to be informed about it to be able to decide whether any further adjustments were necessary. These efforts produced solutions for a variety of problems. The established links achieved finally the co-operation between the Senate Department / the districts and the new system provider Mobile Parking. This co-operation was originally arranged to last until 31 January 2006 but it has just been prolonged until the end of March 2006.

TRANSPORT

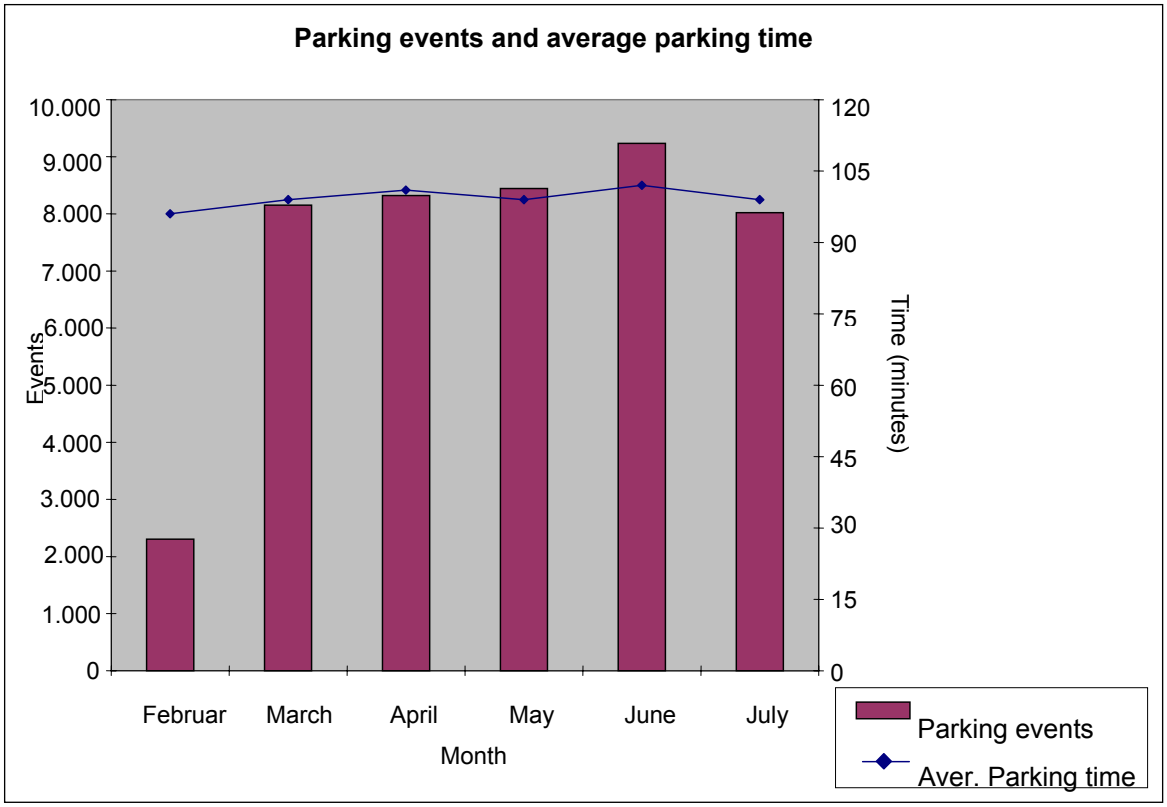
Transport patterns

Because of the delayed implementation no specified data about the travel behaviour of the users could be gained. Yet, results of other experiments and the estimation of an involved demonstration partner[24] lead to the assumption that no changes can be expected by simple changes of payment routines.[25]

It is agreed, that some changes can be achieved through the extension of parking regulations or by a future flexible handling of parking fees. In any case, empirical studies, which take into account possible evading strategies of car drivers, have to verify such assumptions.

The next two figures give an impression about the development of parking events over the months and the distribution of parking events by parking time (data from begin of February until the end of July 2005).

Figure 8: Distribution of parking events by month and average parking time



Source: Mobile Parking, analysis evaluation team

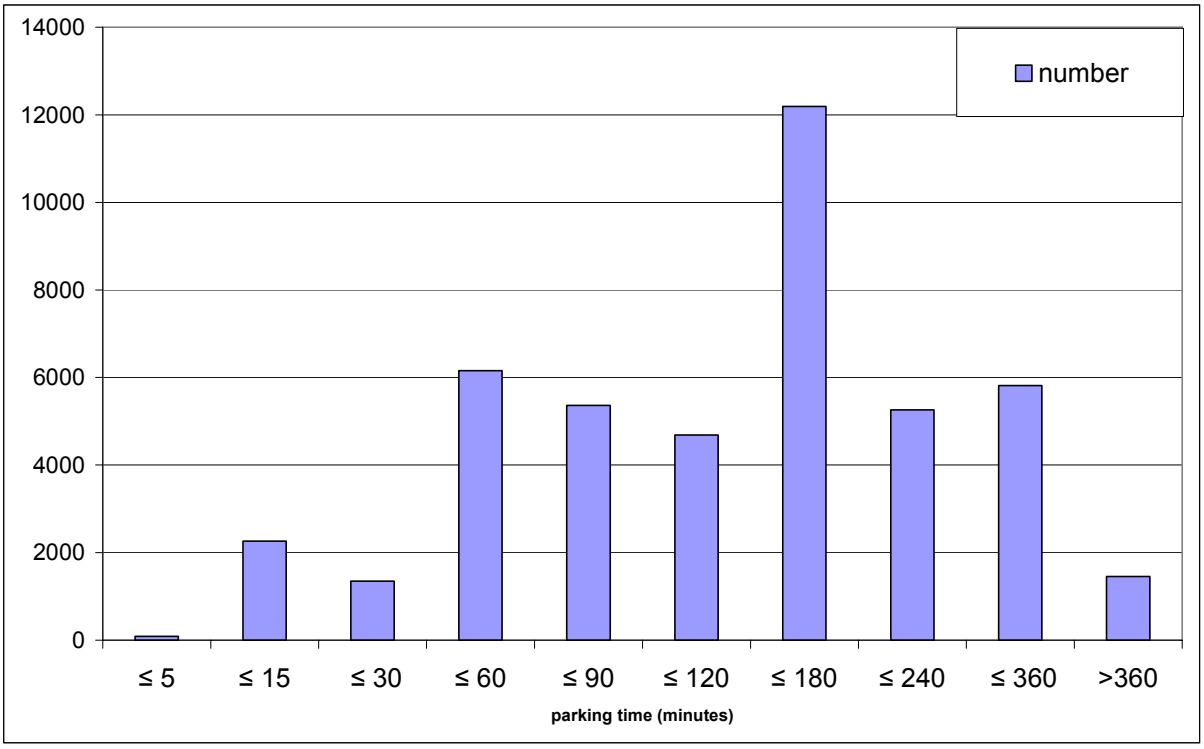
[24] Interview evaluation team with FAV, 24.06.05

[25] Boltze et al. (2005: 60)

As outline before, the results of the data provided by Mobile Parking show some inconsistencies with the results of the user survey. It can be speculated that those differences are because the users that replied to the service belong to the group of frequent parkers and service users, whereas a large number of people that only occasionally use the service did not reply but are included in the data above. Evidence for this can be found particularly with regard to the number of parking events.

Regarding the distribution of parking events by parking time (Figure 9), it appears that the majority of parking events is between one and three hours per event, with the latter taking up by far the biggest share. While there also are a considerable number of long-time parkers, the amount of users that park only for short periods of time, i.e. 5 – 30 minutes, is surprisingly low.

Figure 9: Distribution of parking events by parking time



Source: Mobile Parking, analysis evaluation team

ECONOMY

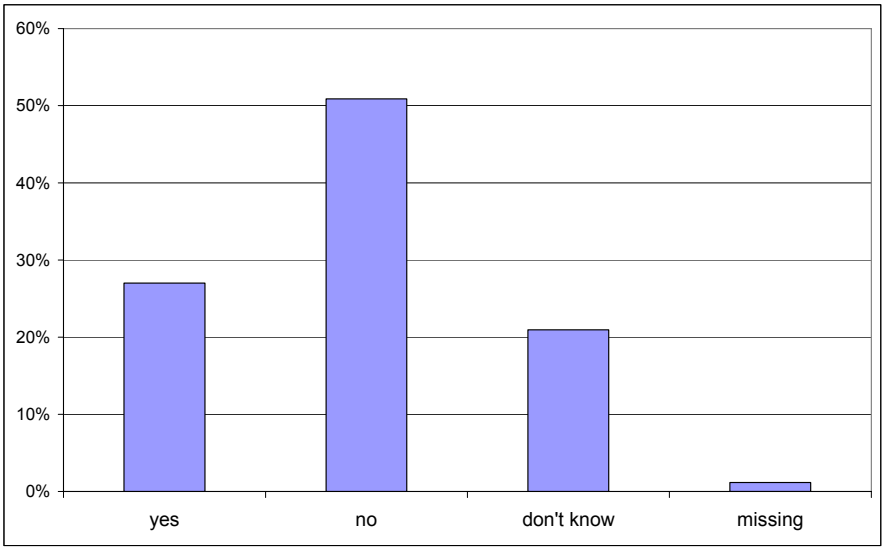
Cost-related impacts

The service is at present free for the users due to its experimental status and due to the additional funding received as a TELLUS demonstration measure. It appears questionable though whether the assumed cost efficiency effects of the service can be achieved. Although the service eases the payment and therefore might increase payment compliance and also revenues, it establishes at the same time by-the-minute billing. Therefore parking revenues

could be reduced if individuals in the past had tended to overestimate their parking duration. Anyway, as simultaneously parking fee schemes were altered in summer 2005 any accounts trying to balance the changes would have been difficult. The evaluation team could not obtain necessary data about possible changes of net revenues for the districts. Furthermore, it is not to be expected that the costly infrastructure for the traditional parking management will be diminished in the near future due to legal constraints regarding the obligatory provision of the traditional system[26] and due to long term contracts with the current contractors.[27]

As the financing of "Handy Parken" is a crucial question, the survey also contained a question asking users about their willingness to pay for the service. The question suggested a possible monthly rate of 50 cents.[28] 27 percents of the respondents would generally agree to pay for the service, 51 percent did not agree, and 21 percent of the respondents were indecisive. While again these results should not be over-interpreted at least a potential for a fee-based service can be shown.

Figure 10: Willingness to pay for "Handy Parken"



Source: Survey evaluation team/Mobile Parking

PUBLIC AWARENESS

The launch of the Mobile Parking service in the beginning of 2005 caused considerable media attention. A significant number of local and national newspapers and magazines as well as television stations took notice of the service introduction.

[26] Schäfer (2004: 152)

[27] Interview evaluation team with FAV, 24.06.05

[28] Actually, users of Mobile Parking in other cities are charged now one Euro per month and registered phone and additional 6 cents per parking transaction. (http://www.handy-parken.de/index1.php; access 17/10/05)

5 Conclusions

From the analysis of the implementation process described above conclusions can be drawn regarding the factors that promoted or hindered a successful implementation of the demonstration measure.

5.1 Drivers

From the analysis of the implementation process described above conclusions can be drawn regarding the factors that promoted or hindered a successful implementation of the demonstration measure.

Co-operation: Establishing and maintaining of contacts to several public administration actors over a long period of time promoted the finally successful introduction of "Mobile Parking" in Berlin.

Personal commitment: The uncertain situation required patience and staying power. It was essential that especially after losing the original system provider the remaining actors did not lose their vision, kept on negotiating and looked for a possible replacement.

Status as an EU-project: Being part of an EU-project helped the demonstrator and local authorities with the various negotiations necessary.

Changes in legal framework: In order to implement the innovative alternative parking management system changes of federal law, federal state law and of other regulations were necessary. The demonstrator was actively involved in several processes regarding the lobbying or negotiating.

Local partner: The difficult and changing legal situation and the changing administrative responsibilities made numerous negotiations necessary. Furthermore, it proved vital that the consortium included with the FAV a partner familiar with the local administration and with supporting local networks. Otherwise language problems alone and the outsider status of both technology providers would have effectively hindered a positive outcome.[29]

5.2 Barriers

Legal framework: The legal framework can be identified as the main barrier for implementing either of the discussed alternative parking management systems. At the project's beginning the legal framework did not allow cashless payment, by-the-minute billing and a practice where users have only to pay for the actual parking duration. That situation improved because of legal amendments but some obstacles remained. Local authorities are further on legally required to keep on maintaining the traditional system beside any innovative alternative system. Consequently they are not fully able to appreciate the benefits of

[29] Interview evaluation team with FAV, 24.06.05

systems, which work mainly without vulnerable street infrastructure and which would enable the introduction of flexible pricing schemes.

Composition of consortium: The first system provider TPS needed a local partner for providing the background technologies. TPS operated only the IT-platform and did not produce the necessary equipment itself. TPS aimed at finding a local investor who would buy a system licence. It proved to be a serious problem that this local partner had yet to be found and was not an initial project partner.

Language: The original system provider TPS depended on English speaking partners in local negotiations. Especially with representatives of local authorities this requirement could not always be met. Negotiations were seriously hindered by that situation.

Conflict of interests: The project illustrates different logics of action and interests of promoters of innovative technologies and public administration. Arguments about cost efficiency and user friendliness lose ground in situations that are dominated by the need to correctly apply laws and regulations, unclear cost structures and demands that the application of a new technology does not cause job losses.

Financial barriers: It was unclear whether the system provider could benefit from the parking fees. The introduction of the new parking management service depended on additional external funds. A further maintenance of the system depends therefore on the willingness of Berlin's public administration to add money or to find a solution where users pay additional fees for the service. Examples in other countries show that it is possible that users are willing to pay for the high comfort of alternative parking management systems.[30]

Lack of user orientation: The original planned TPS system would have required a certain investment of the potential users. They would have had to buy in-car units (~ 150 Euro, as a compromise a symbolic price of 20 to 50 Euros was under discussion). The initiators had a weak concept of potential target groups, access to those groups and plausible arguments for them to invest into the limited trial.[31] The appeal of technological aspects dominated the project.

Contract amendment: The various changes made a contract amendment necessary. It took a long time until it was clear that the new provider was accepted and that therefore financial security for the implementation was granted.

Administrative reform: During the implementation phase a reform of administrative responsibilities took place. That made time consuming new negotiations necessary, for which the new responsible contact persons had to be found. As in some cases the now responsible districts needed time to employ those persons additional delays were caused.

[30] Schäfer (2004: VI)

[31] Interview evaluation team with FAV, 24.06.05

5.3 Resume

The demonstration measure aimed at establishing an innovative parking management system with the aim of providing a user-friendly service and of increasing the flexibility and cost efficiency of parking management. The introduction of such a system should lead to positive impacts on the acceptance of parking regulation. It should enable advanced pricing schemes which could influence the parking demand.

The original concept of TPS aimed at modernising traditional methods of regulated parking which are often accompanied by inconveniences for the users (coins and estimates of the parking duration are needed). In addition to that, traditional systems cause large efforts for the maintenance of the necessary infrastructure. But, any introduction of alternative parking management systems requires prior legal changes in Germany. As an instrument to influence traffic development regulated parking depends on political decisions. The concept of the demonstration measure maybe underestimated legal restrictions for the TPS-implementation. The system's introduction was especially depending on early enough amendments of federal law and federal state law. Although the various decision making processes were influenced by the demonstrators' lobbying activities it had not been sure that the necessary amendments would take place in time. The long waiting period and unclear outcome of the changes made negotiations with possible operators of the local service centre difficult. Although an exceptional permit could be gained the situation could not be improved greatly because of the consequential permit's time limitation. These obstacles caused the heavy delay, the loss of the original system provider and the resulting alteration of the implemented system.

When finally installed the innovative system "Handy Parken" was immediately adopted by many users. It could be proven that the technology fulfils the requirements and is generally accepted. "Handy Parken" was first implemented in two Berlin districts in February 2005, and was followed by the introduction in four additional districts eight months later.

Achievement of objectives

Despite several delays caused by a hindering legal situation and the resulting change of the technical provider the demonstration measure could reach almost all of its immediate objectives. A specific legal situation in Germany, which requires an ongoing existence of the traditional infrastructure, hinders principally any strategies aiming at a more flexible parking management including varying prices according to demand. Nevertheless, important first experiences with by-the-minute billing were made.

Table 3: Overview of grade of achievement of objectives

IMMEDIATE OBJECTIVES	
Recruitment of 300 test persons	ACHIEVED
Implementation of the Tele Parking system in the demonstration area	ACHIEVED
Making parking management more flexible	PARTLY ACHIEVED
Achieve extensive political and public awareness for TELLUS	ACHIEVED
Improve public-private co-operation	ACHIEVED
INTERMEDIATE OBJECTIVES	
Change in legal framework	ACHIEVED
Full scale implementation in Berlin	ACHIEVED
Making parking management more cost efficient/convenient	[data missing]
Enhance acceptability of parking management	[data missing]
ULTIMATE OBJECTIVES	
Implementation in other German cities	
Achieve modal shift by parking management	
Reduce car kilometres	
Grade of achievement: ACHIEVED – ALMOST ACHIEVED – PARTLY ACHIEVED – NOT ACHIEVED	

In the light of the initial legal situation one could conclude that some intermediate and ultimate objectives of the demonstration measure had been very ambitious. A high grade of implementation and an administration willing to and prepared for the strict expansion of regulated parking are preconditions for really influencing private car use. Besides, the implementation of alternative parking for payment of parking charges, which makes parking routines more comfortable, can of course have an effect that contradicts the initial aims of parking management. The following scenario will examine the necessary strategies for any reduction of car kilometres or any modal shift.

The demonstration as it appears now is the necessary first step in that ambitious direction.

Furthermore, it has to be kept in mind that any broadening of the service exceeding the experimental phase meets some general legal challenges as public authorities are more and more forced to tender any public contracts according to European public procurement law. The previous technical provider can not influence in this case the concrete outcome.

6 Scenario

6.1 Introduction

The process of scenario building for the TELLUS measure Mobile Parking is somewhat different, since impacts are to be expected not because of the measure itself, but because of its interaction with the parking management scheme of the city. Thus, estimation of impacts in the evaluation areas under consideration, assessment of possible side-effects and, moreover, of synergies, are carried out based on the information and data provided in the impact assessment chapter of the Integrated Transport Plan for Berlin. Most relevant in this regard is the scenario 2 of the StEP that contains a wide range of measures, among which parking management is a central element, and corresponding estimates on their combined impacts on transport and transport generated effects in the city.

6.2 Description of measure characteristics in 2015

In the year 2015 every area in Berlin that is subject to parking management will also allow for the paying parking fees using the (by then advanced) Mobile Parking technology. Teething problems that had occurred during the pilot phase of the technology implementation in TELLUS will have been solved. People are more than used to the technology, and the administrative staff responsible for controlling parking payments is at ease with handling the reading devices. Registering and signing up for using the service is done mainly via the internet, and several methods of paying the monthly parking bill (credit card, bank transfer, automatic deduction of bills from bank account) are in place. Discount parking rates for environmentally friendly vehicles are also offered, thereby linking parking management with policies aiming at the encouragement of the use of environmentally friendly, for example natural gas powered, vehicles. [32]

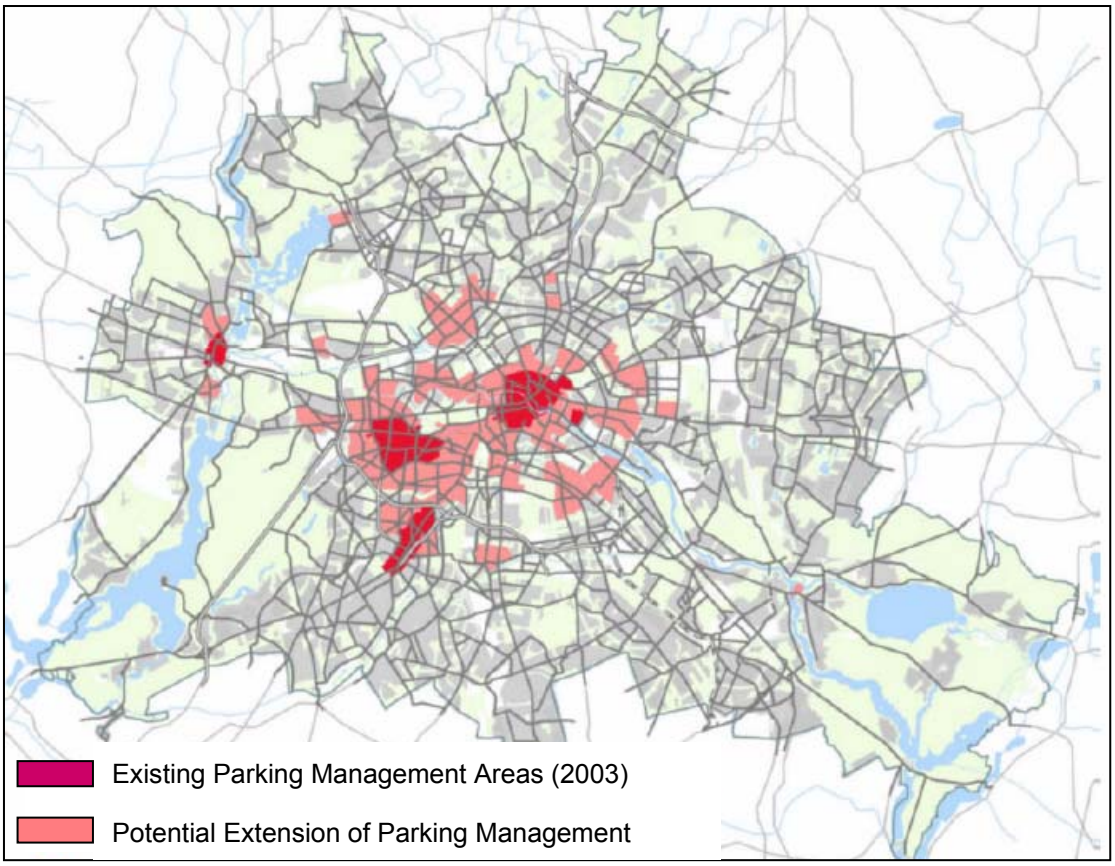
6.3 Framework conditions

Since the measure can only be implemented in areas under parking management, the continuation of parking management schemes as well as the extension of the respective parking areas is the decisive factor for the estimation of impacts. Additionally, based among others on the lessons learned in TELLUS, the urban transport policy of the year 2015 will have experienced some major changes, resulting in the creation of conditions that are favourable for both, a wider introduction of parking management and an extended use of the Mobile Parking services:

[32] First successful experiences with this approach have already been made in the CIVITAS projects MIRACLES and TRENDSETTER, for example in Stockholm, Winchester and Graz.

- **Extension of the parking management areas**: Scenario 2 of the StEP envisages extension of areas under parking management well beyond the present scale. Up to the year 2015 the extension will be carried out in a step-wise manner to finally cover all of the identified inner city areas that are subject to pressing parking demand. Such a pressing parking demand is expected when at least two out of a range of parking motives (residential parking, work/commuter based parking, use of shopping facilities, parking for taking up leisure activities) coincide and as a result the demand exceeds the supply of parking space. It is assumed that this correlation of parking motives will mainly occur in the high density inner city areas. The overall area thus identified is about twice the size of the areas currently under parking management (Figure 11). [33]

Figure 11: Extension of parking management areas as proposed by the StEP



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2003)

[33] It is expected that extending the existing parking management schemes to the identified areas will relief their residents from unsuited permanent parking of people that do not live in the area, improve access to the local businesses and stimulate the use of public transport. However, a more detailed analysis is necessary to verify this assumption for the areas under consideration before the implementation of parking management.

- **Implementation of other StEP-measures:** Scenario 2 contains all of the measures envisaged in the StEP. These include pricing and restriction measures, organisational measures, information and motivation as well as spatial measures, which determine the spatial structure of the city up until the horizon year 2015. Also, it is envisaged that all of the infrastructural measures will by then be put into place.[34]
- **Continuation of the trend towards the use of mobile phones for purposes beyond mere phone calls:** It is assumed that this trend will not only continue, but moreover recent developments at the time of writing indicate that in the future the mobile phone will be put to use in various forms for transport related purposes, such as buying tickets for the public transport, information supply on traffic flow, passenger information, etc.[35]
- **Technology improvement and interoperability of systems:** In order to support the use of mobile communication devices guidelines and technology standards to ensure interoperability of systems have been put in place. This means that in every city where a service similar to Mobile Parking is offered, platforms have been developed that allow Mobile Parking customers to use their Berlin account there as well. In turn, customers from other cities, for example tourists and business people, can use their local accounts when in Berlin. Moreover, interoperability with the mobile payment offers of the public transport sector is also achieved, meaning that also public transport tickets can be purchased by mobile phone.[36]

[34] The Integrated Transport Plan contains four scenarios, each building on the previous one in an add-up manner. Thus, Scenario 0 can be seen as the business-as-usual scenario (BAU), containing all the transport policy measures that – by the time of plan development – had already been in place. Scenario 1 contains the BAU-case plus extended and new infrastructure measure. Scenario 2 ads extended parking management. Scenario 3 is most comprehensive in that it contains all of the aforementioned plus the re-organisation of road-bound transportation and a new speed limit concept for the city.

[35] One example for how mobile phones are increasingly used in a transport-related context is the London Congestion Charge. There it turned out that the most popular way to pay the congestions fees is by means of the mobile phone (Stated by Dave Wetzel, Transport for London, at the 8th World Congress of the Major Metropolises in Berlin, 11 – 14 May 2005). In the MIRACLES project, the city of Rome has successfully demonstrated the use of mobile phones for journey planning via on-line information.

[36] Timetable information for public transport can already be assessed via mobile phone, and efforts are currently undertaken to introduce e-ticketing in Berlin. In other German cities, similar undertakings are currently underway. The consultancy Arthur D. Little expects that by the year 2008 mobile payment will have a turn over of about 38 billion Dollar worldwide, which shows the enormous potential of the technology (Tagesspiegel 30.10.05).

6.4 Analysis of potentials

The following analysis of potentials refers to impact analysis carried out in the StEP for extended parking management. It is assumed that Mobile Parking will contribute to achieving the named impacts.

Transport

Calculations[37] carried out for the StEP conclude that transport demand (regarding amount of daily movements of people and goods) within the inner city (within the S-Bahn ring) will slightly decrease by about 3 – 4%. However, transport movements to and from this area will increase by about 10% due to expected loss of population in the centre, increase of inner-city jobs and (partly generated by these two developments) increased distances between the place of work and home.

While these developments can be expected to increase the use of the car for commuting and daily travels[38], the extension of the parking management schemes achieves a shift in the modal split with increasing shares of the public transport. In fact, it is estimated that mainly because of increased parking management the number of car based trips can be reduced by about 150,000 per day, corresponding to a reduction of about 10%. About half of these trips will now be carried out using public transport. The other half of the car trip reduction is due to shifting transport movements, i.e. drivers avoid the areas where parking management has been implemented. Translated into mileage developments it is expected that parking management will cause a reduction of more than 450,000 km p.a. as compared to the mileage developments calculated without parking management.

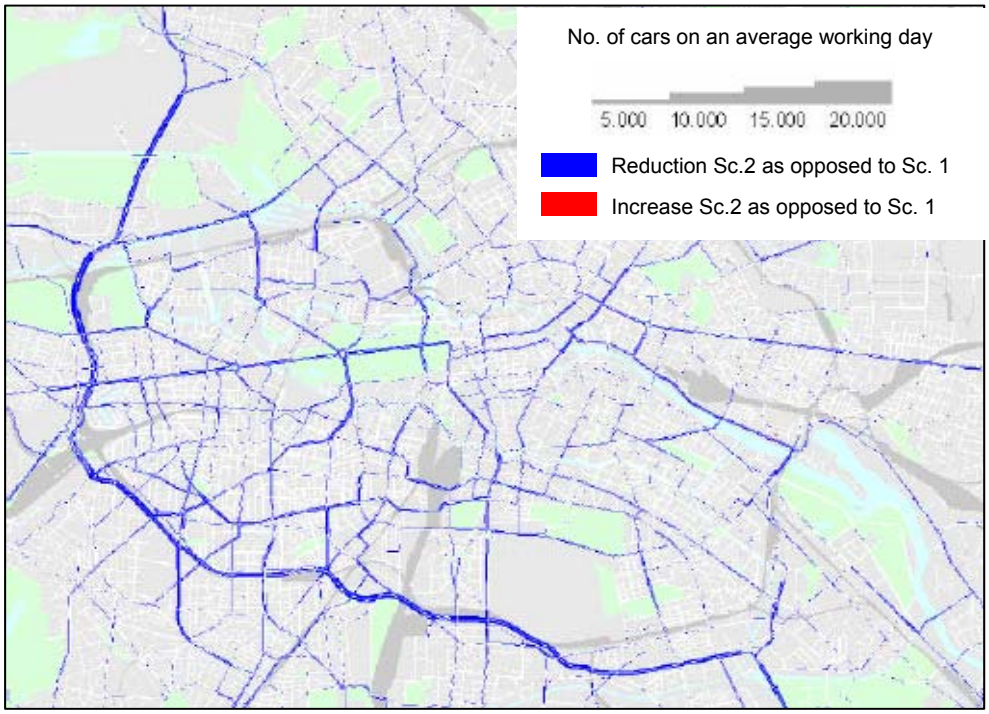
Extension of the parking management schemes achieves a **shift in the modal split** with increasing shares of the public transport. In fact, it is estimated that mainly because of increased parking management the **number of car based trips can be reduced** by about 150,000 per day, corresponding to a reduction of about 10%.

Figure 12 illustrates how the reduction of cars can be allocated spatially onto the street network. This reduction is considerable and will have a large impact on the city. As Figure 13 shows, the main road network of the entire city experiences a considerable decrease of car based mileage.

[37] Base year for the StEP calculations is 1998.

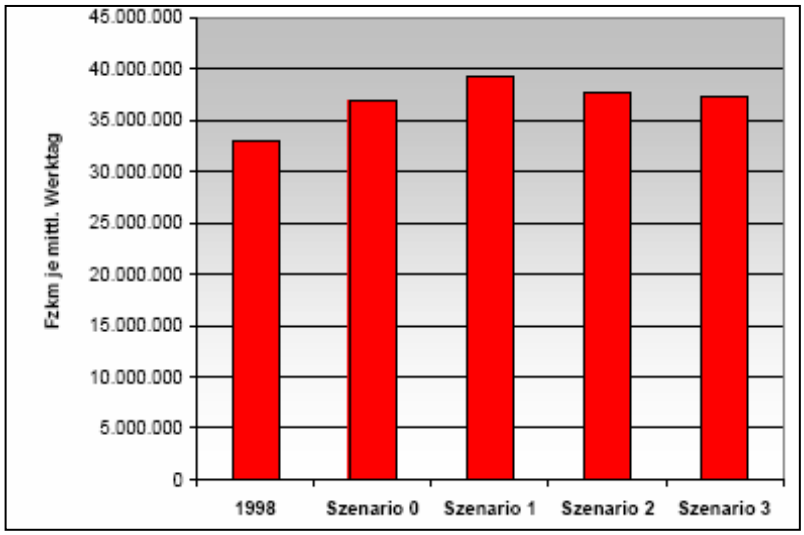
[38] This is exactly what happens in the Scenarios that do not include parking management.

Figure 12: Transport development in the inner city due to extended parking management



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2003)

Figure 13: Development of road based transport on the main roads in the entire city

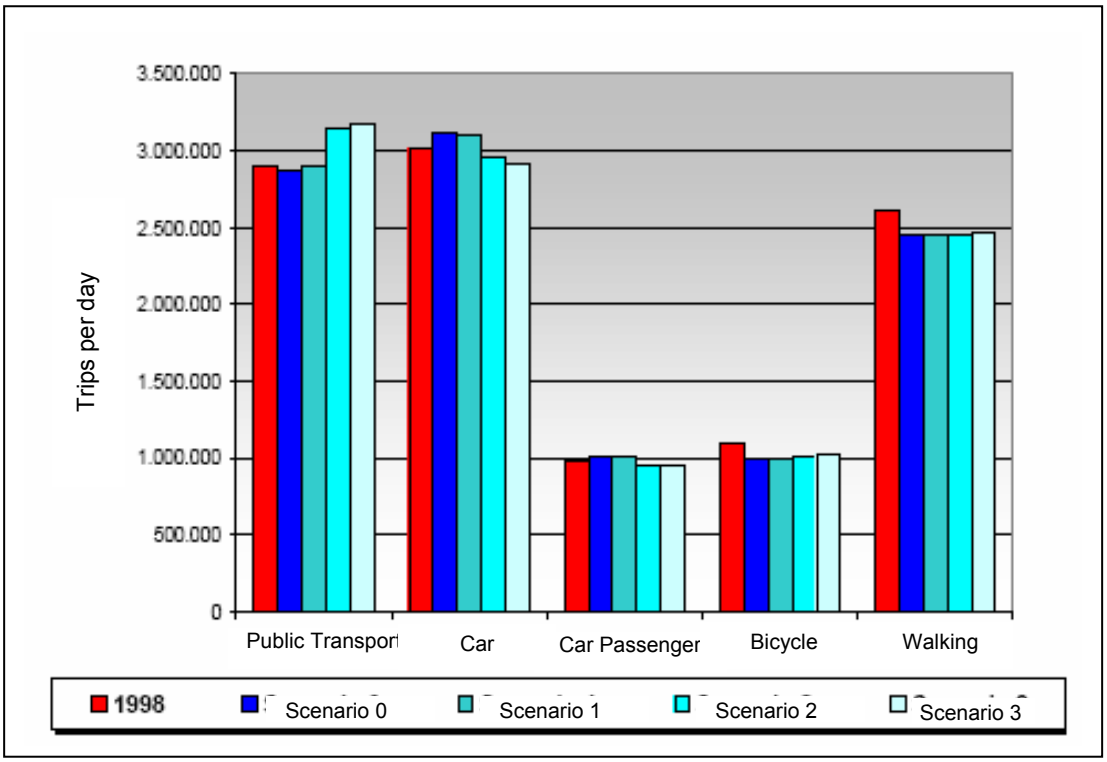


Source: Senatsverwaltung für Stadtentwicklung (ed.) (2003)

In addition to that and as mentioned above, about half of the trips previously carried out by car are now shifted to public transport. In the parking management scenario of the StEP this leads to an increase in the share of public transport on total transportation in the city by about 9%. While not all of these developments can solely be allocated to parking management, it nevertheless plays an important role in the interdependent network of measures that are implemented based on the StEP. In comparison, the additional measures of the third scenario generate only a slight additional increase of just 1%, which again underlines the effectiveness of parking management (Figure 14).

However, in the light of the expected overall transport developments, i.e. an increase in transport movements, which is strongly based on the car, the achievements of the parking management schemes appear in a different light. The general trend of increasing numbers of transport movements is not reversed, yet a large proportion of that increase is directed towards the public transport.

Figure 14: Comparison of transport demand in the entire city in 1998 and the scenarios



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2003)

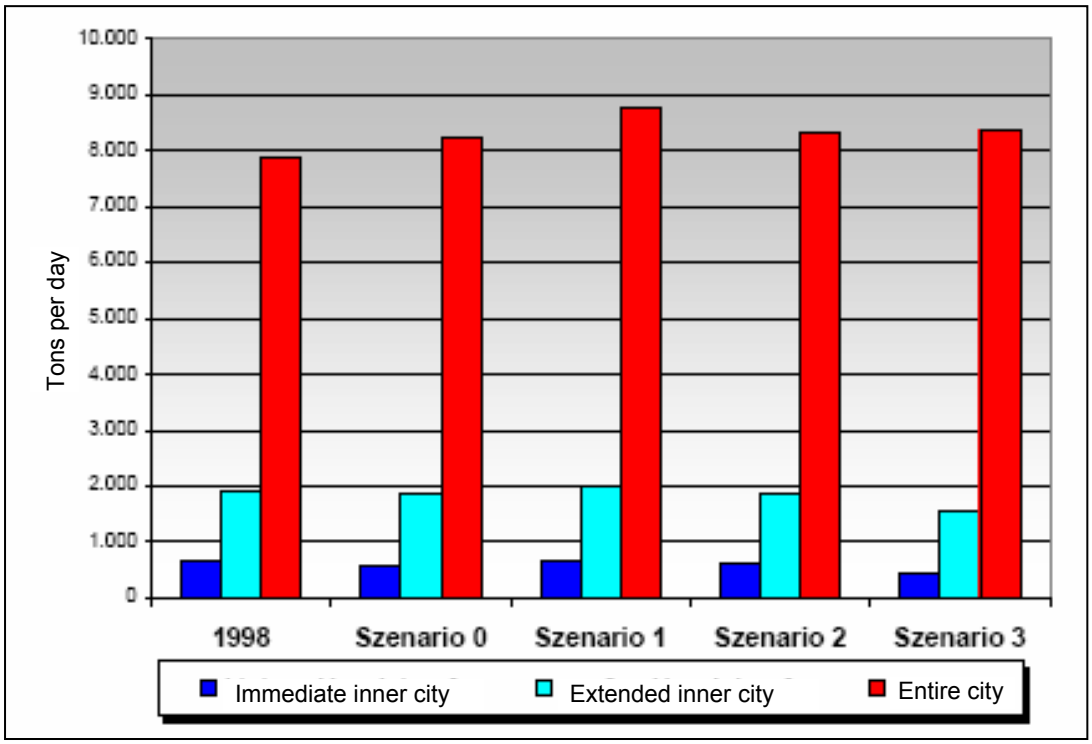
Apart from positive impacts on modal shift and number of cars in the inner city, the general **trend of increasing car usage can not be obverted.**

Environment and Energy

Regarding environment and energy it has to be noted beforehand that transport related impacts of parking management also lead to the generation of positive environmental effects. However, the overall increase of transportation demand somewhat overcompensates these positive effects. Improvements in vehicle technology and road surfacing therefore lead to much stronger impacts than the other measures proposed in the StEP scenarios. Nevertheless, slight differences in the calculations also show that parking management might help to achieve a change for the better with regard to the urban environment.

Regarding emissions, these slight changes mainly concern CO_2 as the principal climate gas. As Figure 15 illustrates, the measures in scenario 2 (and 3) slow down the increase in CO_2, however they do not serve to break the ongoing upwards trend. Nevertheless, the (parking-management based) difference between scenario 1 and scenario 2 results in an annual reduction of about 6% of the air pollutants NO_X and CO_2, generated by the reduction in mileage.

Figure 15: CO_2 emissions in different areas of the city and in different scenarios



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2003)

If, however, parking discount for environmentally friendly vehicles is introduced, the impacts on air quality might be more pronounced, since people get an additional incentive to replace old cars with low-emission vehicles.

Similar effects are expected for noise emissions. All of the scenarios show a reduction of noise in the main street network, which is mainly due to vehicle and surfacing improvements. Thereby, the reductions mainly relate to a decline in road sections that are affected by peak noise levels (65 db (A) in daytime and 55 db (A) at night).[39]

Other measures of transport planning show a less decisive impact, however, it is stated that in the immediate inner city further noise reductions can be achieved by implementing and extending parking management schemes.

The reduction of car driven mileage achieved by, among other measures, parking management results in a reduction of air pollutants, yet the overall **trend towards pollution increase can only be slowed down** but not reversed.

Society

As stated above, it is assumed that the use of mobile phones in a multi-purpose way will increase in the near future. Additionally, the rise of a new generation of users that has grown up using mobile information and communication technologies in various ways in their everyday life might lead to an increase in users of Mobile Parking as well. Based on this line of reasoning, it is frequently stated that the technology will help to increase acceptance of parking management in general. This is further underlined by the fact that the technology is well able to overcome one of the nuisances related to paying parking fees, namely the need to carry around coins all the time and still failing to have the exact amount ready on the spot. Common sense therefore suggests that providing customers with an easier way to pay for parking will in turn generate an increase in the readiness to pay and will also lead to greater compliance with parking management. Whether or not this assumption finds evidence in real life can not be stated for sure at this point. Thus, no definite account of the impact of the Mobile Parking technology on the future acceptance of parking management can be provided here.

Mobile Parking might help to increase **acceptance of and greater compliance** with parking management.

Economy

Frequently concerns are being raised as to the likely impact of parking management on local businesses. On one hand, it is estimated that parking management and its effects (reduction of number of cars in the inner city) will increase the quality of the urban space and thus, it might generate positive impacts on local businesses. On the other hand, however, it is feared that because of the need to pay for parking people will look for alternative places to shop that offer free parking, which is mostly the case with shopping malls outside urban areas,

[39] At the same time, however, the number of road network sections that are affected by lower noise levels increases.

consequently leading to loss of business in the inner city. The scenario 2 of the StEP assumes, that parking management will lead to about 75,000 trips not made to the inner city but elsewhere, while another 75,000 trips will be handled using public transport. At the same time the general transport demand is expected to increase, leading to a situation where the two developments more or less counterbalance each other. This makes it difficult to estimate the impact on local businesses, especially since customer demand is generally determined by a much broader range of factors than transport alone. Thus, no detailed account can be given on the likely developments in the future.

Considering not only parking management in itself but rather the economic effects of mobile parking, different issues arise. Supporters of the system generally emphasise that the technology might help to save money on maintenance and management of the areas under consideration. At the same time it is assumed that because people are more willing to comply with parking fee regulations (because of increased comfort and flexibility), the amount of money collected from parking fees will increase. Paradoxically, negative revenue effects might occur because of the exact same reasons, since: a) increased willingness to pay might in turn lead to less money raised from parking tickets, and b) conventional ticket machines will still have to be provided due to legal (and social justice) reasons. However, empirical data and hard evidence supporting either of these possible developments are still lacking, so that again no final conclusions can be drawn even with regard to future developments. Nevertheless, it appears to be reasonable to conclude that the technology is not a ‘cash cow’, and that financial and economic considerations must therefore not be determining factors when the introduction of parking management supported by Mobile Parking or similar services is considered.

Economic impacts are difficult to project, however it seems reasonable to suggest that the technology should not be seen merely as a ‘cash cow’.

6.5 Resume

According to the Integrated Transport Plan of Berlin, the main impact of parking management appears to be on transport demand in the inner city. A calculated reduction of 150,000 car trips per day shows the importance of parking management. This might not come as a surprise, since a car spends the overwhelming share of its life-time standing and not moving. Thus, from a transport policy point of view (and with the aim of strengthening public transport and reducing motorised individual transport), it makes sense to stronger tackle the issue of the standing car.

However, the reductions caused by parking management are counterbalanced by the general developments in transport demand and the continuing trend also for the year 2015 towards longer and more trips. Since this is due to spatial and economic factors, an inversion of this trend – or even simply a neutralisation of the same – can only be achieved by more comprehensive and large-scale measures than the ones observed here. The StEP

acknowledges that in the estimates regarding environmental and social effects of parking management.

Putting the emphasis on the mobile parking technology, it is assumed that it will support the day-to-day handling of parking management and therefore help to generate the positive impacts thus achieved.

B.3 Demonstration Measure 6.5 – Road Pricing

1 Introduction

Demonstration measure 6.5 was concerned with developing conceptual approaches for an emission-based road-pricing scheme for heavy duty vehicles. The rationale behind this measure is the internalisation of external costs of transportation. The concept development in TELLUS is a preparatory step for the introduction of road pricing in Berlin. The demonstrator was Fachgebiet Wirtschafts- und Infrastrukturpolitik (WIP, Working Group for Infrastructure Policy) of the TU Berlin in co-operation with the Senatsverwaltung für Stadtentwicklung (Senate Department of Urban Development).

2 Description of demonstration measure

2.1 Demonstration design[40]

The measure aimed at selecting and introducing a Heavy Duty Vehicles (HDV) network, which facilitates the lowest possible emission exposure for the city's inhabitants. For this purpose, a multi functional road pricing scheme was proposed to be developed, taking into account not only noise and emission profiles of the used HDV, but also their actual driving behaviour and the actual exposition of citizens along the HDV-routes. Furthermore, peak-pricing was to be included in the concept.

The work carried out for the measures was supposed to include an analysis and implementation of different forms of organisational matters, such as traffic light pre-emption, one-way-streets, night-time-lorry-ban and speed-limits of 30 km/h. Further actions to be analysed included the limitation of gross vehicle weight as well as infrastructural measures (number of lanes, closing/blocking of side-streets), and the utilisation of different communication mediums (maps, guidelines, agreements), all of which were aimed at the prevention of transit in the inner city and in sensible areas of the city. Additionally in the context of this measure it was envisaged to analyse and introduce tolls depending on exhaust- and noise-standards of the vehicle, gross-vehicle-weight, time of travel and distance of travel.

[40] Description of work, ANNEX A TELLUS Project descriptions, issued 29 October 2001

2.2 Transport Plan context[41]

In the Integrated Transport Plan the TELLUS measure "Concept for heavy-duty vehicles road pricing" is integrated in the category of pricing and regulatory measures as an important element of the strategy towards a clean urban freight transport.

2.3 Objectives

In co-operation with the evaluation team the demonstration measure set itself objectives on different levels addressing short-term outputs and long-term outcomes as well as intermediate steps. Beside the documentation of the implementation process these objectives build the basis for the evaluation of the measure. But it has to be considered that the content of the measure was basically the first objective.

MMEDIATE OBJECTIVES
Design of a multi functional road pricing scheme for Berlin
INTERMEDIATE OBJECTIVES
Acceptance of concept by citizens and transport industry
Implementation of road pricing systems
Influencing the transport patterns of heavy goods traffic
ULTIMATE OBJECTIVES
Reduce NOX emissions from heavy traffic
Reduce traffic related CO2 emissions and energy use
Reduce traffic related energy use
Reduce air pollution and noise
Minimisation of external costs of heavy goods traffic

2.4 Situation before TELLUS / Innovative aspects

According to legal regulations like the air quality directive, Berlin could be subject to an extensive introduction of road pricing in the future. However, apart from the lengthy preparation of a HDV road pricing scheme for German motorways, which was undertaken on national level, inner-city pricing of roads under consideration of the actual congestion and

[41] Senatsverwaltung für Stadtentwicklung (ed.) (2003)

environmental situation had not been undertaken. Regarding HDV-traffic in Berlin, the only measure implemented before TELLUS was the blocking off of certain (mainly residential) side-streets.

The innovative aspects of the measure include the provision of the organisational conditions and the co-operational structure (municipality, chamber of commerce, haulage companies etc.) for the definition of the HDV route network.

3 Implementation process

The demonstrator developed a road-pricing system by modelling the traffic effects of HDV road pricing in Berlin. Input parameters for the model like the value of time and distance for HDV and passenger cars were mainly based on theoretical studies. The general cost elasticity for urban traffic was additionally estimated based on the experiences of the road-pricing in London. For the valuation of external effects the changed air pollution and noise levels were calculated based on data of the Senate Department of Urban Development. The costs for the environmental pollutions were drawn from the reviewed literature. Additionally the congestion level was examined. On the basis of the calculated external costs a simplified uniform pricing structure for all road types was developed. A differentiation of the prices for different EURO norms could not be implemented due to the complexity of the model-calculations.

The study finds that there are economic benefits, which arise from the reduction of mileage of the HDV, changed congestion levels and the consequently achieved reduction in air and noise pollution. However, these benefits are lower than the investment costs for the applicable tolling technology. In comparison to the installation and operational costs the potential gain of welfare benefits seems to be very small. So the demonstrator concludes that an implementation of the explored environmentally oriented HDV charging system cannot be recommended without any adjustments concerning e.g. the inclusion of effects from congestion relief into the calculations and moreover, a pricing of passenger cars as well. The calculations were carried out only for the year 2003. So no forecast was made to analyse the possible effects that could be realised by a road pricing system in Berlin in the future. Contrary to the initial plan, the effects of alternative policy instruments were not explored and compared to a road pricing system in Berlin.

The work on this conceptual study was regularly (every 3 to 6 months) discussed with the Senate Department of Urban Development of Berlin. The results were presented on the CIVITAS/TELLUS workshop “Urban Road Pricing for Sustainable Cities” on 18th February 2005 in Berlin organised in the context of demonstration measure 6.5. In the course of this workshop different cites that already have road pricing systems - such as London, Leeds and Trondheim - presented their schemes and the lessons learned. Moreover the results of this conceptual measure were discussed in the scientific community to ensure a high quality of the modelling process. It was planned to arrange another more practice-oriented workshop

with relevant stakeholders such as haulage companies, the chamber of commerce and citizens, which should have been organised by demonstration measure 10.4 “Customer and User Participation”. But according to the demonstrator there was no interest on the part of the stakeholders to discuss such concepts. So the comments of these groups were not included in the development of the concept.

Outlook

The scientific results of this measure will be used in a project commissioned by the Federal Ministry of Transport, Building and Housing concerning road pricing schemes in Germany. Further research will be carried out in co-operation for instance with the Volvo-foundation. Moreover, the results will be used by the Senate Department of Urban Development for a positioning in transport policies. However, according to the Senate Department of Urban Development road pricing for HDV will most likely not be implemented in the city of Berlin within the next ten years to come. The study added supporting arguments to this notion. It is thus more likely that measures like on-street parking regulations and environmental zones will be applied for the purpose of reducing traffic emissions in the inner city.

4 Results

4.1 Evaluation methods

Measure 6.5 is one of the two conceptual measures that had been carried out in Berlin. In accordance with the Evaluation Plan and as stated in Chapter B of this report, the evaluation undertaken is of a conceptual kind, i.e. descriptive in regard to the established criteria.

In order to obtain the information needed for the evaluation, meetings with the demonstrator took place in April 2002 and October 2005. The meetings served the purpose of up-dating the status of implementation as well as the exchange of information on results and necessary changes regarding the contents and objectives of this measure. After the measure had come to a close, an interview[42] was carried out with the Senate Department of Urban Development in order to find out about the further utilisation of the results. Furthermore the half-yearly management and progress reports delivered by the demonstration measure were analysed.

[42] Interview with Senate Department of Urban Development, 20.10.2005

4.2 Impacts / Concept evaluation

SUITABILITY OF CONCEPT FOR IMPLEMENTATION

The main outcome of demonstration measure 6.5 was that due to marginal welfare benefits a road pricing system for heavy duty vehicles in Berlin is not reasonable. However, revenues gained through the scheme are not included into the calculations, even though that probably would have had an effect on the cost-benefit-analysis that was carried out. Moreover, benefits result from the reduced HDV mileage and the so reduced air pollution and noise emissions.

According to the Senate Department the report is written in a solely scientific manner, and thus, more practice oriented policy makers in the transport sector can not use it in an effective way. The results are an important input for the scientific community in this field, but for the Senate conclusions concerning transport policies would be much more useful.[43]

COMPLETENESS OF IMPACTS CONSIDERED

The main focus of the study lies on the economic impacts. No environmental impacts are directly analysed. The main objectives of TELLUS as NO_X- and CO_2-emissions, energy use and noise emissions are only calculated in terms of external costs and are not directly considered in the analysis of the developed road pricing scheme in terms of reduced emissions.

VALIDITY OF ASSUMTIONS AND STATE OF SCIENTIFIC KNOWLEDGE

The results of WP 6.5 were presented on the CIVITAS/TELLUS workshop “Urban Road Pricing for Sustainable Cities” on 18th February 2005 in Berlin and in this context largely discussed in the scientific community. Based on the kind of feedback received from the scientific community and surveyed by the evaluation team, it is assumed that the report is based on realistic assumptions and on the state of the scientific knowledge.

PARTICIPATION OF STAKEHOLDER GROUPS

Apart from the Senate Department of Urban Development no stakeholder group was involved in the development process of the road pricing concept. The demonstration measure chose a strictly scientific-oriented approach. The planned, more practice-oriented workshop with relevant stakeholders such as haulage companies, the Chamber of Commerce and Citizens was not carried out. According to the demonstrator the reason for that lay in the absence of interest on the part of the stakeholders so that the demonstrator and P.O.P. (10.4 Customer and User Participation) could not realise such a discussion.

[43] Nevertheless, the demonstrator promised to hand in a German summary of the main findings and conclusions that would be more useful for the work of the administration.

PUBLIC AWARENESS

Awareness for TELLUS was achieved among the participants of the scientific workshop "Urban Road Pricing for Sustainable Cities" on 18th February 2005 in Berlin, who might have taken information on TELLUS back to their institutions. Beside the TELLUS workshop the results of this measure were presented at the following conferences:

- Workshop of the DVWG-Bezirksvereinigung Berlin-Brandenburg "City-Maut in Berlin?", 17 March 2004, Berlin.
- 2nd Conference on Road Pricing, 14-15 July 2005, Kuhmo, Finland.
- 4th Conference on Applied Infrastructure Research, 8 October 2005, TU Berlin.

5 Conclusions

From the analysis of the implementation process described above conclusions can be drawn regarding the factors that promoted or hindered a successful implementation of the demonstration measure.

5.1 Drivers

Cooperation with Senate of Berlin: For modelling a road pricing system for the city of Berlin the input data is one of the most important issues. According to the demonstrator the co-operation between the TU Berlin and the Senate Department was very fruitful and the scientists got all the data they needed.

5.2 Barriers

Delay of the implementation of the federal highway toll: One of the bases for the road pricing scheme were the experiences with the German highway toll. Since the implementation of that toll was delayed, demonstration measure 6.5 started later than planned because information on possible shifts in transport flows from highways to other major routes were needed for the calculations. Furthermore the reference scenario could not be evaluated within the time frame of TELLUS because the first evaluation report for the German highway toll is not yet published.

No communication with stakeholders possible: According to the demonstrator the relevant stakeholders were not interested in a presentation and discussion of the results of this conceptual measure. So the link between the scientific work and the practical implementation and its barriers and drivers could not be established.

5.3 Resume

The aim of this conceptual measure was the development of a road pricing system for heavy duty vehicles. The report itself is self-contained and follows a logical and consistent inner

course. The work is strongly scientific oriented. From the point of view of the evaluation team it would have been advisable to include the impact of urban pricing scenarios for trucks on the local environmental situation, the exploration of alternative policy instruments and the comparison of them to the road pricing with respect to impacts.

Due to the absence of the workshop with the relevant stakeholders and the largely theoretical orientation of the measure it is not allowed for the easy assessment of the outcome in the practical field of transportation policy. From the scientific side the results will be used in following projects concerning road pricing system for – among others – the Federal Ministry of Transport or in further research projects.

Achievement of objectives

As already described in Chapter 2.3 the measure aimed at different level objectives. In the following it will be assessed how far these goals could be achieved. Details on the underlying arguments for the assessment can be found in ANNEX 1.

Table 4: Overview of grade of achievement of objectives

IMMEDIATE OBJECTIVES	
Design of a multi functional road pricing scheme for Berlin	PARTLY ACHIEVED
INTERMEDIATE OBJECTIVES	
Acceptance of concept by citizens and transport industry	
Implementation of road pricing systems	
Influencing the transport patterns of heavy goods traffic	
ULTIMATE OBJECTIVES	
Reduce traffic related CO_2 emissions and energy use	
Minimisation of external costs of heavy goods traffic	
Reduce air pollution and noise	
Reduce NO_x emissions from heavy traffic	
Grade of achievement: ACHIEVED – ALMOST ACHIEVED – PARTLY ACHIEVED – NOT ACHIEVED	

As shown in Table 4, the immediate objective “Design of a multi functional road pricing scheme for Berlin” is partly achieved. Since the conclusion of the measure 6.5 has more or less the direction not to implement a road pricing for heavy duty vehicles in Berlin due to marginal welfare benefits, in all probability the intermediate and ultimate objectives will not be achieved on the basis of this concept study.

6 Scenario

This demonstration measure is not included into the scenario process.

B.4 Demonstration Measure 7.5 – Future Management of Urban Public Transport

1 Introduction

Demonstration measure 7.5 was concerned with developing conceptual approaches for public transport under competition. The underlying policy aims at changing the modal split in favour of public transport by increasing service quality.

The future liberalisation of the transport market and the challenges arising from it, namely competition and tendering procedures, are at present highly controversial issues in Germany. There is an ongoing and conflict-ridden debate about whether or not the transport market should be opened up to competition and how this could be organised to ensure transport quality. The uncertainty resulting from this debate particularly with regard to the legal framework also affected the course and the outcome of the measure.

The demonstrating partners were DIFU (Deutsches Institut für Urbanistik - German Institute of Urban Affairs) as subcontractor of DB Rent and WZB (Wissenschaftszentrum Berlin für Sozialforschung – Social Science Research Centre Berlin) as subcontractor of the FAV. The measure was divided into three different yet interrelated parts, however in the course of carrying out the measure the contents of part 2 and 3 had to be modified due to contemporaneous developments in the field of transportation.

2 Description of demonstration measure

2.1 Demonstration design[44]

The objective of "Future Management of Urban Public Transport" was to probe new procedures for the modernisation of the organisational and financial frameworks for future-oriented public urban transport under the future conditions of liberalisation and competition. In order to fulfil its objectives, the measure was designed to consist of three different yet interrelated parts:

In the first part, a management business game was to be conducted with the aim of identifying the roles and options for actors in the transport market when undertaking the task of improving public mobility services and efficiency.

For the second part, it was planned to define realistic and innovative quality standards based on recent European research work. As main outcome it was intended to define a set of

[44] Description of work, ANNEX A TELLUS Project descriptions, issued 29 October 2001

quality assurance indicators, which then was to be demonstrated in different public transport situations and different modes of transport (metro, tram, bus, commuter train).

Lastly, in the third part an analysis of how public transport firms learn in the process of fundamental transformations was to be undertaken. The focus of this part was set on benchmarking of organisational learning in public transport companies.

2.2 Transport Plan context [45]

In the Integrated Transport Plan, the TELLUS measure Future Management of Public Urban Transport is integrated in the category of pricing and regulatory measures, namely the utilisation of optimisation potentials of 'controlled competition'. Furthermore, it supports the measure of the organisational category, which reads as introduction and extension of additional flexible public transport services.

2.3 Objectives

In co-operation with the evaluation team the work package set itself objectives on different levels addressing short-term outputs and long-term outcomes as well as intermediate steps. The objectives outlined below already reflect first alterations in the demonstration design, especially in regard to part 2 and 3 of the measure, which were altered to better fit the actual developments and requirements. Beside the documentation of the implementation process these objectives form the basis for the evaluation.

IMMEDIATE OBJECTIVES

Part 1)

Carrying out a "Management Business Game"

Identifying the options of the actors of the "Management Business Game" for improving public mobility services and efficiency

Improve intra-organisational co-operation at the city level

Achieve extensive political and public awareness for Tellus

Part 2)

Defining realistic and innovative quality standards for functional/area related tendering

Part 3)

Establishing a benchmarking tool for local public transport plans

[45] Senatsverwaltung für Stadtentwicklung (ed.) (2003)

INTERMEDIATE OBJECTIVES
Improve quality of public transport
Increase customer satisfaction
Increase customer loyalty
Gain new customers

ULTIMATE OBJECTIVES
Increase public transport use
Increase the modal share in favour of public transport

2.4 Situation before TELLUS / Innovative aspects

Decisions were taken on the European, German and regional level of Berlin to allow for the liberalisation of public transport. However, since the legal situation as well as the time frame for liberalisation had not been clear (and still are not), the responsible administrations as well as other actors in the transport market deal with a great number of uncertainties. These relate to both, the political goals, which require the continuous improvement of mobility services, and the need for more efficiency.

While the subject itself is a novelty in German transport planning, the particular innovative aspect of the measure lies in the methodologies chosen for its implementation, i.e. the management business game and the virtual tendering procedure.

3 Implementation process

Part 1: The Management Business Game

The objective of the Management Business Game was to facilitate a structured and open discourse about the upcoming changes in the legislative framework and the resulting consequences for public transport in Berlin. The tool of the Management Business Game was chosen because it offered the opportunity for the relevant Berlin actors to come together in a context independent from their day-to-day business and freely exchange their opinions. In the context of the Game four workshops were held. The nine participants of the Game represented the three main groups of actors in the field of transportation, i.e. passengers, the (public) entities responsible for transport planning and tendering, and a number of transport operators. The constellation of the actors provided for the fact that the Game actually represented the factual situation and constellations in Berlin urban transport policy and planning. The workshops were organised and held in a closed shop manner, meaning that in order to allow for an open discussion all information and papers provided and produced in the sessions were supposed to remain confidential until the final results had been presented to the public. However, the confidential workshop results were prematurely and unexpectedly

published in a newspaper by an unknown party, so that the confidence of the participants was challenged and a planned fifth workshop on scenario building had to be cancelled.

The development of two scenarios was therefore undertaken by the demonstrator itself. They outlined fundamental changes in and structures of public transport developments. Among other things, questions regarding the future organisation, quality assurance, financing and competition were considered. In August 2003 the results of the workshops and the scenarios were presented to the relevant bodies of Berlin, such as the Senate Department of Urban Development. Moreover, the results of the Management Business Game and an analysis of the instrument itself and its outcome were published in a comprehensive compendium.[46]

Part 2: Quality Definition for Functional/ Area Related Tendering

One of the outcomes of part 1 was that in order to make use of the opportunities of a liberalised transport market, safeguarding transport quality is a major issue and depends on the provisions made in the course of the tendering procedure. Thus, it became the aim of the second part to demonstrate how a functional performance description could be set as a prerequisite for a tendering procedure.

In a first step, a review of experiences made with functional allocations in Germany and in other European countries was carried out. Out of this review the theoretical and practice-related knowledge necessary to formulate the performance description were derived. Following this, the demonstration part was carried out, which contained a virtual tendering procedure for a selected area in Berlin. In addition to the project team on the side of the demonstrator, an expert panel consisting of three legal practitioners was established, who were asked to test the legal and factual suitability of functional tendering of bus lines in Berlin.

The demonstration was carried out in the course of two workshops held in November 2003 and January 2004 respectively. The first workshop was mainly concerned with selecting the area for the tendering procedure. The initial idea to carry out the demonstration in the same area where the TELLUS measure Car Modal (8.5) was implemented could not be followed through. Instead the district of Berlin-Spandau was identified as most suitable for a virtual transport bid.

The second workshop focussed on the definition of performance features, which are appropriate for a functional tendering procedure. The suggested performance description was reviewed by the legal expert panel. In a further step the question of in how far functional tendering procedures might support an increasing provision of innovative transport services that operate independently from fixed routes or set time-tables was considered. The discussion led to the suggestion of the instrument of equivalences, meaning that for example

[46] Bracher et al.(2004)

as an alternative to the common practice of defining the maximum distance for a bus stop, an equivalent maximum waiting time for a taxi could be set and included in the description. The aim is to guarantee a similarity of service provision for demand-orientated services. In order to find out about customer acceptance, the project team commissioned an external consultant to carry out a study regarding this issue for the area of Spandau.

The main conclusion of part 2 was that functional tenders are suitable under certain conditions only. In the city of Berlin the public transport network even on district level is too complex and involves to a great extent transport demands that go well beyond the scope of an area, where functional tendering is possible.

These results together with the aforementioned study on equivalences will be published in July 2005 and further disseminated by means of technical articles and expert seminars.

Part 3: Benchmarking Results Concerning Local Public Transport Plans

Findings from the prior two parts underlined the importance of high-quality Local Public Transport Plans for the definition of public transport service goals for quality and performance. Additionally, these plans serve as information basis for transport operators, who want to take part in the bidding process. In Germany, the main instrument to fulfil these requirements appears to be the Local Public Transport Plan (Nahverkehrsplan, NVP).

In order to incorporate the previous findings the third part of the measures was reshaped so as to develop a benchmarking tool for the evaluation of Local Public Transport Plans. The demonstrator therefore undertook a comparison of Local Public Transport Plans from all over Germany. Additionally, Local Public Transport Plans from Sweden, France, the Netherlands and the UK that equalled the scope and background of the NVP were also included in the comparison. However, in the process of comparing the different plans, it was found that the quality of German NVP varies greatly between communities and local authorities. What is more, many plans show a lack of consistence as regards substance, which leads to a deficit in their usefulness for the guidance of the tendering procedure. Consequently, the attempt to develop a benchmarking tool could not be followed through as originally intended. The criteria that were initially developed by the demonstrator as benchmarking standards thus took on the character of a guide for structuring NVP and for providing the contents in the level of detail necessary.

In order to make the results available and stimulate an open discussion a workshop was organised that brought together representatives and experts from the field of transport planning from all over Germany. Among these experts were also representatives of the transport planning group of the German Council of Cities. The discussions focussed on the present deficits in plan preparation and contents as well as structural problems. The demonstrator incorporated the workshop results into the benchmarking guidelines.

Outlook

It is envisaged to further continue the dialogue on NVP development. A first step towards this is that DIFU is going to take the chair of the transport planning group of the German Council of Cities. The research carried out for this activity together with the inputs derived from the discussions and a detailed description of the criteria developed will be published in the last quarter of 2005.[47] Furthermore, dissemination activities will continue at least until the end of the year.

The Management Business Game contributed to the knowledge of the participants and might therefore in the future influence their work and the work undertaken by their respective entities. Unexpected political promises in connection with a new tariff agreement in 2005 with Berlin's chief public transport provider BVG (Berliner Verkehrsbetriebe) might result in a situation where there will be no publicly organised tendering procedures up to the year 2020. Nevertheless, it might be possible that the BVG itself will commence to organise tendering procedures for certain transport services in the city, which in turn might lead to the utilisation and implementation of the TELLUS results. Part 3 of the measure formulated quality criteria for Local Public Transport Plans, which are likely to be implemented in Berlin and in other German cities, especially because the demonstrator is taking the chair of the transport planning group of the German Council of Cities and will continue a dialogue oriented process with authorities in Berlin and in other communities on the subject, thereby acting as a multiplier of the generated results and insights.

4 Results

4.1 Evaluation methods

Measure 7.5 is one of the two conceptual measures that had been carried out in Berlin. In accordance with the Evaluation Plan and as stated in Chapter B of this report, the evaluation undertaken is of the conceptual kind, i.e. descriptive in regard to the established criteria.

In order to obtain the information needed for the evaluation, regular meetings with the demonstrator took place between July 2002 and March 2005. The meetings served the purpose of up-dating the status of implementation as well as the exchange of information on results and necessary changes regarding the contents and objectives of this measure.

Due to the confidential character and closed-shop manner of the workshops in part 1, it was not possible for the evaluation team to attend the sessions and assess issues of co-operation. Furthermore, the original plan to hand out questionnaires to the participants of each of the held workshops in the first project phase in order to evaluate the method, the progression of the measure and the effects could not be followed through. Instead a survey

[47] Lehmbrock et al. (2005, in press)

was posted out to the contestants subsequently to the last workshops. The focus of the questionnaire was on the objective of improved co-operation and on other related impacts, such as the usefulness of the work shop attendance for the participant's daily work and recommendations as to the possible improvements of the applied methodology. Seven out of nine participants returned the questionnaire; the results are presented in Chapter 4.2.

Moreover, the results of the first part were presented to the Senate Department of Urban Development, additionally the results of all three parts of the measure were reviewed by the Senate Department and analysed in an interview carried out by the evaluation team in October 2005.

In order to reflect on the implementation process and identify its drivers as well as barriers, interviews with the demonstrator were carried out in September 2003 (for part 1) and in March 2005 (for part 2 and 3).

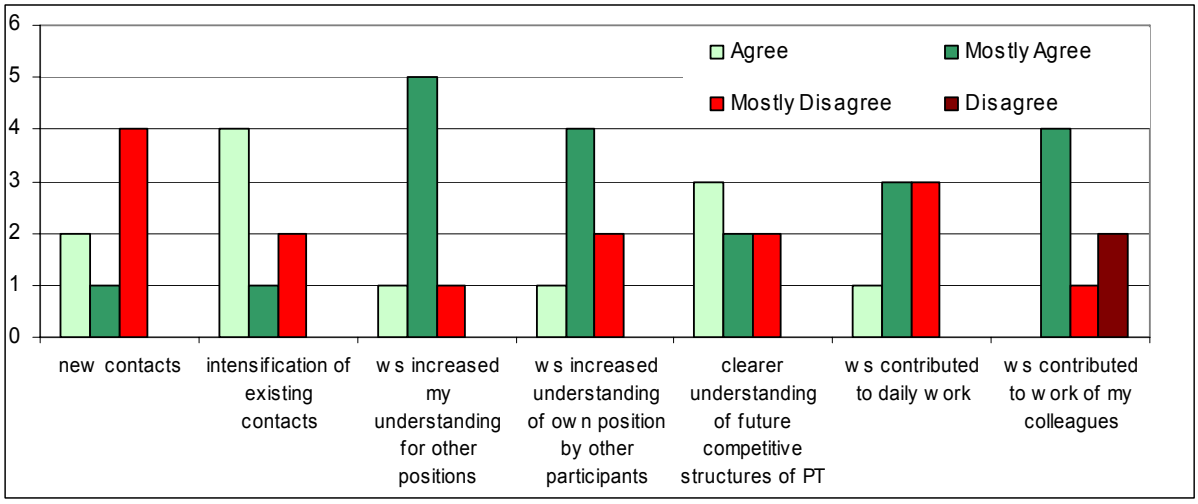
4.2 Impacts / Concept evaluation

Part 1)

EFFECTS ON CO-OPERATION OF PT STAKEHOLDERS IN BERLIN / EFFECTS ON INFORMATION LEVEL OF WORKSHOP PARTICIPANTS

Throughout the life cycle of the measure the demonstrator sought intensive co-operation with various actors, both public and private, in the field of transportation planning. The participants of the workshops in all three project parts represented a broad range of professionals involved in transportation planning and the operation of services. What is more, part 1 of the work package explicitly aimed at fulfilling the objective of improving intra-organisational co-operation at the city level. In order to assess the impact of the management business game on co-operation, a questionnaire was sent out to the participants. The survey revealed that the majority of the participants saw the business game as a contribution to better co-operation. As Figure 16 illustrates, most participants mentioned the intensification of existing contacts and the increased understanding of each others positions as major benefits, which are likely to improve future co-operation. What is more, the participants also stated that participating in the workshops helped them to obtain better insights in and a clearer understanding of the future competitive structures of public transport. Knowledge gains were achieved for example through the presentation of experiences made in other countries with the deregulation of the transport markets. The corresponding information was provided in the workshops and helped the participants to develop a deeper understanding of the complex interactions that characterise the transport market and also to value the positive benefits that derive from alternative ways of organisation instead solely focussing on the possible risk. Furthermore, the stated contribution towards the daily work of the participants and their colleagues might be interpreted along the lines of learning process that has continued even outside the workshops.

Figure 16: Results of survey on the impacts of the Management Business Game on co-operation



Part 2) and 3)

CONSIDERATION OF THE STATE OF SCIENTIFIC KNOWLEDGE ON PUBLIC TRANSPORT MANAGEMENT

In order to carry out the work proposed for the second and third part of the measure, research on the state and practice of functional / area related tendering as well as on the development and implementation of Local Public Transport Plans in Germany and in other European countries was undertaken.

CONSIDERATION OF THE RESULTS OF THE MANAGEMENT BUSINESS GAME (FOR PART 2 ONLY)

The results of the Management Business Game formed a major input for the virtual tendering demonstration.

EXPRESSION OF CLEAR POLICY SUGGESTIONS FOR FUTURE MANAGEMENT OF PT IN BERLIN

The results of part 2 and 3 were used to formulate requirements also regarding policies, which are necessary for creating the legal and professional environment needed for translating the outcome of the measure into practice. Likewise, policy suggestions were issued following the Management Business Game and made public to the Senate Department as well as to a wider professional audience in the related publication. What is more, the results of part 1, i.e. the game and the scenarios, support the political positioning of the Berlin Senate, particularly with regard to the shifting legal framework for public transport. Nevertheless, the recent developments in the Berlin transport market (i.e. the

continuation of the dominating market position of the transport provider BVG) indicate, that for the time being this effect is more an indirect one, contributing to opinion-forming and future oriented strategic work of the administration.[48]

SUITABILITY OF THE REPORT FOR IMPLEMENTATION (CONSIDERATION OF IMPLEMENTATION CAPACITY)

The outcome of part 2 was that functional tendering in Berlin is a highly complex matter and might be difficult to implement. Implementation might therefore take place less pronounced, e.g. when tenders contain a mixture of conventional and functional elements, and more indirect via the present publicly entrusted transport provider BVG. Whether or not the quality criteria for Local Public Transport Plans will find their way into transport planning practice can as yet not be established, however the dissemination activities of the demonstrator appear to be fruitful and promising.[49]

PUBLIC AWARENESS

Awareness for TELLUS was achieved among the participants of the workshops, who might have taken information on TELLUS back to their institutions. However, whether or not this multiplication effect appeared can not be assessed due to lack of information.

Awareness for the new challenges in transportation policy was raised through the workshops as well and, moreover, through two publications in scientific transport journals, one article in a transport planning anthology and about eight presentations given in various scientific and expert contexts. Apart from these past activities, the demonstrator, i.e. DIFU, has stated that the outcome and results of the activities carried out in TELLUS will continue to form a part of the seminar series and other professional training activities of the Institute.

5 Conclusions

From the analysis of the implementation process described above conclusions can be drawn regarding the factors that promoted or hindered a successful implementation of the demonstration measure.

5.1 Drivers

Flexibility: After the Management Business Game, the contents and objectives of work packages 2 and 3 were reshaped according to the problems that had been identified as most pressing and practicable by the players of the Game. Because of that, the results might be of more relevance now to the respective actors in transport planning and provision.

[48] Interview with Senate Department of Urban Development, 20.10.2005

[49] This notion was supported by the Senate Department of Urban Development in an interview carried out by the evaluation team on 20.10.2005

Closed-shop-character of the workshops: Since the workshops were not open to the public and only those invited by the demonstrator were allowed to take part, the closed-shop atmosphere together with the promise of confidentiality enabled the participants to talk without restraint. Thus, the results generated in the course of the workshops are close to the real-life context and not influenced by considerations on what would be the politically correct statement.

Inner coherence of the project: As a consequence of the above, each part of the work package builds on the results of the previous one, which makes the structure of the project logical and the results comprehensible.

Broad range of actors: In the Management Business Game as well as in the workshops held in part 2 and 3 a broad range of actors representing various fields of the transport profession as well as experts from other disciplinary backgrounds were involved. This stimulated a fruitful debate and provided for the spreading of the knowledge on the project scope and results even outside the immediate participants. It thereby also supported the awareness for TELLUS among experts and politicians.

5.2 Barriers

Premature publishing of workshop results: The unexpected newspaper reporting after the fourth workshop, which made results and confidential information provided solely for the discussion public, led to irritations among the participants and subsequently to the cancellation of the planned fifth workshop. Therefore, instead of the developing the scenarios together with the participants the project group had to do it themselves. Additionally, the presentation of the scenarios and related business game results to the relevant units of the Berlin administration was overshadowed by these developments, which may have also affected the attitudes towards the measure.

Unclear legal situation: While the need for opening up the German transport market and foster liberalisation is apparent, the details on how and when liberalisation will set in had been unclear throughout the life cycle of the measure and they still remain to be unsettled. Naturally, this affected both, the measure itself and the possibility of implementation in the future.

Present state of local public transport planning: Since there is at present no consensus on the contents and structure of NVP in Germany, the project group found it difficult to develop benchmarking criteria as initially envisaged in part three of the work package. In order to make use of the generated result of the review of plans, the objective of this part therefore shifted towards the provision of guidelines for plan development, contents and structure.

5.3 Resume

Demonstration measure 7.5 tried to probe new procedures for the upcoming modernisation of organisational and financial frameworks of public transport under the future conditions of liberalisation and competition. The intension of the work package was to clarify the roles of the various actors in the transportation markets under the future conditions and to identify the challenges that arise for transport planning especially with regard to tendering procedures and the awarding of contracts to private carriers. Since the three parts of the work package were carried out in consecutive order, each part built on the experiences made and the findings generated in the subsequent part. Therefore, the initial contents of parts 2 and 3 were altered as a reaction to the issues and problems identified as most pressing. Consequently, this meant the abandonment of the initially planned development and demonstration of a quality assurance system as well as the issue of organisational learning.

Instead, part 2 focussed on the instrument of functional performance descriptions as a basis for tendering procedures, since in work package 1 the need for clear guidelines and detailed information for bidders and operators was emphasised.

Part 3 explored the new challenges for transportation planning in the light of competition even further by addressing Local Public Transport Plans. What is more, the work package had to shift its focus from benchmarking to the development of guidelines in order to adequately address the present shortcomings on this particular level of transport planning.

The measure thus presents itself as self-contained and following a logical and consistent inner course.

However, the particular character of the measure and its largely theoretical orientation do not allow for the easy assessment of the outcome in the practical field of transportation policy. The implementation of the results – be it the insights gained as to the necessary quality standards of functional performance descriptions or the requirements formulated for Local Public Transport Plans – is within the responsibility of politics and practice, and time will show to what extent and with what outcome they take up the formulated recommendations.

Achievement of objectives

As already described in Chapter 2.3 the measure aimed at objectives of different levels. The following table assesses how far these goals could be achieved. Details on the underlying arguments for the assessment can be found in ANNEX 1.

Table 5: Overview of grade of achievement of objectives

IMMEDIATE OBJECTIVES	
Part 1:	
Carrying out a Management Business Game	ACHIEVED
Identifying the options of the actors of the "Management Business Game" for improving public mobility services and efficiency	ACHIEVED
Improve intra-organisational co-operation at the city level	ACHIEVED
Achieve extensive political and public awareness for TELLUS	ACHIEVED
Part 2:	
Defining realistic and innovative quality standards for functional/area related tendering	ACHIEVED
Part 3:	
Establishing a benchmarking tool for Local Public Transport Plans	PARTLY ACHIEVED
INTERMEDIATE OBJECTIVES	
Improve quality of public transport	n.a.
Increase customer satisfaction	n.a.
Increase customer loyalty	n.a.
Gain new customers	n.a.
ULTIMATE OBJECTIVES	
Increase public transport use	
Increase the modal share in favour of public transport	.
Grade of achievement: ACHIEVED – ALMOST ACHIEVED – PARTLY ACHIEVED – NOT ACHIEVED	

As it can be seen from the table above, the measure achieved all of its immediate objectives and can therefore be rated as a successful measure in itself. However, neither the policy recommendations nor the quality criteria or any other outcome of the three parts of the project found direct implementation within the life cycle of the project. Due to the conceptual character of the measure, however, it can be assumed that a learning process has been initiated for the participants in the various workshops and also for politicians and representatives of the administrative authorities involved, and this might eventually lead to the application of some of the results in future transport planning in Berlin and beyond. Nevertheless, since this is a lengthy and complicated process, which is also influenced by a

wide range of developments outside the framework of TELLUS, the evaluation can issue no clear statements on the eventual contribution of the measure to the intermediate objectives. Thus, the intermediate objectives are rated as not applicable.

6 Scenario

Measure 7.5 forms a background component of the scenario developed for measure 8.5 (Car Modal).

B.5 Demonstration Measure 8.4 – Metropolitan Fleet Car

1 Introduction

The demonstration measure "Metropolitan Fleet Car" (MFC) aimed at strengthening the concept of car sharing in Berlin and other German cities. Thereby the strategy to win companies for providing their fleets to car sharing and vice versa use car sharing cars for business trips was chosen. The objective behind this was to optimise the capacity of those fleets and make them more cost efficient. The demonstration measure Metropolitan Fleet Car was carried out by DB Rent GmbH, a subsidiary of the German railway company Deutsche Bahn AG (DB AG). DB Rent is a provider of fleet management and operates the DB Carsharing for DB AG. DB Carsharing already keeps a net of 600 car sharing stations in 80 German cities. Thereby they co-operate with local car sharing partners, which in Berlin is StattAuto CarSharing AG (since June 2005 operated by Collect Car B.V./Netherlands under the name Greenwheels).

2 Description of demonstration measure

2.1 Demonstration design[50]

The objective of the implementation of Metropolitan Fleet Car was to design a concept for and demonstrate a more efficient operation of company car fleets. Therefore the cars of these private fleets were planned to be used for car sharing during times when they were not needed by the company itself.

To test the concept 120 out of approximately 200 cars of the DB AG car fleet in Berlin should have been made available to the local car sharing company during week-ends and evenings, the demand peaks of car sharing. Thus, the fleet utilisation should have been enhanced leading to a corresponding reduction of private cars in the city. Also it was expected to achieve cost reductions for both, the fleet owner as well as the car sharing users.

In order to implement the fleet operation concept it was planned to develop a business plan and the technologies to be applied and adapted for reservation, accounting and service.

Finally the Metropolitan Fleet Car should have been demonstrated and evaluated under day-to-day conditions. After the demonstration phase it was planned to adapt the business plan according to the results obtained and prepare a wider introduction of the service.

[50] Description of work, ANNEX A TELLUS Project descriptions, issued 29 October 2001

2.2 Transport Plan context[51]

The Local Public Transport Plan Berlin calls car sharing a key to intermodality and therefore sees it as an important supplement to the conventional public transport. Users of car sharing are generally frequent users of public transport, bike and foot. So the promotion of car sharing is also seen as promotion of environmental friendly urban transport.

In the Integrated Transport Plan of Berlin as a promotional measure for car sharing it is foreseen to create a parking privilege for car sharing vehicles in the public space.

2.3 Objectives

In co-operation with the evaluation team the demonstration measure set itself objectives on different levels addressing short-term outputs and long-term outcomes as well as intermediate steps. Beside the documentation of the implementation process these objectives build the basis for the evaluation of the measure.

IMMEDIATE OBJECTIVES
Carry out market research
Develop a business plan
Develop a concept for the demonstration of Metropolitan Fleet Car (MFC)
Demonstration of the Metropolitan Fleet Car concept under day-to-day conditions
Substantial use of the fleet capacities
Reduce costs for fleet owner and car sharing users
INTERMEDIATE OBJECTIVES
Make the operation of passenger car fleets more efficient
Wider introduction of Metropolitan Fleet Car
Reduce private cars in the city
ULTIMATE OBJECTIVES
Reduce car kilometres
Reduce traffic related CO_2 emissions and energy use

2.4 Situation before TELLUS / Innovative aspects

Fleet cars operated by large companies and administrations were in service during business times on weekdays while private car sharing users demanded cars mainly on weekends and on weekdays in the evening. The combination of both demand structures had been probed neither in Berlin nor anywhere else in Germany. Within MFC the technical and organisational

[51] Senatsverwaltung für Stadtentwicklung (ed.) (2000); Senatsverwaltung für Stadtentwicklung (ed.) (2003)

basis for the implementation of that concept had been created (adoption/application of innovative information/communication technologies for flexible reservation, accounting and fleet operation).

3 Implementation process[52]

The implementation process can be divided into two phases. Whereas in the first phase it had been tried to carry out the demonstration according to the originally stated design, phase two was characterised by an adaptation to the market conditions that were identified through an analysis of the experiences made during phase one.

Phase one:

After developing a web-based car sharing software and a business plan, which estimated a potential of 3,000 cars operated under MFC in Berlin until 2010, the operational phase of MFC started in spring 2002.

Originally it was planned to demonstrate the service with the fleets of the Senate Department and the DB AG. Since these institutions were not ready to implement the MFC concept the demonstrator started to approach other companies in order to attract them as partners for MFC. The criteria to contact the companies were personal contact or knowledge about them having large fleets. Thereby the demonstrator could build on its operating experience and contacts developed within DB Carsharing as well as on the customer network of DB fleet service. A structured market research was not carried out.

The target groups envisioned were private companies and public institutions with large fleets.

Private companies

Several private companies were contacted but due to various reasons, in the beginning no partner for MFC could be found in Berlin. A big company was interested but had to forward the request to its head quarter in another German city. In another company the cars were assigned to the employees as part of their salary. Outpatient care services that were considered to be potential MFC customers turned out to be not appropriate, for example, because of their cars being in use or on stand-by 24 hours a day, seven days a week, and thus, they are at no times available for car sharing.

Negotiations with one of the subsidiary companies of DB had been quite advanced but could not be brought to a successful close. Reasons were that the number of cars available to car

[52] Interviews with DB Rent, 05.08.2005 and 27.06.2005 as well as TELLUS reporting

sharing was quite small and the fleet was not accessible during the night because of the closure time of the parking garage.

(Formerly) public authorities/institutions/companies

In the (semi-) public field the demonstrator approached several institutions (like local authorities, a waste company, local energy and gas suppliers and the local transport company). Of these institutions only the local transport company (Berliner Verkehrsbetriebe, BVG) was ready to participate in MFC.

Various individual reasons and circumstances stood against an implementation of the model. In one institution the staff association entered an objection because they feared that this would lead to a cutback of the jobs in the fleet management department. The waste company had too many special purpose vehicles with fixtures and labelling that could not be used for car sharing. The gas supplier had CNG vehicles that were considered to be not suitable for car sharing purposes. One main barrier for the implementation of MFC in public authorities was their (accounting) structure. These institutions do not have the cost transparency that would be needed to calculate the saving of costs. Hence according to the demonstrator it was not possible to convince them of the financial benefits to be achieved by making the car fleets more efficient.

Demonstration with BVG

The pilot with BVG was carried out with two cars from November 2003 until April 2004. The operational part did work well, but no permanent co-operation could be established. The contract negotiation process was more complicated than expected. Problems arose with taxation and insurance. For instance special insurance conditions for public transport companies made it hard for DB Rent to compete. Nevertheless to get the service started and establish a good practice example DB Rent got involved in this project even they though had to pay extra. Since according to the demonstrator BVG did not want to accept real market prices for the service and demanded contract conditions that were not acceptable by DB Rent, after a short demonstration the measure was stopped and did not pass into a regular operation.

Customer and user participation

In the context of the demonstration process described above, a survey among potential customers (companies) and car sharing users had been carried out by the demonstrator of TELLUS measure 10.4 (Customer and User Participation) in order to verify hypotheses on name recognition and target groups for the MFC service (see Chapter B.9).

The experience with the potential company partners showed that there were some incompatibilities that hindered the use of company fleets for car sharing. First the favourite

target group “large companies with large fleets” is often located in peripheral parts of the city, whereas car sharing is mostly frequented in the central part of the city. So due to low demand of car sharing cars in these areas the goal of making the fleets more efficient by letting them to car sharing in the hours when they are not used by the company would not have been achieved.

The second was that a considerable part of the company cars could often not be used for car sharing. Whether they consisted of special purpose vehicles with fixtures and labelling or of representative cars, which did not fit into the main demand group of car sharing, they were not suitable for private car sharing.

Phase two

In phase two the strategy was changed. Instead of using the company owned cars for car sharing, now companies that were already established or potential fleet management customers of DB Rent were the focused target group. It was felt that MFC should not be a stand alone product, but a service integrated in the portfolio of the leasing service of DB Rent. Thus, it was incorporated into the DB Rent general sales and distribution strategy. The software developed for MFC could be used by the customers of DB Rent for the disposition of their fleets. The experiences showed that companies preferred the all-in-one concept to making their own cars available to car sharing.

The demonstration, which was originally planned to end in July 2004, was extended twice to finally last to January 2006.

In June 2004 DKB Services GmbH, the internal car rental for the employees of DKB bank, could be won as partner for MFC. In connection with this, four new car sharing sites have been opened in the centre of Berlin.

Since February 2005 DB Rent operates the Lufthansa CarPool in Berlin with MFC technology and concept, which also led to the provision of a new car sharing site. There the high costs of the parking space provided for the air personal of the flight company led to the implementation of the MFC concept.

Since the beginning of 2005 the fleet of DB AG has been reorganised. This was part of the DB internal cost reduction programme “Qualify Plus”, which started in October 2004. In comparison to the situation at the start of TELLUS now the cost pressure was high enough to get MFC accepted and implemented. 1,000 cars of the DB fleet were identified as suitable for pooling. Criteria for the selection were that the cars were not allocated to a specific employee, they had no special equipment, they were not used on at least two out of seven days of the week, they were located at railway stations or in the inner city, and they were publicly accessible 24 hours a day[53]. Those 1,000 cars will be gradually replaced by 500

[53] Presentation of Thomas Pitzschke (DB Rent) at “TELLUS Berlin Lessons Learned - Nachhaltiger Stadtverkehr in Berlin“, 19.10.2005

MFC cars. In Berlin up to October 2005 250 cars could be replaced by 130 MFC cars, and two new car sharing sites have been opened.

Moreover since September 2005 DB Rent operates about 35 cars of the German Federal Armed Forces in Berlin, which led to the provision of two new car sharing sites in the centre of the city.

MFC in other cities

From the very beginning MFC was more successful in other German cities than in Berlin. The company Valeo in Bietigheim-Bissingen (southern Germany) with a fleet for 5,000 employees has been MFC partner since October 2002. 2003 several branches of the DB AG subsidiary DB Netz followed. In January 2004 DB Rent took over the Lufthansa CarPool in Hamburg and in March 2005 in Cologne with MFC technology and concept. In May 2004 the DKB Service GmbH Potsdam joined in (three, later four cars). In two cases (DKB, Lufthansa) the contacts led to a later demonstration with a branch of the companies in Berlin.

Outlook

Metropolitan Fleet Car is an established service integrated in the fleet management of DB Rent, which will continue after the end of TELLUS.

Regarding the actual car sharing it is planned to further gain new customers in Berlin (target 10,000 users, now: 8,000) and provide a dense network of stations all over the city. Moreover DB Car sharing will be one part of the services provided to referees and journalists at the football world championship in 2006.[54]

In the end of 2005 a pilot project of the Senate Department of Urban Development in co-operation with two districts of Berlin will be carried out. The aim is to raise the accessibility of car sharing cars in the city. Therefore it will be tested, if a legal way can be found to withdraw public parking space from public use and reserve it for car sharing stations.

4 Results

4.1 Evaluation methods

Between April 2002 and June 2005 regular meetings with the demonstrator as well as the analysis of the TELLUS report documents served to up-date information on the status of implementation. In order to reflect on the implementation process and identify its drivers as well as barriers, interviews with the demonstrator were carried out in August 2004 and June 2005. Furthermore, in these interviews the demonstrator was asked to assess the public-private co-operation and customer and user participation in the framework of the measure.

[54] Press conference of DB AG, 11.08.2005

Due to the changes in the demonstration design the impact evaluation according to the indicators stated in the Evaluation Plan could not be carried out as planned. As a result of the first low implementation level for the evaluation areas “economy”, “energy” and “environment” no data could be obtained for the demonstration phase. For the same reason surveys planned for the assessment of the acceptance of the service could not be carried out.

It must be noted though that during the last months of the demonstration measure, implementation appears to be picking up considerably. However, the measurements needed for obtaining information on these evaluation areas could not be carried out within the remaining length of time.

For the evaluation area “transport” first monitoring data was available at the time the evaluation report was written that shows trends of the development. Estimations of the potential development of the transport related indicators can be found in the scenario in Chapter 6.

4.2 Impacts

TRANSPORT[55]

In the DB AG fleet in Berlin 250 cars could be replaced by 130 MFC cars. Monitoring during the first months of implementation of the MFC concept within the DB AG fleet in Berlin showed that those MFC cars were used about 30 % more than the average car before.

Before, the average car drove ca. 923 km, after the implementation the amount was 1,200 km per month. Calculating this for the whole fleet a maximum reduction of 74,750 km could be achieved during one month. Due to the lack of further surveys there is no information about the exact amount of the reduction and how it was achieved (less trips or trips done by other modes). Therefore no assessment for the MFC concept in general and for its environmental implications can be made at this stage.

Furthermore the data available does not allow quantitative assessment of the respective proportions of the different user groups (DB AG employees, car sharing members, etc.) using the cars. But it does show that car sharing members constitute a considerable part of the users, and the fleet is no longer used only by the company. This in turn means that in the case of the DB AG the MFC-concept of shared use works out as envisaged.

PUBLIC AWARENESS

Besides several presentations about the MFC concept given to companies and institutions the demonstration measure aimed at discussing the service in the scientific community on a

[55] Information by Prof. Dr. Andreas Knie on 13 October 2005

national and European level. A presentation was given on the conference »eTransport – Improving Urban Mobility« in Brussels on 26 February 2006 and published in the related policy guidelines. Furthermore an article in a German scientific transport journal was published in September 2005.

Moreover two press conferences one at the start of the measure in December 2002 and one in August 2005 were held.

5 Conclusions

From the analysis of the implementation process described above conclusions can be drawn regarding the factors that promoted or hindered a successful implementation of the demonstration measure.

5.1 Drivers

Professional approach of marketing/sales activities: In late 2003 DB Rent car sharing and sales were centralised under one head which led to a more professional approach of marketing/sales.

Integration of service into general sales and distribution strategy: MFC has been integrated in the portfolio of the leasing service and was no stand alone product anymore. Companies preferred the all in one concept to making their own cars available to car sharing, which led to an increased acceptance.

Cost pressure: Due to the increasing cost pressure the fleet of DB needed to be rationalised which led to the acceptance (by the controlling department) and introduction of MFC. High costs of parking space provided to the employees were also the reason for Lufthansa to implement car pooling and the MFC concept.

5.2 Barriers

No clear view of the market: In the beginning any market research or feasibility study was carried out.

Company-internal opposition: The company cars are often handled like “unofficial private cars” and are part of company internal incentive systems. Emotional relationship of employees with “their” company car and informal use leads to absence of willingness to give it away to other users like e.g. car sharing members.

Incompatibility of company fleets and locations with requirements of car sharing: Locations of big companies and their fleets are mostly different from location of car sharing stations. Moreover company parking sites are often not accessible for the public (on-site parking etc.). So cars are potentially available for car sharing but cannot be made accessible to the car

sharing users. Furthermore company cars often have fixtures and special equipment and are therefore not suitable as car sharing cars.

No visible cost-advantage for public companies / authorities: Public authorities and formerly public companies do not have the cost transparency that would be needed to calculate the saving of costs. Big companies get special rates by insurance companies so fleet providers cannot compete.

Structure of fleet organisation in public institutions: The responsibility for the fleet is divided into an operational and a financial part. In consequence, no flexible use of budget is possible. Furthermore the management is decentralised. Often each department is responsible for its own vehicles. For the implementation of the MFC concept a more bundled management would be a precondition.

Lack of support: The public authorities and the institution, which were originally planned to be demonstrators of new services, withdrew their commitment. It was hard to get acceptance for the service from the Senate Department as well as from inside of DB Rent.

Financial problem of a consortium partner: The car sharing partner encountered economic difficulties which made the implementation process sometimes difficult.

Specific local fleet situation: The Berlin market was hard to penetrate. Large fleets are often owned by formerly public institutions and to win these for the MFC concept was not possible due to the above mentioned reasons. MFC was more successful outside of Berlin.

No public space made available for car sharing stations: It is stated in the Transport Plan that in order to raise accessibility of car sharing cars, public parking spaces should have been made available to car sharing since to rent/buy parking spaces from private providers is too expensive for car sharing companies. This did not happen before the very end of the TELLUS project. In the end of 2005 a pilot project of the Senate Department of Urban Development in co-operation with two districts of Berlin will be carried out. It will be tested, if a legal way can be found to withdraw public parking space from public use and reserve it for car sharing stations.

5.3 Resume

The intention of TELLUS measure 8.4 was to introduce the shared use of fleets by companies and car sharing providers. The underlying assumption was that the usage patterns of these fleets are complementary and bringing them together can make their operation more cost efficient. Furthermore the concept of car sharing was intended to be promoted by increasing the number of car sharing cars available, the opening up of new car sharing sites and the availability of a larger range of cars. At the same time, getting companies to make their cars available to car sharing during off-business hours also strove to make better use of the cars that are already present in the city.

While being implemented successfully in other German cities, in Berlin MFC encountered a number of difficulties that were partly due to the specific structure and characteristics of companies and public bodies there, especially with regard to their handling of car fleets. The spatial component (i.e. larger businesses situated in the periphery of the city where car sharing demand is lowest) as well as the lack of cost transparency (in (semi-) public entities) and the still prevailing attitude of company car users to hold the vehicles as 'theirs' all hindered the successful implementation of the measure. However, the demonstrator reacted to these difficulties and re-shaped the strategy.

Instead of trying to convince companies to provide their fleets for car sharing, the service was integrated into the DB Rent general sales and distribution strategy. The focus now lay on companies that were already established or potential fleet management customers of DB Rent and that had thus already taken on a more rationalistic attitude towards their company cars.

However, the processes required for re-shaping the strategy and making it work took a long time, which is why only towards the end of the TELLUS-life cycle the measure really did come into implementation. By then it was too late for the evaluation to collect the data necessary for analysis of impacts. Therefore, all of the evaluation results have to be seen under the constriction that they only consider the processes and results achieved up to September 2005. However, the measure is still ongoing and might prove to achieve the objectives set in the future.

Achievement of objectives

As already described in Chapter 2.3 the measure aimed at objectives of different levels. The following table assesses how far these could be achieved. Details on the underlying arguments for the assessment can be found in ANNEX 1.

Table 6: Overview of grade of achievement of objectives

IMMEDIATE OBJECTIVES	
Carry out market research	PARTLY ACHIEVED
Develop a business plan	ACHIEVED
Develop a concept for the demonstration of Metropolitan Fleet Car (MFC)	ACHIEVED
Demonstration of the Metropolitan Fleet Car concept under day-to-day conditions	ACHIEVED
Substantial use of the fleet capacities	[data missing]
Reduce costs for fleet owner and car sharing users	[data missing]
INTERMEDIATE OBJECTIVES	
Make the operation of passenger car fleets more efficient	[data missing]
Wider introduction of Metropolitan Fleet Car	PARTLY ACHIEVED
Reduce private cars in the city	[data missing]
ULTIMATE OBJECTIVES	
Reduce car kilometres	
Reduce traffic related CO_2 emissions and energy use	
Grade of achievement: ACHIEVED – ALMOST ACHIEVED – PARTLY ACHIEVED – NOT ACHIEVED	

As shown in Table 6, the demonstration measure could reach the objectives that were connected to its direct outputs to a big extend. In addition, at the end of the TELLUS project the trend for a wider introduction of the service can be foreseen.

Due to the late start of the implementation on a larger scale level and related lack of data within the project life cycle it was not possible to assess the objectives addressing the outcomes of the service. These will be estimated for the time frame 2006-2015 and will be described in the scenario in Chapter 6.

6 Scenario

6.1 Description of the measure characteristics in 2015

The MFC-service is based on a fast developing technology applying mobile communication techniques combined with internet interface applications. A prognosis of a definite technology's state of the art for 2015 is impossible, and therefore it is hardly feasible to envision likely features of the service. However, on all accounts it is extremely likely that the future technology will promote an even better management of fleets and a comfortable access to different varieties of commercial car pools. Navigation systems will be an average fleet car component. The service will be internationalised using standardised IT-systems. Easy cross-border bookings will be available. Booking of and access to cars will be possible via mobile phones. Transmitted data will include car status information regarding for instance

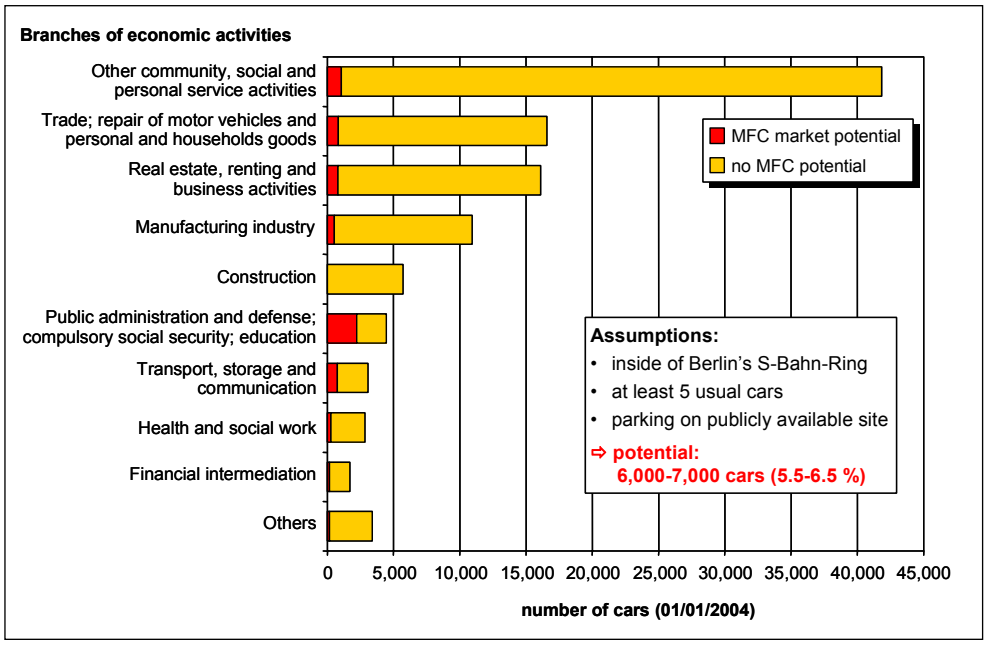
fuel and oil fillings, which will economise maintenance costs. In addition to that, information about actual vehicle positions will be transmitted using mobile communication modules. This feature makes pre-defined pool stations less necessary. Users gain information about nearest located unengaged cars via internet or cell phone software applications. Cars can be "offered" in a more decentralised way, which enhances accessibility and will therefore again economise costs.

An important condition for further success in 2015 is the ready availability of professionally managed fleet cars and a strong public appearance. For that purpose not only DB Rent but also other car sharing enterprises had been seeking support from the Senate Department for Urban Development to create reserved public parking spaces. These developments led to a successful implementation of the MFC fleet management and similar solutions like business car sharing in Berlin's administrative bodies and other enterprises operating throughout the city. The introduction of the technology based fleet management helped to implement a broader efficient mobility management in public authorities and enterprises, which includes access to public transport and supplementary innovative transport solutions like "Call a Bike", a decentralised, technology-based bike sharing system. On the whole private car sharing will have benefited considerably from becoming more common and accessible because of such generalised integrated solutions.

6.2 Market diffusion

One of the most crucial questions regarding the future success of the measure relates to the number of commercially used cars in Berlin that can and will have been transformed into MFC cars. A conservative estimation amounts to 6,000 to 7,000 vehicles, which would be 5.5 to 6.5 percent of Berlin's business car stock (see Figure 17). These estimates are brought about by a range of assumptions that concern the suitability of certain trades, location of enterprises and the number of enterprise cars potentially available for car sharing. A higher potential is assumed for public administrations because of a much higher degree of centralisation leading to higher numbers of pool cars. Other branches show much more fragmented structures, including small car numbers per enterprise and a higher degree of specialised cars, which are unsuitable for MFC. To justify conversion expenses a minimum number of five cars per enterprise are roughly assumed. Furthermore, enterprises should be located within Berlin's S-Bahn-Ring in order to be attractive for private car sharing users. Another precondition concerns accessibility of cars, which should be located on public parking spaces.

Figure 17: Stock of commercial cars and MFC market potential



Sources: Kraftfahrt-Bundesamt (2004), own calculations

Anyhow, this potential of 6,000 to 7,000 vehicles corresponds to less than one percent of Berlin's total car stock, since commercially used cars make up only ten percent of the total stock.[56] Further potentials can be assumed among privately registered cars, which nonetheless are used for business purposes.[57]

6.3 Framework conditions

As seen above, certain assumptions about framework conditions, which support a broader use of MFC based solutions, have to be made.

- Wider introduction of MFC to public owned fleets: Public authorities set an example by an enforced introduction of the efficient use of shared cars combined with enhanced marketing activities. To increase the positive effects, only cars that fulfil advanced environmental standards will be used;
- Cost transparency of trips with commercially used cars and business trips respectively;
- Incentives for a general mobility management, which makes use of innovative transport solutions that aim at an optimised utilisation of resources by restructuring of accounting arrangements for short distance business trips in administrations;
- Changes of the legal regulation regarding travel expenses reimbursement;

[56] Total stock of cars in Berlin at 01/01/2004: 1,226,299 (Kraftfahrt-Bundesamt (2004))

[57] Wermuth et al. (2003); Steinmeyer, Wagner (2005)

- Privileged access of shared cars to public parking places;
- Putting car insurance contributions for MFC vehicles on a par with the special conditions for cars used by public administrations or public owned companies.[58]

6.4 Analysis of potentials

Transport

Examining the effects of MFC two main changes are caused by the demonstration measure, namely changes of vehicle stock and changes of vehicle mileage. Since no detailed research is available for both effects from the MFC model project, recourse was made within the scope of estimates of potential to a recent study on the traffic-related and ecological effects of DB AG (Deutsche Bahn AG) car sharing.[59] The effects on the total stock of vehicles, as analysed in this study, can be regarded as representative for MFC.

Vehicle stock

The professional restructuring of fleets leads to newer cars which (automatically) fulfil higher environmental standards. At the beginning of the year 2004, the average age of the car sharing fleet of the DB AG was 1.5 years (see Figure 18). For comparison: the same figure of the German car stock was 7.6 years.[60] This is not a singular occurrence as fleet management includes a constant replacement of older vehicles.

Another effect consists in optimising vehicle numbers according to actual needs. Generally, with MFC-technology fewer cars are necessary to realise the same or even higher grades of mobility. Registering and managing conventional car fleets with MFC-software supports an efficient allocation of trips per car. As a consequence, the **number of cars constituting a given fleet will be minimised**. So the expected increase of company cars will be mitigated or stopped.

Because of the combined business and private use of MFC cars there could be an indirect **decreasing effect on the number of private cars** as private car sharing becomes more attractive and available.[61] However, the quantitative side of these effects is extremely difficult to forecast.

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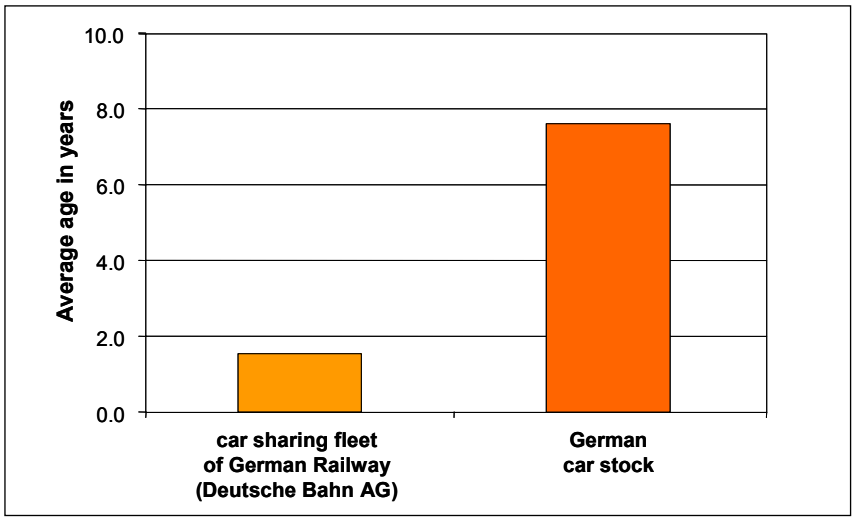
[58] At present MFC suffers from cost disadvantages as public administrations are paying considerably lower insurance contributions than companies and private individuals

[59] Schmied, Hochfeld (2004). This study was carried out by Öko-Institut on behalf of the Wissenschaftszentrum Berlin (WZB) within the framework of the project *"Intermodale Angebote. Sicherung der Anschluss- und Übergangsmobilität durch neue Angebotsbausteine"* of the Federal Ministry for Education and Research.

[60] Schmied, Hochfeld (2004)

[61] Schmied, Hochfeld (2004). The study delivered representative evidence for the fact that private car sharing users are more likely to not own a car than the average German citizen. Even though membership in a car sharing company does not directly lead to the abolition of an existing private car, it does nevertheless prevent

Figure 18: Average age: DB car sharing fleet in comparison with German car stock (01/01/2004)



Source: Schmied, Hochfeld (2004)

Due to the optimisation of the fleet management the **size of the fleet will decrease.** Due to constant replacement the cars will fulfil **high environmental standards**.

It is assumed that the increased attractiveness and availability of car sharing cars will lead to a **lower number of private cars in the city.**

Mileage development

When implementing the MFC concept for the fleet management there are different options for the development of the mileage.

Option 1: The mileage **stays** the same, because the new management does not have an effect on travel behaviour of the employees.

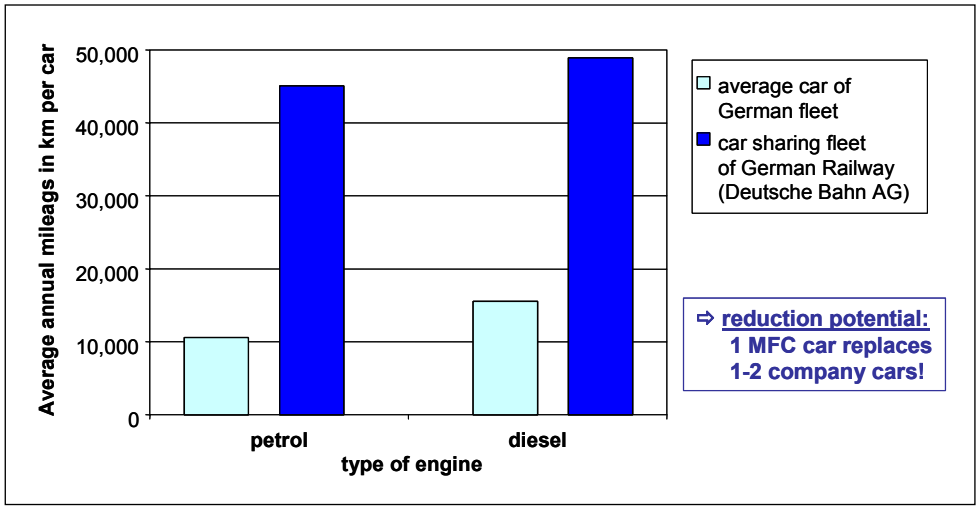
Option 2: The mileage **increases**, because the new service enables a more flexible access to cars for business trips, i.e. cars from the car sharing fleet can be booked in situations where formerly no company car would have been available and other transport modes would have been used.

Option 3: The mileage **decreases**, because the cost transparency with regard to each business trip may be an incentive to reorganise business trip scheduling leading to a more efficient pooling of trips. If other transport modes cause fewer expenses for certain trip purposes, users can be systematically referred to make use of public transport or shared bikes.

people from buying one, at least as long as their membership lasts. If private car sharing becomes more attractive because of MFC this will therefore also reduce the overall private vehcile stock.

Comparison of the vehicle mileage of cars on average and of shared car fleets can be based on the results of the above-mentioned empirical project,[62] according to which average mileage per car-sharing vehicle (private use) is around 45,000 to 50,000 km/year. The annual mileage of an average vehicle in Germany is between 10,000 and 15,000 km. This shows that in the area of private use a car-sharing vehicle produces the mileage of 3 to 5 private cars. In other words, one car-sharing vehicle can replace between 2 and 4 privately-used cars.[63] Applying these figures to the business sector, and on the assumption that company-used vehicles have a greater mileage than privately-used vehicles, it is estimated that an MFC vehicle can replace 1 to 2 company cars (see Figure 19).

Figure 19: Average annual mileage per car: DB car sharing fleet in comparison with German car fleet in 2003



Source: Schmied, Hochfeld (2004)

For the analysis of the MFC potentials it is assumed that because of a more effective use of pool cars **1-2 company cars can be replaced by one MFC car**. It is estimated that the potential of 6,000 to 7,000 cars can be transformed at best into 3,000 to 3,500 MFC-cars.

In addition to that it is assumed that the **overall mileage of the business car fleets managed with MFC technology will decrease** because of higher cost transparency of car use and the simultaneous offering of transport alternatives via a professional mobility management.

[62] Schmied, Hochfeld (2004)
[63] Schmied, Hochfeld (2004)

Environment and Energy

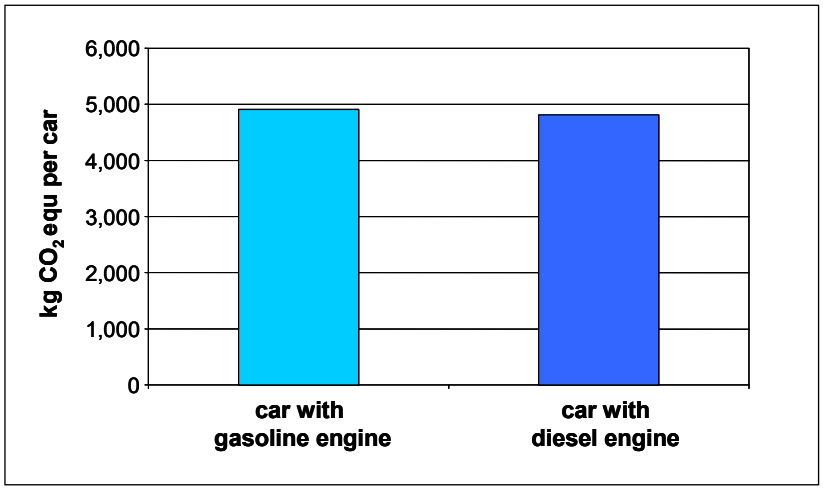
Assumption 1: As MFC enables certain savings with regard to necessary vehicle numbers it can cause a reduction of production incurred emissions.

Assumption 2: The constant replacement of older vehicles can reduce the emissions of the total vehicle fleet.

Figure 20 illustrates that for the manufacture of a vehicle – irrespective of whether it is equipped with a spark-ignition or a diesel engine – almost 5 tonnes of CO_2 equivalents arise. As estimated above, for each MFC vehicle the purchase and thus the production of 1 to 2 vehicles can be avoided. **Assumption 1** therefore represents around 5 to 10 tonnes of CO_2 equivalents per MFC vehicle.

The following comparison provides a better appreciation of this reduction: Car-induced emissions in Berlin in 2015 will amount to 3.3 million tonnes of CO_2 equivalents. If, for example, 1,000 cars are made redundant because of MFC technology, 0.3% of car-induced greenhouse gas emissions will be avoided per year. Savings resulting from assumption 1 are therefore insignificant.

Figure 20: Greenhouse gas emissions (CO_2 equivalents) of car production



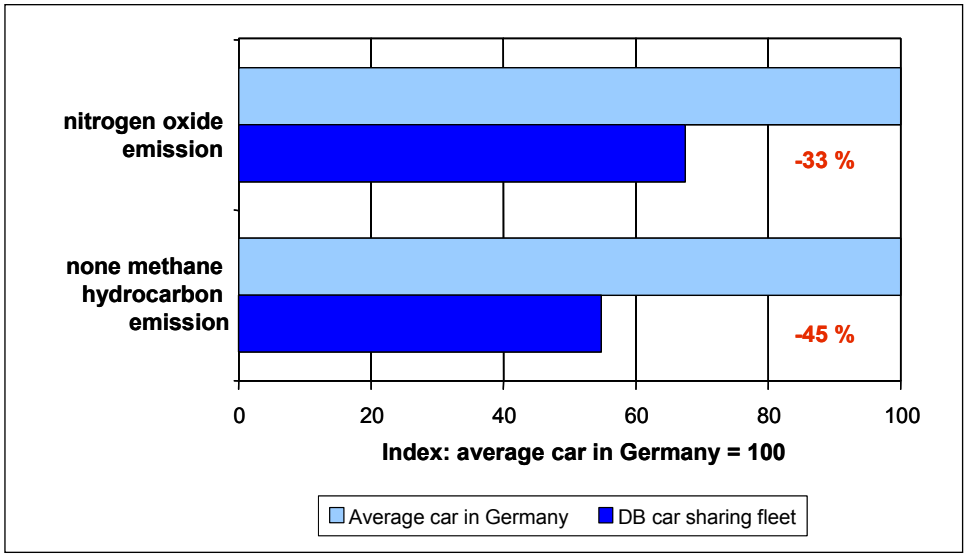
Source: Kolke (2004)

The effect of **assumption 2** can be shown in the example of the above-mentioned recent study on the DB car-sharing fleet.[64] Through regular modernisation of the vehicle fleet, emissions per km can be appreciably improved compared with the German average (private and commercially-used vehicles). Emissions of nitrogen oxide from DB car-sharing vehicles are 33% lower, and those of non-methane hydrocarbons 45% lower (see Figure 21). Savings on the part of MFC are likely to somewhat less, since commercially-used vehicles are not as

[64] Schmied, Hochfeld (2004)

old as the German average – precise analyses are, however, not available. The values shown should therefore be regarded as the upper limit.

Figure 21: Emissions per car: DB car sharing fleet in comparison with German car fleet in 2003 (weighted by mileage)



Source: Schmied, Hochfeld (2004)

The decrease in vehicle numbers through optimisation of the fleets can lead to a **reduction of 5,000-10,000 tons of greenhouse gas emissions.**

Due to the utilisation of newer cars **NO_x emissions can be reduced up to 33%** and **none methane hydrocarbon emission up to 45 %** per vehicle kilometre.

Society

An important result of implementing MFC within the life cycle of TELLUS was that the necessary organisational and billing restructuring was met often with considerable resistance among the affected employees. For instance, an informal use of business cars for private purposes is no longer possible. When business cars are used as some sort of employee gratification new arrangements have to be found. It is assumed that those hindrances will be overcome until 2015 as cost pressures on enterprises will lead them to more formalised structures or to an outsourcing of fleet management.

With its activities DB Rent aims at an innovative access to transport modes, which strategically complements the core product train journey. Providing these accesses to professionally managed cars or bikes users are systematically liberated from the previous dominating exclusive use of private or business car. A broad application of such services until 2015 will help to enforce the multimodal usage of different transport alternatives by business as well as private customers. Providing access to shared vehicles therefore

contributes to the allowing or to the stabilizing of such multimodal routines which is already nowadays a main effect of private car sharing and Call a Bike.[65]

As private car sharing becomes more attractive and available there is a positive impact on the mobility of people not possessing a private car.

The extended use of MFC enforces the **multimodal usage of different transport alternatives** by business as well as private customers. Multimodal routines will be stabilised, which will **reduce the previous dominating exclusive use of private or business ca**r.

Economy

The introduction of MFC potentially leads to cost transparency with regard to each business trip. The information made available by digitised registration of each trip length and real-distance-based billing will be used once more to optimise business trip costs. MFC entails considerable advantages when cars are necessary only occasionally for short periods of time. It allows cost-efficient access to an increasing variety of transport vehicles.

6.5 Resume

The scenario shows likely effects of a broader usage of MFC until 2015: MFC contributes to a more-efficient use of vehicle fleets. This has the effect that a given mobility requirement can be provided with fewer vehicles. Fewer cars also means, however, that in car production interrelated environmental effects can be avoided. The regular modernisation of MFC vehicle fleets also has he effect that adverse environmental effects can be reduced. Modern cars emit fewer pollutants and use less fuel – this is particularly significant with respect to the high mileage in the business area. Estimations based on results of a recent project[66], show nonetheless that the positive consequences of the MFC-potential in 2015 are limited in relation to the overall developments of Berlin's transport sector.

Even when the measure is used up to its full potential, it is thus not possible to achieve a radical decline of car related emissions or a fundamental change in business car usage in Berlin. This is hardly surprising, bearing in mind the (likelihood of a) continuing trend towards an even more widespread use of private cars as the main emitting source of greenhouse gases. Yet even though they appear to be limited, the positive effects of MFC should not be underestimated. Especially positive effects regarding the contribution towards a strengthening of multimodal transport patterns deserve particular attention. MFC generally supports strategies aiming at the intelligent use of existent resources – therefore directly or indirectly reducing the pressure to enhance the concerned resources or infrastructures like necessary cars or necessary parking spaces in cities.

[65] Franke, Maertins (2005)
[66] Schmied, Hochfeld (2004)

Combinations with other demonstrations might lead to a mutual amplifying of effects. For example, a city-wide parking management, which includes privileged parking space for all forms of systematically shared cars, would create incentives for business and private car sharing, which both allow for reduced car numbers.

B.6 Demonstration Measure 8.5 - Car Modal

1 Introduction

The demonstration measure “Car Modal” aimed at the reduction of private car use and the increase of occupancy rates by offering alternative and flexible mobility services in peripheral areas of Berlin. By enhancing the accessibility of Public Transport in these areas it was intended to attract new customer groups. The original measure design contained the implementation of three mobility services, but during the TELLUS project only one, “CharterCab” a collective taxi service, could be tested.

2 Description of demonstration measure

2.1 Demonstration design[67]

The objective of Car Modal was the demonstration and establishment of new forms of collective transport and vehicle use. Therefore it was planned to create new options for urban travellers. The planned measure consisted of three mobility alternatives: A collective taxi service (“CharterCab”), a virtual disposition centre for car pooling based on private cars for collective use (“Fellow Passengership”) and a car-rental with the option on one-way-trips without fixed stations in the city centre (“Telematic Cashcar”).

All of these alternative services were based on new communication technologies (GPRS, UMTS and Bluetooth). Software to manage the services was supposed to be developed and implemented in the course of the demonstration process. Moreover, the Car Modal services were intended to be an integrated part of the public transport system.

Further components of the demonstration included the planned creation of a customer organisation called “Mobil Club” with a minimum of 500 members, the consideration of legal restrictions and the establishment of close contacts to the customers.

2.2 Transport Plan context

In the Transport Plan of Berlin the TELLUS measure Car Modal is integrated in the category of organisational measures. It is part of the bundle of measures that aims at the implementation and extension of additional flexible PT services to achieve a modal shift favouring public transport. [68]

[67] Description of work, ANNEX A TELLUS Project descriptions, issued 29 October 2001

[68] Senatsverwaltung für Stadtentwicklung (ed.) (2003)

2.3 Objectives

In co-operation with the evaluation team the demonstration measure set itself objectives on different levels addressing short-term outputs and long-term outcomes as well as intermediate steps. Beside the documentation of the implementation process these objectives built the basis for the evaluation of the measure.

IMMEDIATE OBJECTIVES
Develop a concept for CharterCab in the southern peripheral region of Berlin
Carry out a simulation of the implementation
Find taxi drivers to join the Mobil Club
Find potential users to join the Mobil Club
Find solution for legal implementation barrier
Implement CharterCab in the southern peripheral region of Berlin
Implement “Fellow Passengership” in the southern peripheral region of Berlin
INTERMEDIATE OBJECTIVES
Enhance the public transport connection of peripheral regions with Berlin
Increase occupancy rate of taxis and private cars
ULTIMATE OBJECTIVES
Increase public transport use (CharterCab as part of PT)
Increase the modal share in favour of public transport
Reduce car kilometres
Reduce traffic related CO_2 emissions and energy use
Reduce air pollution and noise

2.4 Situation before TELLUS / Innovative aspects

Before the implementation the target area was only served by a scheduled bus service, which was (and still is) operated by the local public transport company “Havelbus”. By then eight bus lines linked different parts of the area with the underground and urban rail stations in southern Berlin and Potsdam. The buses operated from Monday through Friday from around 5:00 am until midnight, during peak period in intervals of 20 or 30 minutes. In the evening hours and on Saturdays and Sundays the frequency was reduced to hourly service. During the night hours there was no operation.

With CharterCab a new service, not bound to timetables and bus lines was introduced based on innovative IT solutions as detection technology and scheduling software. By the implementation of the service the intention was to improve the accessibility of the area by providing a flexible collective taxi services during the evening and early night hours.

3 Implementation process

The service

The first component of Car Modal, the CharterCab service was started in November 2002 with three taxi vans (see picture on the right) and ran until January 2004. It was implemented as a commuter service to and from the public transport stations of selected peripheral areas in the South-West of Berlin. The customers which had to be members of "Mobil Club" could order CharterCab via mobile phone, phone or internet and were picked up at home. The ticket costs were Euro 4.30 per ride, which is about double the regular fare for a single journey ticket on Berlin's public transport network.

User participation[69]

During the implementation phase CharterCab received intensive concomitant support by the TELLUS demonstration measure "Customer and user participation" (demonstration measure 10.4, P.O.P. Consulting). In autumn 2002 P.O.P. took over the customer participation activities.

In co-operation with the demonstrator target groups were identified and a market analysis was carried out. Local representatives (20-30) of these target groups were contacted, interviewed and invited to workshops to get a feedback on the design and communication of the product. In November 2002 a simulated pre-run of the service was carried out, which was widely covered by the media.

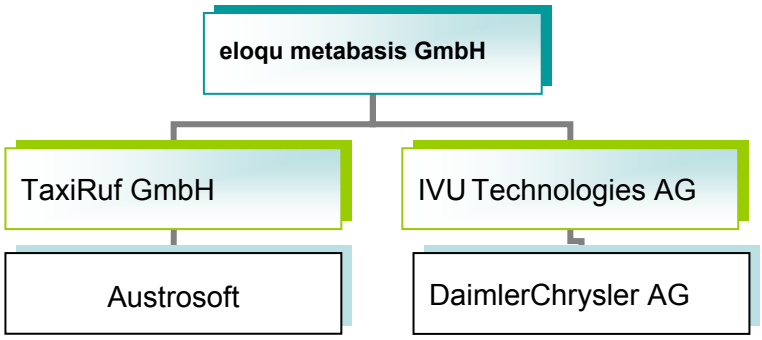
The user participation led to a redesign of the service. Following the request of the customers the operation hours were extended from the initial '6:00 p.m. to 12:00 a.m.' to '5:00 p.m. to 2:00 a.m.'. Furthermore it was shown that commuters and pub visitors did not belong to the potential target group of the service, but instead school children did who had not been considered initially. Elderly were interested in the service mainly during the morning hours. Due to budget reasons the service could not cover the requested time of the day, and therefore this group could not be taken into account. Another result of the customer participation was that some "gut assumptions" made about the target groups like "the commuter with the PDA" had to be adjusted to reality. The related concept of the "early adopters" could thus not be applied. This led to a shift from a predominantly technology oriented to a more user oriented approach.

[69] Interview with P.O.P. Consulting, 23.04.2004

Consortium

For the implementation of the measure a consortium was established comprising four main partners (Figure 22): The transport telematics company eloqu metabasis GmbH (project manager); a local taxi disposition centre (TaxiRuf GmbH) with its subcontractor Austrosoft as the provider of taxi disposition software; a supplier of IT systems for transport and logistics processes (IVU Technologies AG), and the subcontractor of IVU Daimler Chrysler AG, which was responsible for software development.

Figure 22: Consortium structure



In September 2002 one of the partners (IVU) left the consortium. As a consequence the planned development of the fleet-management software could not be completed. What is more, due to the complicated contracting situation the results of the work undertaken by Daimler Chrysler were also lost for the consortium when IVU left. In order to cope with the new situation, the already existing taxi-management software of TaxiRuf (developed by Austrosoft) was used instead. Furthermore, a switch from GSM based communication to DataFunk became necessary. Because of that, only taxis equipped with this particular system could be used for the service.[70]

Legal situation

From the very beginning of the demonstration, the project partners were facing a complicated legal situation.

In Germany, the local public transport market is highly regulated. Every commercial public transport enterprise needs an official operation permit. What is more, standard local public transportation on roads is generally the only permissible operation-service. Such a standard public transport service needs to fulfil a number of requirements in order to be permissible, e.g. there needs to be a defined starting and ending point, and exact time-tables must be established in advance. The need for an operational permit applies to every line. Moreover, the transport market is traditionally monopolised by the already existing, often municipally

[70] Interview with eloqu-metabasis, 27.01.2004

owned companies. Competition is basically nonexistent since other than pre-existing transportation lines are rarely allowed. The rationale behind this structure is to better serve the public interest, by creating safe and reliable service.

Originally, the project partners intended to overstep the obligatory permit application process by using a private "Mobil Club" model. However, it was not possible to follow this strategy through.

Nevertheless, in order to enable the demonstration to proceed an operational permit by the authorising agencies of Berlin (Senate Department) and the relevant district in Brandenburg was required. Since the innovative transport service CharterCab fell neither in the category of a taxi-service nor was it considered a public transport-service, the project partners applied for a special permit. This permit would have allowed for the operation of an experimental public transport-service. Especially in the first phase of the project, until the middle of 2003, intensive negotiations with the related public institutions had been necessary (local administration, affected public transport enterprises, police, Taxi Association). Yet the legal situation remained unclear throughout the entire project. A permanent permit for CharterCab was not granted, however the negotiations led to a "gentlemen's agreement". But the informal and temporary dimensions of this agreement did not negate uncertainty. Such a situation of ambiguity was a poor basis for extensive marketing activities. Hence, according to the demonstrator, the project's uncertain legal status prevented the project from reaching its target of 500 members in the "Mobil Club."

Reduced implementation

Along with the problem outlined above, the time and financial resources needed for the measure were also underestimated, which finally led to a reduced implementation. The demonstrators believed that a successful CharterCab-service was an indispensable prerequisite for the proposed additional services, so that in the end the further components of Car Modal (car pooling and car rental) were abandoned in March 2003.[71]

Integration into public transport

Since it appeared that CharterCab could not run as an additional mobility service in a cost-efficient way it was planned to integrate it into the public transport service. When the attempt of the management of TELLUS Berlin to establish a co-operation with the transport association of Berlin Brandenburg (VBB) failed, negotiations with the public transport company of Berlin (BVG) commenced in May 2003. They were stopped in January 2004 though, since the BVG saw various critical points regarding the integration of CharterCab into the regular PT service as a substitute for the classic bus service.[72] One of the main points was that the service had to be ordered by the customers by telephone. The reason was that

[71] Interview with eloqu-metabasis, 27.01.2004

[72] Interview with BVG by Lisa Ruhrort (WZB) in July 2004

from a BVG point of view according to the transport plan of Berlin a public transport service must be available at an S-Bahn station without the need for prior ordering. At least a call box, which would provide access to the service for those without mobile phones, would have had to be installed. Furthermore, extra capacities for larger passenger streams during peak hours would have had to be made available. In order to fulfil this requirement, a larger number of taxis would have had to be provided with the technical equipment. Additionally it was assumed that the customers would not prefer the CharterCab door-to-stop service to the "ordinary scheduled public transit bus" because they would have had to pre-order it. Based on this line of reasoning, the BVG saw no potential for attracting new customer groups.

Moreover, the calculation that the substitution of regular buses by CharterCab would reduce the costs for the BVG was not agreed on (see Chapter "Impacts").

Outlook

Since July 2005 the CharterCab disposition technology has been used for a door to door mobility service for disabled persons in Berlin provided by the CharterCab partner TaxiRuf, commissioned by the Senate Department of Berlin. Due to legal restrictions for the time being the service can only run for a demonstration phase with an exceptional permit. At present an EU-wide tendering is carried out for the taxi service.

Furthermore TaxiRuf would like to develop a product that could be disseminated to other cities via franchising.[73]

4 Results

4.1 Evaluation methods

Between April 2002 and January 2004 regular meetings with the demonstrator served to update information on the status of implementation as well as on the number of users and their transport patterns.

In September 2003 a survey among the 50 members of the CarModal Mobil Club was carried out by the evaluation team in co-operation with P.O.P consulting (Customer and User Participation). All of the 15 active users and 8 of the 35 non-users of CharterCab could be interviewed on their travel behaviour and acceptance of the service.

In order to reflect on the implementation process and identify the factors of success as well as barriers, interviews with the demonstrator, P.O.P consulting and the BVG were carried out at the end of the measure.

[73] Presentation of TaxiRuf at TELLUS conference "TELLUS Berlin Lessons Learned – Sustainable Urban Transport in Berlin" on 19 October 2005

Furthermore, in the final interview the demonstrator was asked to assess the public-private co-operation and the involvement of the Customer and User Participation (10.4) throughout the life cycle of the measure.

The measurements for the evaluation areas “society” and “transport” could - with minor changes due to deviations in the demonstration design - be carried out as stated in the Evaluation Plan. As a result of the low implementation level no data could be obtained for the evaluation areas “economy”, “energy” and “environment”.

Potential impacts in these areas were estimated for the time frame 2006-2015 and are described in the scenario in Chapter 6.

4.2 Impacts

SOCIETY

User acceptance

In January 2004 the Mobil Club counted 50 members, out of which 15 were customers of CharterCab. The service had an average of 11 passengers per day.

The Users

- 57 % are female
- Average age: 50 years
- 73 % own a monthly PT ticket
- 80% can always or almost always use the car
- 93% use normal taxi infrequently or never

Source: Survey Mobilclub members September 2003

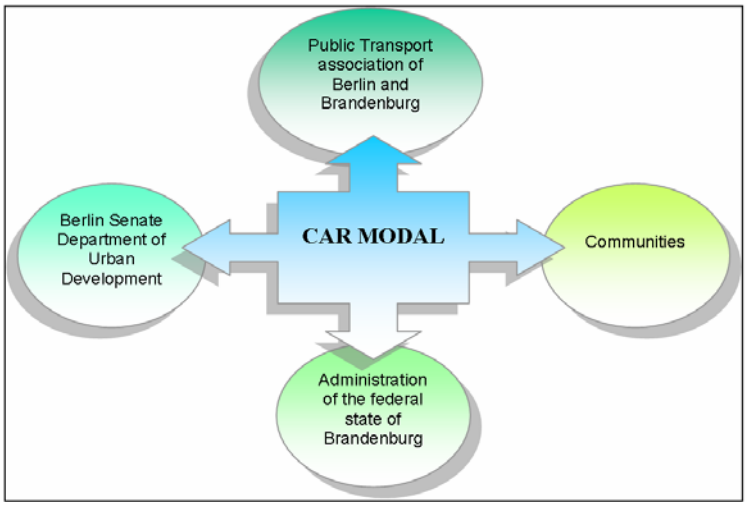
In a survey, carried out in September 2003 among the members of the Car Modal Mobilclub by the Evaluation group in co-operation with P.O.P consulting (customer and user participation) 9 out of 15 of the actual users of the service said they were very satisfied with CharterCab, and only one said he was not satisfied. Reasons for criticism were the lack of integration into the public transport system and the resulting high additional ticket costs. Furthermore it was criticised that the information provided about the service was not sufficient.

In the customer survey reliability and flexibility were named as being generally the most important qualities of a transport means. CharterCab was rated very well in these categories. 91 percent of the respondents rated the reliability of CharterCab “good” or “very good”; 80 percent did so for its flexibility. The average waiting time between order and arrival of the taxi was 14 minutes.

Public-private co-operation

During the implementation process of CharterCab the demonstrators co-operated with several public institutions[74]: The aim of these contacts was to solve the unclear legal situation of the service and to realise the integration of CharterCab into the PT network. An advantage for the negotiations was that CharterCab was part of an EU-project. This helped to open doors and to promote the co-operation with the partners.

Figure 23: Public-private co-operation



A barrier was the unfavourable start of the co-operation. The demonstrator was not aware that an exceptional permission was needed, so in the beginning he did not involve the authorities. The responsible authority read about the implementation of the service in the newspaper and informed the demonstrator about the necessity of an exceptional permission.

According to the demonstrator the negotiations initially appeared to go into a positive direction. But even though regular meetings were held, some problems could not be solved. Until the end of the demonstration measure no written commitments were given by the authorising body.

Also the negotiations with the Public Transport Company of Berlin stopped without an integration of CharterCab into the public transport net.

TRANSPORT

Transport patterns

The average occupancy rate of the CharterCab taxis was 2.4 passengers/vehicle from November 2002 to May 2003 and 1.2 passengers/vehicle from April 2003 to December 2003.[75] The service was used during the entire week with a peak on Fridays and lower use during the weekends, especially on Sundays. The peak hours were between 10 and 12 p.m. The average trip length was four kilometres and in 67 percent of the cases the service was used for leisure trips and in 33 percent for business trips.

[74] Interview with eloqu-metabasis, 27.01.2004

[75] Continuous monitoring by eloqu metabasis and TaxiRuf

ECONOMY

Due to lack of available data no detailed assessment of the cost-efficiency of CharterCab could be carried out but according to the demonstrator the service did not pay for itself. It showed that the service is only financially feasible when it is subsidised respectively an integral part of the public transport system. This is an experience that is shared by similar projects carried out before.[76]

Calculations carried out by the demonstrator for the negotiations with BVG showed that the integration of CharterCab in the public transport network and the related substitution of conventional buses with the CharterCab service can bring about saving of costs. According to BVG calculations the operational costs for the buses as well as the labour costs (substitution of "expensive" BVG bus drivers with "cheaper" subcontractors) would indeed decrease, however the costs of acquisition and maintenance would remain[77].

PUBLIC AWARENESS

Although the measure faced many problems during the implementation phase the demonstrator undertook a good number of activities to make CharterCab known to the public. On local, regional and international level 10 presentations on conferences were given and several workshops were organised to communicate the measure to experts and politicians. Moreover 9 newspaper articles in local and regional daily press about CharterCab and 5 newspaper articles in connection with the launch of the mobility service for disabled persons were published. Moreover the regional TV broadcasted twice a short report about the services.[78]

5 Conclusions

From the analysis of the implementation process described above conclusions can be drawn regarding the factors that promoted or hindered a successful implementation of the demonstration measure.

5.1 Drivers

From the analysis of the implementation process described above conclusions can be drawn regarding the factors that promoted or hindered a successful implementation of the demonstration measure.

[76] Lorenz et al. (n.d.)
[77] Interview with BVG by Lisa Ruhrort (WZB) in July 2004
[78] TELLUS reporting

Customer and user participation: The customer and user participation helped to identify target groups and to integrate them into the testing and development of the product. So the CharterCab design could be adjusted to the users needs.

Personal commitment: For the success of the demonstration it was essential that individuals in the public authority backed the implementation of CharterCab.

Mediation support for negotiations: In difficult negotiation situations it was helpful for the process to have an independent player (demonstration measure 10.4) to moderate the discussion process.

Status of EU-Project: The label of being part of an EU-project helped to open doors. This was important for the communication with the public authorities as well as for the contact with the potential users of the service.

5.2 Barriers

Legal framework: An important barrier for the implementation of the innovative mobility service was the high level of public transport regulation.

Lack of user orientation: In the beginning the design of the service did not focus on the potential users and their needs but on the technological aspect of the mobility service. The target groups to be reached were not clearly identified.

Lack of integration into transport system: Although CharterCab was meant to be a feeder for the local public transport system it was not integrated into it. This led to three negative consequences. First, in order to use the service an additional ticket had to be bought by the customers. Second, there was no synchronisation of schedules and information services between CharterCab and the public transport network. Third, without the integration into the local public transport system cost effective servicing could not be achieved. Negotiations with the BVG, which where aimed at facilitating the integration of the service by replacing low frequented night bus lines with CharterCab, failed in December 2003.

Financial barriers: The implemented service could not cover all costs. For permanent operation, additional subsidies would have been required. Theoretically, public grants exist for such purposes, but specific demands and requirements must be fulfilled. CharterCab, however, was unable to meet official obligations, since it did not match the legally defined description of permissible transport. Additionally, there was no budget for extensive marketing activities needed to raise public awareness for the new mobility service.

Information: According to the feedback of the potential customers too little information about CharterCab was provided in the taxis, at bus stops and at light rail stations. So the service was not visible to those who did not use it on a regular basis.

Contract structure: Because DaimlerChrysler was just a subcontractor of one partner (IVU) all of their work was lost when IVU left the Project.

Communication barriers: The actors of the demonstration measure were from different backgrounds (small companies, big companies, consultants and authorities) Due to differences in their communication cultures misunderstandings sometimes made co-operation difficult.[79]

Unfavourable start of co-operation: The authority responsible for the exceptional permit was not involved from the very beginning and read about the service in the newspaper. This made co-operation initially difficult.

Non-acceptance of CharterCab by other Taxi-Associations: Contrary to what had been expected in the beginning of the measure the taxi associations of Brandenburg and Potsdam/Havel were sceptical with regard to the CharterCab idea. The initial assumption that taxi drivers would be open-minded to the concept could not be proved. The service was seen as competitor and threat to the own business.

5.3 Resume

The demonstration measure tried to establish an innovative service to make PT in peripheral parts of Berlin more accessible, attractive and flexible. In the beginning the project focus was very much on the technical component of the implementation.

The communication with potential user groups that was initiated later on, set off a learning process, which in turn led to a revision of the focus of the demonstration measure. The needs of the potential customers were put into the centre of attention. Target groups could be identified and addressed, but due to budget reasons and legal problems no wider marketing campaigns to inform potential users could be carried out.

So despite the fact that in the initial market analysis and in the user survey people were sympathetic to the service, the number of actual passengers was very small. Instead of intended 500 customers only 12 could be won over as regular users.

Whether or not a higher demand would have led to a successful and sustainable operation can not be assessed here. Apart from the acceptance of the potential customers, legal and co-operation related issues played an important role.

A crucial barrier to the implementation of the innovative mobility service was the complicated legal situation. Taking into account that the public transport market requires complex legal manoeuvring, intentions of the demonstrator to avoid official applications were perhaps imprudent. Pre-project analysis of results and experience from similar projects would have been beneficial. Such a strategy could have reduced misunderstandings and complications in later negotiations with the administration and concerned enterprises.

[79] Interview with P.O.P. Consulting, 23.04.2004

Regarding the difficulties with obtaining public funds and subsidies for permanent operation, a possible solution to the difficult situation centres on integrating the CharterCab service into the traditional public transport of established companies. In order to gain necessary funding and solve legal problems, this would require consent from all related administrative actors and local transportation enterprises.

Achievement of objectives

As already described in Chapter 2.3 the measure aimed at objectives of different levels. The following table assesses in how far these goals were achieved. Details on the underlying arguments for the assessment can be found in ANNEX 1.

Table 7: Overview of grade of achievement of objectives

IMMEDIATE OBJECTIVES	
Develop a concept for CharterCab in the southern peripheral region of Berlin	ACHIEVED
Simulation of the implementation	ACHIEVED
Find taxi drivers to join the Mobil Club	ACHIEVED
Find potential users to join the Mobil Club	PARTLY ACHIEVED
Find solution for legal implementation barrier	NOT ACHIEVED
Implementation of CharterCab in the southern peripheral region of Berlin	PARTLY ACHIEVED
Implementation of “Fellow Passengership” in the southern peripheral region of Berlin	NOT ACHIEVED
INTERMEDIATE OBJECTIVES	
Enhance the public transport connection of peripheral regions with Berlin	NOT ACHIEVED
Increase occupancy rate of taxis and private cars	NOT ACHIEVED
ULTIMATE OBJECTIVES	
Increase public transport use (CharterCab as part of PT)	
Increase the modal share in favour of public transport	
Reduce car kilometres	
Reduce traffic related CO_2 emissions and energy use	
Reduce air pollution and noise	
Grade of achievement: ACHIEVED – ALMOST ACHIEVED – PARTLY ACHIEVED – NOT ACHIEVED	

As shown in Table 7 the demonstration measure mostly reached its objectives in the immediate sphere. The measure could partly be implemented and could finish its demonstration phase. However, an extension and permanent implementation of the service was not possible due to financial, legal and co-operation problems. Since this extension would have been necessary to obtain effects addressing the transport and environmental

objectives, the intermediate and ultimate objectives could not be reached successfully by the measure.

Despite the incomplete achievement of objectives and the small degree of implementation the demonstration measure can be assessed as successful in regard to the criteria adaptability and gain of knowledge through the implementation. Most notably:

- The project partners were able to adjust the demonstration design in a flexible and innovative manner to the current requirements and basic conditions, which appeared in the course of the project, and
- CharterCab, a service form combining individual and public transport, has been run over a longer period under real life conditions, and in this manner experiences with customers, operators, authorities and transportation companies could be gained.

6 Scenario

6.1 Introduction

The aim of the TELLUS Car Modal measure in Berlin was to improve transport connections in peripheral areas of the city through the introduction of flexible, demand-oriented transport services. In order to estimate the potential long-term impacts of such a flexible service, the results of the implementation of Car Modal, and particularly of CharterCab (CC), during the life cycle of TELLUS were used as starting point for further assessment. Furthermore, in order to plant the estimates firmer into a real-life context, some of the more practical calculations were carried out based on actual and projected conditions in a selected case study area. Likewise, supplement data and information derived from other studies and projects were also incorporated into the upscaling exercise.[80]

6.2 Description of the measure characteristics in 2015

CC is an integrated part of the public transport network. The CC fare is therefore equal or only slightly above the fare for other modes of public transport.

6.3 Framework conditions

Based among others on the lessons learnt in TELLUS, the urban transport policy of the year 2015 will have experienced some major changes, resulting in the provision of necessary preconditions for flexible services, such as:

[80] Sources and references used are provided in the extended version of the present text, which can be found in ANNEX 3.

- **Re-adjustment of legislative framework:** The conventional and flexible public transport have the same legal statues and are subject to the same legal requirements and opportunities.
- **Equal access to tendering procedures:** for conventional and flexible services.
- **Comprehensive and coherent transport policy:** The service is part of a bundle of measures of transport policies that supports an intelligent use of the existent transport infrastructure. These complementary measures work together with the flexible CC, for example by favouring access to the inner city with the public transport over car dominated accessibility.

6.4 Description of case study area

In order to illustrate the potentials of the service calculations were carried out with regard to an area in Berlin-Mahlsdorf.[81] In the Local Public Transport Plan Mahlsdorf is mentioned as one of the peripheral areas in Berlin, for which the introduction of flexible services is envisaged. The district is located in the eastern periphery of the city. It is a predominantly residential area with mostly low-density detached and semi-detached housing. Mahlsdorf together with neighbouring two other former village settlements make up the largest suburban detached housing estate of Berlin.

The case study area is connected to the inner city by an S-Bahn line in the north, complemented by bus and tram lines (Figure 24). A tram line runs along the western main road and intersects with a bus line that goes farther to the east, covering a distance of 3 km.

However, the bus line runs at low frequency (on average every 20 minutes) 72 times a day in each direction between 5 a.m. and midnight. Passenger numbers add up to a total of 450 in each direction on an ordinary working day. On average there are about six passengers per tour in a bus that has the capacity to transport 155 people (51 seats and 104 standing).

[81] The actual TELLUS demonstration area for the CharterCab service was in the south-western periphery of Berlin. However, the calculations necessary for upscaling were carried out with regard to a different area in south-east Berlin on the grounds of better availability of the data and information needed for the analysis.

Figure 24: Mahlsdorf transport connections

6.5 Analysis of potentials

The potentials have been estimated based on two considerations: First, what are theoretical options, i.e. what could generally happen if a flexible service was to replace a bus line; and second, what is the most likely line of development with particular (but not exclusive) focus on the case study area.

Transport

<u>Passenger development</u>

There are different ways, in which passengers might react when a bus line is replaced by a flexible transport service.

- **Option 1:** All of the bus passengers switch to the new service.
- **Option 2:** A number of new passengers will be attracted to the service because of the demand orientation of the service, the increase in comfort (door-to-station service) and flexibility that had previously not used public transport. [82]
- **Option 3:** The service loses passengers probably because of the need to pre-order the service, the reluctance of former bus passengers to make use of a new service, etc. However, this possibility is not taken into account in the scenario.

[82] The transport development plan of Berlin assumes that by implementing the entire bundle of measures contained in the plan a passenger increase of about 7% in the public transport sector can be achieved. The 7% therefore also mark the upper limit of the passenger gains to be expected for a CC-service.

For the analysis of the CC potentials it is assumed that an increase in passenger numbers can be achieved in the area. It is estimated that 480 passengers will be using the flexible service in each direction, adding up to a total of **960 passengers a day**.

Mileage development

When transforming a bus operated into a CC operated service there are different options for the development of the mileage.

- **Option 1:** A better matching of transport demand and supply leads to a **decrease** of mileage travelled
- **Option 2:** A better matching of transport demand and supply / the provision of a door-to-station service and the coverage of a wider corridor instead of a single street-bound line leads to a mileage **increase.**[83]

Since the intention is to provide a more comfortable, flexible and demand oriented service, it is estimated that the CC will run more frequently than the bus. For the case study it is estimated that **90 tours per day** in each direction will serve these purposes, meaning that the daily mileage will increase to **540 km / day**.

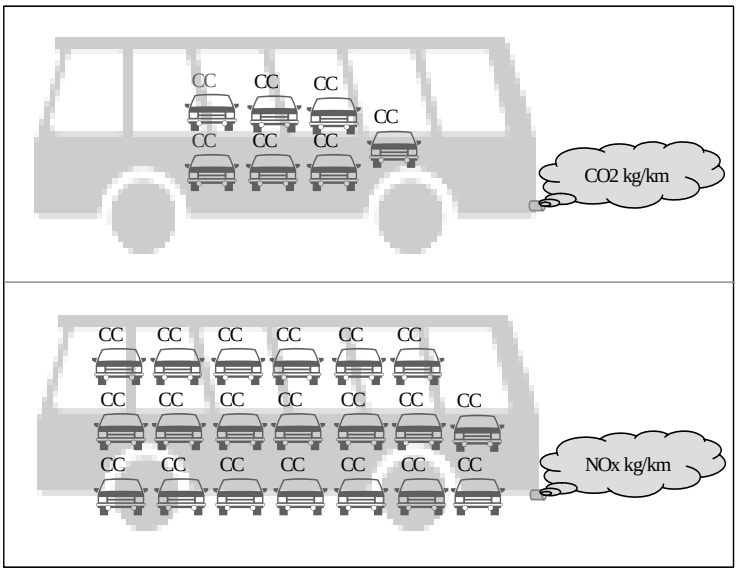
Environment and Energy

The emissions can be reduced considerably if a flexible service replaces the bus line.[84] (Figure 25). Regarding CO_2 emissions, a bus produces seven times more CO_2 per km than CC. Regarding NO_X the difference is even more obvious with a ratio of 1:20. Looking at these figures it appears to be virtually impossible to overcompensate the emission advantage of the taxi van with mileage increase.

[83] For example if the flexible service travels at the customers demand, which might appear at times when a bus would not have travelled, or if the bundling of tours is not possible due to a temporally scattered demand. Also, additional passengers might cause a need for the service to operate more often along the route, which will also generate a mileage increase.

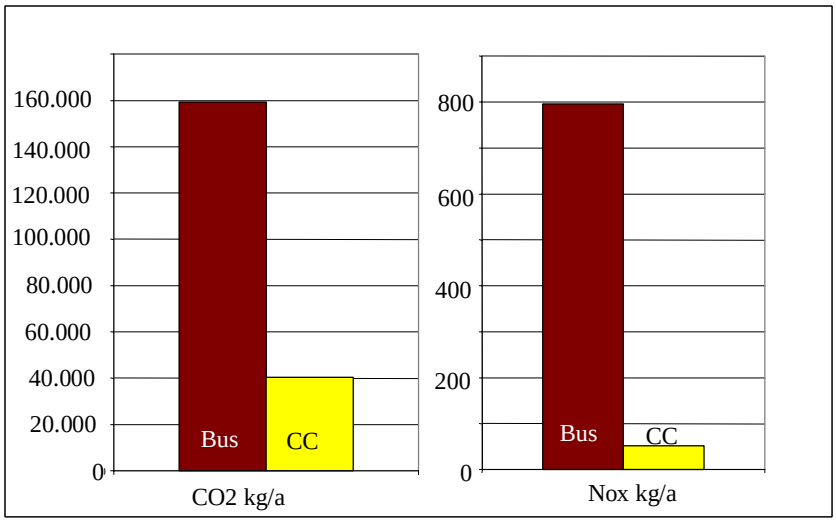
[84] This is mainly because the fuel consumption of taxi vans is lower because of the lower weight of the vehicle and the smaller size of the engines

Figure 25: Comparison of vehicle emission factors[85]



For the calculations in Figure 26 it was estimated that the CC service would run 180 times (including door service) during the day as opposed to the 144 bus tours. Nevertheless, the CO_2 emissions add up to only 25 per cent of the emissions generated by the bus, i.e. CO_2 emission reduction is 75 per cent. Even more obvious, the CC service reduces NO_X emissions by about 94 per cent annually.

Figure 26: Comparison of annual emissions in the case study area



[85] The calculations of emissions, etc. are based on the engine characteristics of the Mercedes Vaneo in comparison with a conventional bus. For the latter, assumptions as to engine and vehicle improvements as well as the renewal of the bus vehicle fleet in Berlin have been taken into account. Thus, the emission calculations are based on the projected vehicle 'state of the art' of the year 2015.

It has to be noted that these calculations only concern the replacement of a 3 km bus line in the case study area. If put into the context of the entire city and its transport emissions, however, the reductions that can be achieved by replacing bus lines with flexible services appear to be of minor relevance, because:

- On the city level there is only a limited number of areas where flexible, demand-oriented services can be applied.
- Bus lines that can either partly or fully be replaced with a flexible service generally run along side roads in peripheral areas.
- According to the transport plan of Berlin, in 2015 about 15 per cent of the total bus mileage will be generated on these side roads, translating to 17 per cent of the CO_2 and 18 per cent of NO_X emissions.
- It is estimated that a maximum of 25 per cent of the mileage on side roads can be taken over by CC under the same conditions as outlined in the case study area example (i.e. passenger numbers increase, mileage increase, emission decrease).[86]

From an **environmental point of view CC does achieve positive impacts**; however **compared to the total emissions of transportation in the city these are only minor**. It has to be considered, however, that locally, i.e. in the areas where CC runs, **air quality improvements** as well as **noise reduction** might turn out to have a positive impact on the local residents' quality of life.

Society

Regarding flexible, demand oriented services there seems to be a general agreement among transport experts that positive impacts regarding social aspects, which can be expected from a CC-service, might be of much more importance than the environmental impacts.[87] Looking at the demographic trends in Berlin especially in their spatial appearance, the following can be assumed:

- Peripheral areas continue to grow in size and population while the inner city experiences a stagnating development.
- From a transport point of view, the shifts in demographics and particularly the changing age structure and growing differences between the inner and outer parts of

[86] If the assumptions and calculations that were considered for the case study area are similarly applied to the 3.75 Mio km annual mileage that CC can take over, emission reductions of about 4.1 t CO_2 and 26 t NO_X can be achieved annually, which really is only a minor fraction of both, public transport and total transport emission in the city.

[87] This was particularly emphasised by the experts participating in the workshop June 2005.

the city will have a major impact on the future transport demand, because the mobility patterns of the elderly are different from those of the younger generations.

- Public transport will be important for the older people, particularly in outer districts where the economic, cultural and social infrastructure is less available.
- The provision of traditional timetabled public transport appears not appropriate for many seniors seeking flexibility in their transport services, based on what they are used to and what they require.
- Demand oriented public transport taking into account the need of the elderly has many advantages, which might make it an alternative to car use and in particular to substitute car uses, such as lifts provided by social networks, e.g. family and friends.
- Additionally the transport service must also hold adequate offers for young people. Transport problems in peripheral, badly connected areas might be most relevant for e.g. teenagers, who desire to enlarge their activity radius but are not yet able to travel individually.[88]
- It appears that CC is well able to fulfil all of the mentioned requirements.[89]

Considering the case study area, it appears striking that the average age is already much higher than in the surrounding high density estates, reaching 58 years. The problems arising from rapid greying of the population with regard to transport will therefore be more pronounced there than in other areas of the city within a short period of time. In 2015 the arising problems will be solved due to CC, since:

- Seniors in Mahlsdorf travel longer distances with more ease and confidence than elder people in peripheral areas that are not (yet) serviced by CC.
- The elderly remain independent from family rides.
- Because of the door-service, they do not have to undertake the strenuous walk to the bus stop anymore.
- The vehicles used are accessibly to the physically impaired as well, which enables them to fully participate in transport.
- Integration with the transport network ensures that the area remains well connected to the inner city. Because of the tariff integration, and especially because of reduced tickets for the elderly, the service is affordable also to seniors with a small pension.

[88] Anecdotal evidence shows that this age group appreciates the benefits offered by flexible collective transport, and they are even willing to pay a little more for it (Information provided by one expert during the expert workshop in June 2005).

[89] This notion is underlined by the results of the CharterCab customer survey, in which the categories reliability and flexibility were rated positive by 91% and 80% respectively of the respondents. What is more, already during the TELLUS demonstration of CharterCab, the average age of the users was 50 years.

- The good transport connections make the area more attractive for people that look for a place to live in the periphery, but who do not want to be car-dependent. Because of that, Mahlsdorf also shows a better mix of different age groups and lifestyles than areas that appear less attractive from a transport connection point of view.

These qualitative assumptions can not yet be supported by empirical data; however, they appear reasonable enough to lead to the conclusion that when considering impacts of new and innovative services, more attention needs to be paid to social issues.

The positive social impacts that can be expected from a CC-service might be of much more importance than the environmental impacts.

Economy

Under proper framework conditions, subsidisation of transport lines can be reduced by between 15 and 45 percent through the implementation of flexible services. By the year 2015 these framework conditions should be put in place, so that the economic potentials of flexible services can be put to use.

6.6 Resume

The analysis of the potentials and possible benefits of a flexible, demand oriented transport service like CharterCab showed that positive impacts are to be expected, both from an environmentally and a social point of view for the year 2015 if the service was put into place city wide. However, calculations indicate that the environmental effects are on a much lower scale than one would expect, which is mainly due to the fact that such a service can only be implemented in certain, closely defined areas of the city, namely the periphery and suburban housing estates.

Nevertheless, the service could contribute to the achievement of the goal of a more sustainable urban transport, combining environmental, social and economic advantages, especially if it is looked at as one of many modules of future urban public transport, which will complement and reinforce each other.

B.7 Demonstration Measure 9.3 – Inner City Logistics Centre

1 Introduction

The demonstration measure "Inner City Logistics Centre" aimed at changing the modal split in freight transport towards more sustainable modes, promoting clean propulsion techniques and improving intermodal co-ordination in the field of freight transport. Therefore, the measure, consistent of three interrelated parts, attempted to promote the advantages of the newly built tri-modal logistic centre Berlin "Westhafen", support the introduction of CNG powered distribution vehicles (in co-operation with measure 12.6 "Introduction of CNG powered vehicles") and develop a container tracking system that improves the efficiency and security of intermodal container transport.

The partners involved were the local gas provider GASAG (Berliner Gaswerke AG – Berlin Gasworks Corporation) with its subcontractors BEHALA (local port operator) and Zapf Umzüge GmbH, one of the biggest German moving companies.

Due to unfavourable framework conditions the demonstration could not be carried out as planned.

2 Description of demonstration measure

2.1 Demonstration design[90]

The demonstration measure "Inner City Logistics Centre" was divided into three parts:

Part 1: Increase acceptance of tri-modal logistic centre

The aim of part 1 of the demonstration measure was to improve the acceptance of the newly established tri-modal logistic centre "Westhafen". This was meant to be achieved by demonstrating the advantages of that centre to the haulage companies and to the citizens alike. Furthermore the operator (BEHALA) planned to consult and support the introduction of innovative logistic services for its customers, which should lead to a reduction of lorry-kilometres in the city.

Part 2: Promotion of clean vehicles

Part 2 of the demonstration measure was to promote and support the introduction of CNG-powered distribution lorries by the haulage companies that handle the transport operations between the logistic centre and the freight recipients. Moreover, this should have been done in co-operation with demonstration measure 12.6 "Introduction of CNG vehicles".

[90] Description of work, ANNEX A TELLUS Project descriptions, issued 29 October 2001

Furthermore, the operator wanted to support the installation of the necessary fuelling infrastructure in order to establish a centre for clean energy propulsion systems.

Part 3: Container tracking system

A new telematics-based container tracking system was intended to be applied by Zapf Umzüge GmbH for inter-modal freight transport from one of the two inner-city logistics centres.[91] The demonstration should have proved that the new container tracking system enhances the economic efficiency of inter-modal freight transport (long distance haulage by rail, short-distance delivery on road) while obtaining positive impacts for the environment (emissions, noise, energy consumption). The pilot project focused on transport movements for housing relocation and incorporated security supervision to enhance the quality of transport services, which is an important pre-condition for the expansion of inter-modal container transport incorporating rail for long distance sections.

2.2 Transport Plan context[92]

In the Integrated Transport Plan the TELLUS measure “City Logistic Centre” is an important module of the strategy towards a cleaner urban freight transport. In particular, it relates to the Transport Plan measures that aim at re-configuration of the inner-city freight transport network and the safeguarding of cargo-handling sites in preferential locations.

2.3 Objectives

In co-operation with the evaluation team the demonstration measure set itself objectives on different levels addressing short-term outputs and long-term outcomes as well as intermediate steps. Beside the documentation of the implementation process these objectives build the basis for the evaluation of the measure.

IMMEDIATE OBJECTIVES

Part 1) Tri-modal logistics centre

Carry out sales and marketing activities to promote the new tri-modal logistics centre

Force new regular long-distance container services by rail and inland navigation (e.g. Berlin-Hamburg, Berlin-Stettin)

Enhance the acceptance of the tri-modal inner-city logistics centre

Attract new haulage companies to the logistics centre

[91] Additional to the logistics centre at Westhafen Berlin contains another logistics centre in the district of Treptow-Neukölln.

[92] Senatsverwaltung für Stadtentwicklung (ed.) (2003)

Part 2) Clean vehicles

Contact haulage companies

Give information about CNG-vehicles in presentations and counselling interviews

Support the introduction of CNG-powered utility vehicles (see measure 12.6)

Part 3) Container tracking system

Design a new telematics based container tracking system

Demonstration of container tracking system by Zapf (forwarding company)

Enhance economic efficiency of intermodal freight transport

INTERMEDIATE OBJECTIVES

Replacement of diesel-vehicles by CNG-vehicles

Expansion of the intermodal container transport using rail and inland navigation

Shift in modal share in favour of rail and inland navigation

Reduction of lorry kilometres

ULTIMATE OBJECTIVES

Reduce traffic related CO_2 emissions and energy use

Reduce air pollution and noise

Reduce NOx emissions from heavy traffic

2.4 Situation before TELLUS / Innovative aspects

Part 1+2: Increase acceptance of tri-modal logistic centre and promotion of clean vehicles

In 2001 the tri-modal logistic centre “Westhafen” had already been in existence; however it had not been used intensively by haulage companies. There was only rarely transport by ship, rail and lorry. Because of its central location the establishment of the inner-city logistics centre appeared to facilitate a modal shift towards environmentally friendly railway transport and inland navigation. Only short distances will remain for the fine-grained delivery by lorries. Using clean vehicles (e.g. CNG-powered lorries) could additionally reduce the environmental burdens of delivery.

Part 3: Container tracking system

In 2001 the moving company Zapf had already conducted much of its long-distance house moving business by rail. The company had early converted to container transport, so that at the end of 2001 500 containers were already in service. The loading of containers onto rail took place at the inner-city logistics centre in the Treptow-Neukölln district of Berlin. The motivation for shifting transport operations towards a larger share of rail transport was primarily based on expected cost reductions. In long-distance transport the higher costs of road transport were mainly accounted for by personnel costs. In contrast to freight haulage,

tenancy changeover transportation required assistants who travelled in the vehicle additional to the driver, and who therefore generated an increase in costs. The main obstacle to a more far-reaching switch to rail that the Zapf company was faced with was that during rail transport the responsible employee did not know about the actual whereabouts of the cargo at a given point in time. This problem was particularly evident when rail shipments were delayed. As a result of increased customer demands Zapf recognised the necessity for continuous and uninterrupted tracking and monitoring of the transport process. Furthermore, there were repeatedly incidents of damage to goods during rail transport (for example, through the theft of goods from containers), which resulted in difficulties in the pursuit of legal claims against the rail operator. In this case, too, the expansion of rail loading was seen to require further action.

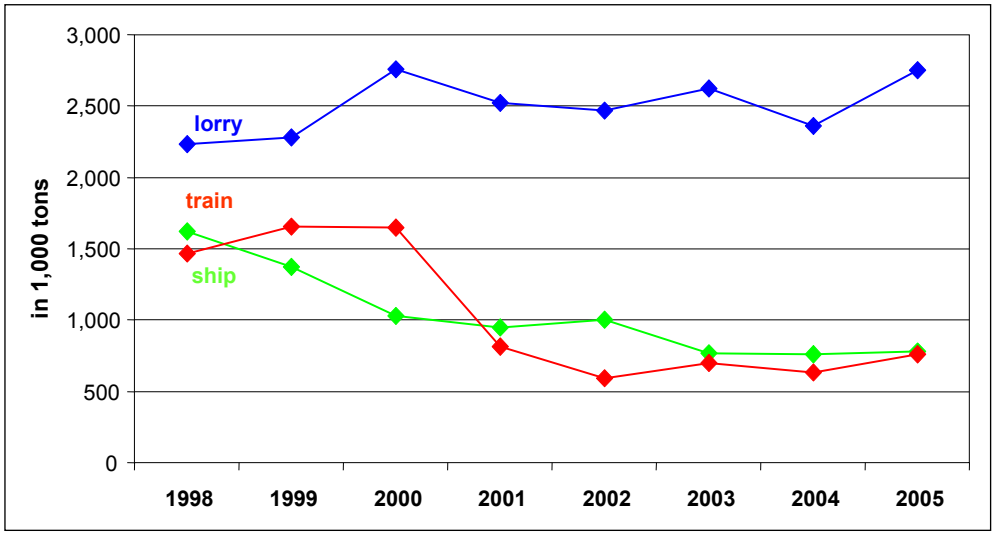
The innovative container tracking system provides a tool to enhance the attractiveness of intermodal freight transport by improving information levels particularly with regard to transship situations.

3 Implementation Process

Part 1: Increase acceptance of tri-modal logistic centre

At the beginning of the measure it soon turned out that the tri-modal logistic centre would not be put into full capacity operation within the next few years, and consequently this part of the demonstration measure could not be implemented.

Figure 27: Traffic volume of freights at tri-modal logistic centre "Westhafen"



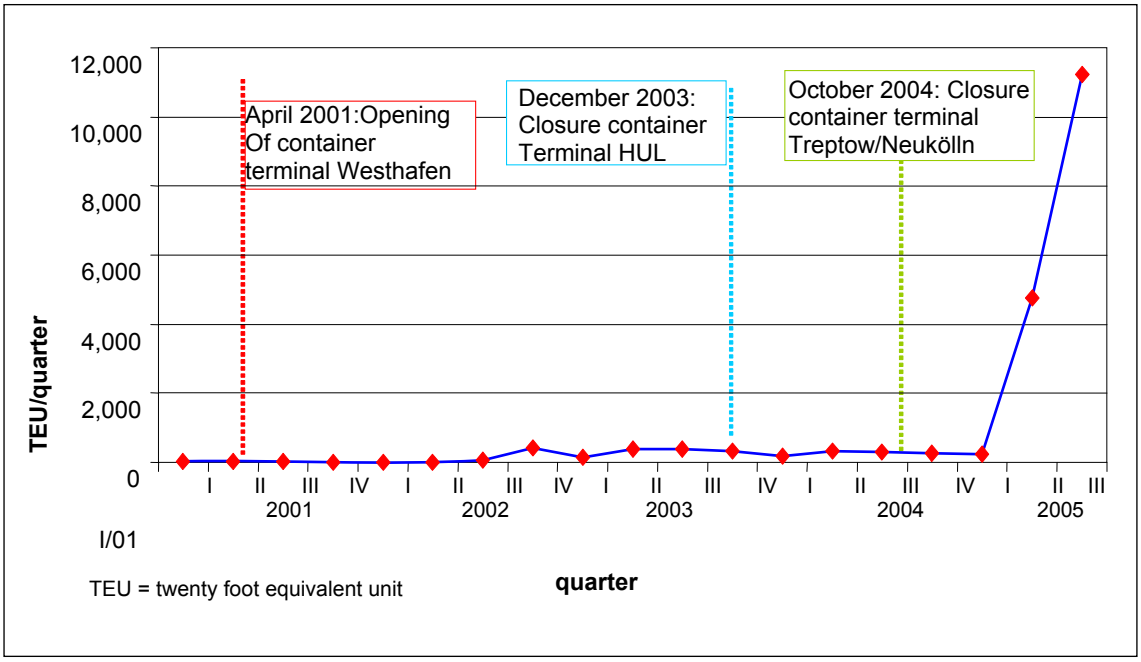
Source: BEHALA (2005)

Figure 27 shows decline of traffic volume by ship and train since 1998. This was due to the retrogressive tonnage carried in this period. A substitution of those transports by modern container transports could not take place mainly due to two reasons. First, the necessary

modernisation of the canal linking Berlin to canal system in the west of Germany was considerably delayed. Second, the German railway company (Deutsche Bahn AG) decided to discontinue regular freightliner service from and to the inner city of Berlin. Consequently, no frequent long distance container transport could be carried out to and from the logistics centre BEHALA-Westhafen. As a result of these developments, the first part of the demonstration measure was dislodged from the demonstration design in the contract amendment.[93]

In April 2005 the situation changed: A private railway company (DHL) started a daily container train operation from Karstadt distribution stock in Unna to Berlin-Westhafen (40 swap trailers per day). The containers arriving are sent on to the Berlin Karstadt department stores. In total, 20,000 containers per year will be passing through the container terminal Westhafen (see Figure 28). Reason for this development was the closure of inner-city container terminal Treptow-Neukölln in October 2004. Since the development is not justified in specific TELLUS activities, evaluation is not possible and useful.

Figure 28: Development of container traffic at tri-modal logistic centre "Westhafen"



Source: BEHALA (2005)

[93] TELLUS reporting (2nd Progress Report, 3rd Management Report, 3rd Progress Report)

Part 2: Promotion of clean vehicles

In the context of the measure 12.6 the introduction of CNG-powered distribution lorries was promoted und supported through funding. However, the intention to link 12.6 directly to the inner city logistic centre had to be abandoned due to the facts that the tri-modal logistics centre was not put into full operation during the life cycle of TELLUS (see part 1) and that no heavy CNG-lorries for the transport of containers were available. Only one general event for haulage companies informing about CNG-powered vehicles was realised in October 2005. Thus, part two of the demonstration measure was also not implemented.

Part 3: Container Tracking System

The principal aim of the third part of this measure was to develop and implement a new telematics-based container tracking system to enable the person in charge to control the actual location of a container online at any time and in any place in Europe during the transport process. At the same time, it was intended to make use of system developments and to implement further system features that were deemed suitable for making rail transport more secure and transparent. Such features included:

- *Movement or shock sensor:* in order to be able to prove whether a container has been jolted during rail transport, leading to breakages of goods;
- *Automatic door-opening control:* as proof of whether the door had been opened without authorisation and goods have possibly been removed;
- *Loading space control:* to improve container loading. The system was supposed to indicate loading levels to enable better loading.

Further demands on the system included a high degree of accessibility and low maintenance costs. Regarding the latter it was also envisaged to equip the system with a solar cell to avoid frequent replacement of batteries.

Based on these demands Zapf started off with testing existing systems of three suppliers (Krupp, Timtec and Diecotec) at the beginning of the measure. However, none of these systems was able to meet the formulated requirements without prior modification and adjustments. Based on these findings Zapf selected the supplier Timtec, whose standard system offered the best basic conditions in terms of both hardware and software to meet the system demands formulated by Zapf.

In a second step, prototypes were developed with the supplier Timtec and were tested in five containers in regular operations throughout Europe. The prototypes already contained all of the desired technical system components (location detection with GPS, shock sensor, door opening control; loading space control; autonomous power supply with a cell system and buffer battery, constant accessibility). For the test phase, recourse was made to the supplier’s standard software. The test was conducted in February 2003, and only minor technical problems (for example, fine tuning of shock sensors) had to be resolved.

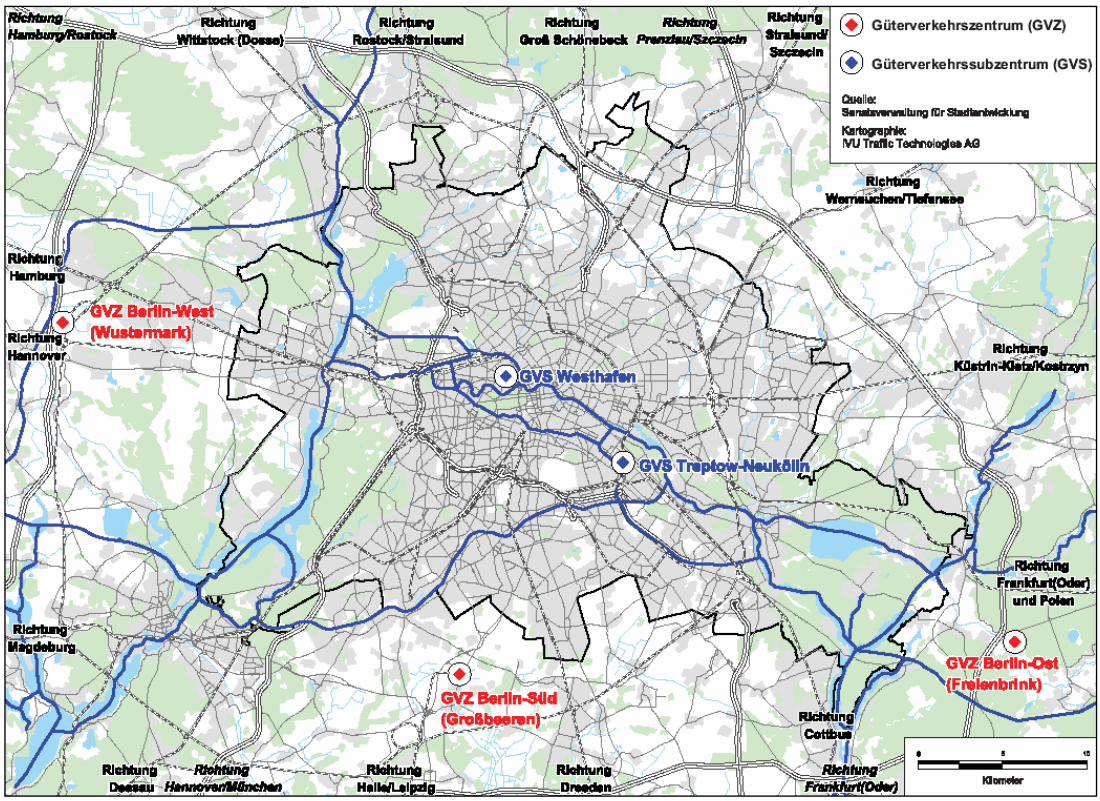
Accessibility of the system fulfilled Zapf's demands. Moreover, it was shown that the loading space control required more sensors than in the test operations in order to be able to detect precise loading of a container.

The functioning of the container tracking system and experiences with test operations were presented to the TELLUS partners at a TELLUS meeting in February 2003 at the inner-city logistics centre at Westhafen in Berlin.

In a third and final step in the summer of 2003, it was planned to equip around 200 containers with the newly-developed GPS-based tracking system. All new containers had been constructed in such a way that the tracking system could be easily installed. Equipping the containers with the tracking system would have involved total capital expenditure of 250,000-300,000 Euro (around 1,200-1,500 Euro per system). However, in the end the containers were not equipped, since by then (June 2003) Kombiverkehr, a subsidiary of German Railways (DB AG), discontinued the regular container rail transport line to and from both inner-city logistics centres in Berlin. Kombiverkehr services were now only available at the logistics nodes of Großbeeren and Wustermark (see Figure 29). Transporting the containers to these nodes and transshipping them onto freightliners, however, was not an option due to economic reasons as it involved costs of 150-200 Euro per vehicle trip (by comparison, total rail transport involved costs of around 250 Euro per container).

Thus, the handling of long-distance tenancy changeovers became uneconomic for Zapf, and consequently the company handed its entire long-distance business over to the Danzas haulage company. As a result, since the summer of 2003 about 5,000 containers have been transported by road instead of rail, corresponding to around 3,000 road trips. What is more, the container tracking system was no longer needed for the road-based transport, since on requirement Danzas offers to retrace transport processes for Zapf. Claims for and losses of goods are also more easily attributable to particular lorry drivers.

Figure 29: Logistic centres (GVZ and GVS) in and outside of Berlin 2004



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2005)

4 Results

4.1 Evaluation methods

Since part one and two of the measure had not been realised during the life cycle of TELLUS these two parts can not be evaluated.

Between December 2002 and July 2005 regular meetings with the demonstrator Zapf served to up-date information on the status of implementation of part three of the demonstration measure. Due to the modification in the demonstration measure design, some of the impact-related evaluation indicators, such as “modal split” and “load factors”, could not be evaluated. Furthermore, since the equipping of containers with the tracking system did not take place at a sufficient rate, the potential impacts of the measure on “energy consumption”, “emissions” and “noise” indicators can only be estimated, which will be done together with a long-term projection of the possible impacts in the scenario.

4.2 Impacts

TRANSPORT

Ease of use

Within the scope of prototype operations it was demonstrated that the software easily enabled control of containers by responsible personnel. The location of a container could be verified on a map; unforeseen incidents (for example, jolts or unauthorised opening of doors) were stored by the system and could be retrieved at any time by the system user.[94]

It had been planned to use software especially developed for Zapf for the equipping of the 200 containers with the tracking system. However, as this did not take place, it was not possible to conclusively assess whether using the software for management and control of 200 containers would have been uncomplicated as well.

Reliability

Reliability was confirmed in the test phase much to the satisfaction of the Zapf company. As of June 2005, the five prototypes have been operated largely free of maintenance needs ever since the test phase in February 2003.

Accessibility problems solely arose as a result of non-availability of the supplier's web server, on which software for test operations was installed. As it had been planned to install the software on Zapf's own web server, these restrictions would also have been remedied.

Functionality

Hardware functionality could be verified in the test phase and in further operations up to the present time. According to Zapf, the system with all its individual components proved successful in real operations. For this reason it is to be assumed that extension to 200 units would not have resulted in problems of functionality. A conclusive assessment is not possible; however, due to the limited number of prototypes.

5 Conclusions[95]

From the analysis of the implementation process described above conclusions can be drawn regarding the factors that promoted or hindered a successful implementation of the demonstration measure.

[94] The evaluation team itself could test the user-friendliness of the software at the Zapf company.

[95] Please note that the conclusions only refer to part 3 of the demonstration measure "Container Tracking System"

5.1 Drivers

High motivation of demonstrator: The demonstrator, namely the Zapf company, was highly motivated to increase its use of rail-bound freightliners. This motivation was due to a number of factors, which also include the by then highly controversial debate on the introduction of a motorway toll for lorries and the continuous increase in traffic jams, which jeopardises in-time delivery.

Economic efficiency: The main reason for the loading of containers onto rail is the reduction of costs. In long-distance transport, using rail is less-costly than road transport for moving companies using their own vehicles. For the demonstrator this was further emphasised by an expected extra costs of 250,000 Euro a year once the motorway toll for lorries became effective.

5.2 Barriers

Availability of inner-city loading facilities: The availability of inner-city loading facilities for transferring containers to rail is a major prerequisite for making rail-bound transport economically attractive. Since the newly built logistics centre in Berlin Westhafen was only put into low-capacity operation it was not attractive for haulage companies to make use of its facilities for transshipping.

Offers for combined transport: Regular combined-transport connections to all important conurbations are indispensable. Currently, the Kombiverkehr company serves only Bönen, Duisburg and Munich from Wustermark. This is barely sufficient for extensive shifting of container transport to rail. Since the freightliner connection to and from the inner city was discontinued, the demonstrator had to abandon its plans of further increasing the share of rail-transported containers. This in turn led to the situation that the container tracking system was not implemented beyond the pilot.

Delay in toll implementation: The introduction of a motorway toll in Germany, which had been expected to stimulate a modal shift in favour of rail-bound transportation of goods, was considerably delayed. As a consequence, the extension of the pilot project and the further equipping of containers with a tracking system were brought to a halt until these plans were finally terminated.

5.3 Resume

The container tracking system demonstration has achieved all the goals formulated for the test phase. The equipping of 200 containers with the GPS-based tracking system did not take place. The reason for this was that in summer 2003 the Kombiverkehr company discontinued the rail connection to the inner-city logistics centres. An extension of the test phase was thus neither sensible nor justifiable from an objective or economic point of view. The functionality and practicability of the system in large-scale operations could therefore not

be proven. Experiences in the test phase support the view, however, that the extension could have been achieved without significant technical or operational problems.

Achievement of objectives

As already described in Chapter 2.3 the measure aimed at different level objectives. In the following it will be assessed how far these goals could be achieved. Details on the underlying arguments for the assessment can be found in ANNEX 1.

As part one and two of the measure was not be implemented the achievement of objectives of these two parts could not be assessed. Due to the change in demonstration design of part three of the measure some of the objectives could not be evaluated such as "Enhance economic efficiency of intermodal freight transport" and the intermediate objectives.

Table 8: Overview of grade of achievement of objectives

IMMEDIATE OBJECTIVES	
Part 1) Tri-modal logistics centre	
Carry out sales and marketing activities to promote the new tri-modal	n.a.
Force new regular long-distance container services by rail and inland	n.a.
Enhance the acceptance of the tri-modal inner-city logistics centre	n.a.
Attract new haulage companies to the logistics centre	n.a.
Part 2) Clean vehicles	
Contact haulage companies	n.a.
Give information about CNG-vehicles in presentations and counselling	n.a.
Support the introduction of CNG-powered utility vehicles (see measure 12.6)	n.a.
Part 3) Container tracking system	
Design a new telematics based container tracking system	ACHIEVED
Demonstration of container tracking system by Zapf (forwarding company)	ACHIEVED
Enhance economic efficiency of intermodal freight transport	n.a.
INTERMEDIATE OBJECTIVES	
Replacement of diesel-vehicles by CNG-vehicles	
Expansion of the intermodal container transport using rail and inland	
Shift in modal share in favour of rail and inland navigation	
Reduction of lorry kilometres	

ULTIMATE OBJECTIVES	
Reduce traffic related CO2 emissions and energy use	
Reduce air pollution and noise	
Reduce NOx emissions from heavy traffic	
Grade of achievement: ACHIEVED – ALMOST ACHIEVED – PARTLY ACHIEVED – NOT ACHIEVED	

6 Scenario

6.1 Introduction

The aim of the TELLUS „Inner-city Logistics Centre“ demonstration measure was to provide fresh impetus to the shifting of goods to environmentally-friendly means of transport. Goods should be transported by rail and inland waterways into city centres, transferred to lorries – where possible to environmentally-friendly vehicles such as CHG-powered vehicles – in inner-city logistics centres and then distributed in the city. Due to general conditions (for example, discontinuance of rail services to the inner-city logistics centres by the Deutsche Bahn, restricted shipping operations), the measure could not be realised as originally planned, and was therefore also not evaluated and assessed. The following estimate for 2015 therefore aims at pointing out, in particular, the traffic-related and ecological potentials of this measure. Moreover, the implications of the increased switching of long-distance removals to rail are demonstrated in the case of the removals company Zapf Umzüge GmbH.

6.2 Description of measure characteristics in 2015

Inland vessels and trains nowadays mainly transport bulk goods (building materials, fuel etc.). Forecasts for freight transport to and from Berlin assume that such goods will decline in importance in the future, with other freight such as capital goods and consumer goods gaining considerably in importance.[96]

Growth in ship and rail transport is therefore most likely to occur when these goods, which are currently almost exclusively transported by road, are attracted to a greater extent to ship and rail. This requires that rail and ship operators offer attractive, flexible and economically competitive services. In rail transport in particular, combined container transport is necessary in order to ensure rapid loading from feeder lorries to rail and, subsequently, from rail to lorries for distribution.

[96] Bundesministerium für Verkehr, Bau und Wohnungswesen (ed.) (2003); Senatsverwaltung für Stadtentwicklung (2003)

The tri-modal inner-city logistics centre at Westhafen in Berlin can play an important role in this respect. It offers, on the one hand, the necessary infrastructure for corresponding transport (for example, container terminals, shipping and rail connections); and on the other hand, due to its inner-city location distribution by lorry can be reduced to a minimum. Moreover, additional capacity for rail-combined transport is available at the currently-closed inner-city logistics centre at Treptow-Neukölln.

For the estimate of potentials for the year 2015 it is assumed that both inner-city locations are available for freight transport by rail, and that Westhafen is available for freight transport by ship. Local distribution of goods, moreover, is carried out to a large extent by environmentally-friendly vehicles (primarily CNG-powered lorries). It is further assumed that Zapf Umzüge GmbH transfers all long-distance removals to rail by 2015, and that the company uses the Treptow-Neukölln site as a freight terminal.

6.3 Framework conditions

Experiences with TELLUS show that the availability of inner-city locations alone is insufficient to ensure the extensive shifting of goods transport to more environmentally friendly modes. More far-reaching framework conditions are therefore required from government and industry:

- **Planning security for the Treptow-Neukölln site.** Berlin's local authorities must guarantee that the area as a whole remains available for the inner-city logistics centre and is not given over to other use.
- **Removal of water-side bottlenecks.** The waterways to Westhafen must be developed in such a way that unrestricted container transport by ship is possible. This means, in particular, that bottlenecks resulting from too-low bridges are being remedied.
- **Campaign for new customers.** A major campaign to attract new customers should be launched by all actors involved (railway companies, ship operators, logistics companies such as DHL, BEHALA). This campaign should be actively supported by the Senate Department for Urban Development. Only through winning over new customers can it be ensured that the supply of rail and ship transport can be expanded and qualitatively improved („chicken-egg problem“).
- **Improvement in combined transport.** With the acquisition of new customers, overnight rail transport between all important German conurbations should gradually be established. At the same time, shipping connections between Westhafen and the most important seaports (Hamburg, Szczecin etc.) should be set up; the supply of combined transport should be continually improved in terms of punctuality and loading times.

- **Transparency of rail and ship transport.** Technical developments (such as Zapf's container tracking system) ensure that the responsible employee can at any time determine online the precise location of a container, irrespective of whether transport is by lorry, ship or rail.
- **Environment-orientated transport concept for the logistics sites.** There is already considerable air and noise pollution in the area surrounding the Westhafen logistics centre as a result of road transport to and from existing industrial estates and companies. The adverse environmental effects of additional road transport on the part of the logistics centre should therefore be kept to a minimum by means of an appropriate transport concept. In this connection, an information campaign on clean vehicles should be started, and all new logistics centre customers extensively informed about the possible use of environmentally-friendly vehicles.
- **Preferential treatment for the environmentally friendly transport of goods in Berlin.** In order to accelerate the changeover to clean vehicles for the local distribution of goods, the local administration could make the use of such vehicles more attractive through appropriate time- and area-related concessions in the inner city.
- **Increasing and extending the motorway toll on heavy-duty vehicles.** Through the motorway toll on heavy-duty vehicles, shifting of transport to rail and ship could be furthered. Surveys show, however, that the present level of the toll is inappropriate for this purpose.[97] An increase in and extension of the toll is absolutely essential.

6.4 Analysis of potentials

Transport

Stronger marketing of both inner-city logistics centres in the future could in principle have the following effects:

- **Option 1:** Combined container transport, which is currently handled at the freight centre at Wustermark, moves to the inner-city logistic centres. As a result, no additional rail transport is attracted, and there are no changes in waterway transport.
- **Option 2:** Through attractive services and the central location of both inner-city logistic centres, new customers are attracted to combined container transport, who have previously transported their goods by road. In addition, individual customers could move from the outer city to inner-city logistic centres.
- **Option 3:** In addition to container transport, new customers could be acquired in the area of bulk goods, which could be shifted from road transport to ship and rail.

[97] Knitschky (2005); Rodekohr (2005)

Option 1 merely results in a shifting of existing traffic from outer-city to inner-city logistic centres, with no additional relief of environmental effects. Were only this effect to occur, operation of the inner-city logistic centres, in particular from the economic point of view, would be even more questionable. Option 1 is therefore not further pursued within the scope of the following estimate of potentials. The same applies to option 3, since the two logistics centres under consideration are unlikely to provide a strong-enough impulse to attract appreciable numbers of new customers from the bulk goods segment. This would only be possible, if all trans-shipment centres for bulk goods in Berlin (docks, company rail connections etc.) were jointly marketed.

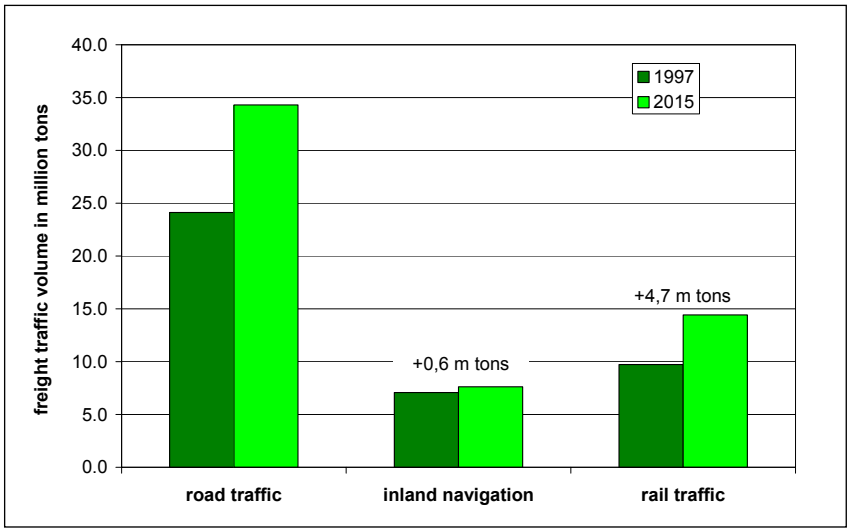
Within the framework of the following estimate of potential, option 2 – attracting new customers and the associated traffic-related and ecological effects – is therefore examined in depth. The side effect of shifting existing rail transport to inner-city logistics centres is not considered further.

Transport volume

Estimates of the potentials of the inner-city logistics centre can be based on the analyses carried out within the framework of the Federal Transport Infrastructure Plan 2003 (Bundesverkehrswegeplan 2003, FTIP)[98]. For the period from 1997 to 2015 an increase in long-distance freight transport (delivery and dispatch) of 0.6 million tonnes by ship and of 4.7 million tonnes by rail is forecasted (see Figure 30). This increase is based on the assumption that the logistics centres (inner-city and outlying areas) are developed, and that, apart from bulk goods, new types of goods and therefore new customers are acquired.

[98] Bundesministerium für Verkehr, Bau und Wohnungswesen (ed.) (2003)

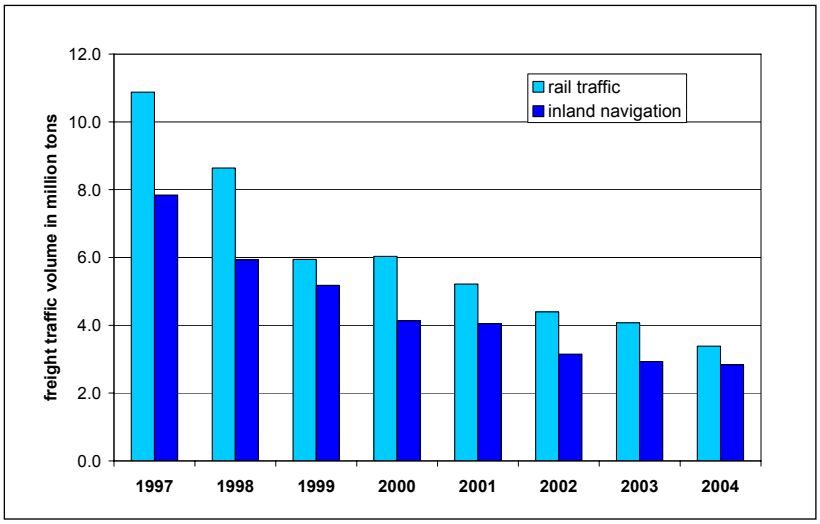
Figure 30: Projection of volume of long-distance freight transport in Berlin (delivery and dispatch) in 2015 as compared to 1997



Source: Bundesministerium für Verkehr, Bau und Wohnungswesen (ed.) (2003)

Current figures on the volume of freight transport (delivery and dispatch) show, however, that the projected growth for rail and ship up to 2015 is to be regarded as too optimistic (see Figure 31[99]).

Figure 31: Development in the volume of goods transported (receipt and dispatch) from 1997 to 2004 in Berlin



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2005)

[99] In comparing the two figures, it has to be borne in mind that Figure 30 relates to long-distance freight traffic and Figure 31 to total freight traffic (including local traffic).

In 2004, for instance, the quantity of goods transported by ship was 3.1 million tonnes below the 1997 value, and rail transport was 5.3 million tonnes below the same base value. The reasons for this are economic developments in Berlin and Germany, the decline in the bulk goods segment (for example, coal, gravel) as well as the closure of the inner-city logistics centres and their transfer to the area around Berlin (especially relevant for rail traffic). Since a strong decline in freight transport by road can also be determined, a shift to road transport is likely to be of minor importance.[100]

On account of these recent developments, the estimate of potential is based on the assumptions that real **growth in ship and rail transport** in the period to 2015 will be **below the forecast** levels of FTIP 2003, and that this growth will **only be partly accounted for by combined container transport**.

On the basis of these assumptions it is estimated that, as a result of the inner-city logistics centre measure, up to 2015 around 25% of the forecast growth of 5.3 million tonnes (see above) for new container transport can be achieved. Some 1.3 million tonnes will thus be switched from lorries to rail or ship. The greater part of this growth (90%) will fall to rail transport (1.17 million tonnes), the smaller part to shipping (0.13 million tonnes).

With an average load of 10 tonnes[101], this represents a total of around 130,000 additional standard containers (TEU = twenty-foot equivalent unit) per year. This figure includes the Zapf company's 5,000 containers, which are currently transported long-distance by road each year. Not included, on the other hand, are containers handled at Westhafen by DHL on behalf of the Karstadt group (2005: around 20,000 TEU, 2006: around 40,000 TEU), since this merely represents traffic transferred from Wustermark.

Through the inner-city logistics centre measure, a **transport volume** (delivery and dispatch) of around **1.3 million tonnes per year** can be **switched from road to rail and ship**. This is equivalent to around 130,000 containers, which represents an annual increase of around 15,000 containers in the period from 2007 to 2015. This means that each year three companies of the size of Zapf Umzüge GmbH must be acquired as new customers.

[100] A substantiated example for this case is that of Zapf Umzüge GmbH (see above).

[101] Personal communication from Mr. Lichtfuß (BEHALA).

Transport performance

Transport performance in tonnes per km (t-km) is the basis for calculating ecological effects. It is calculated as the product of transport volume[102] and average transport distance. For this, of course, the total route is considered and not merely the route section in Berlin. As far as inland transport by ship is concerned, it is assumed that traffic occurs in the main between Hamburg and Berlin.[103] For rail transport, it is assumed that Hamburg is the source and destination of around 50% of transport, with the Ruhr Region (represented by Dortmund) and Munich each accounting for 25%.[104]

The result is an annual transport performance of around 560 million t-km for rail and 50 million t-km for shipping. In addition, around 55 million t-km per year are provided by feeder and distribution transport by road.[105]

Transport performance by ship and rail resulting from the shift to inner-city centres is around 610 million t-km. Feeder and distribution by lorry of around 55 million t-km are additionally necessary. Were the same quantity of goods to be transported by lorry, the transport performance would be considerably less at 520 million t-km.

Environment and Energy

Emissions

Figure 32 shows that greenhouse gas emissions[106] per t-km in 2015 for ships and trains are 63% and 70%, respectively, below those of heavy-duty vehicles. The greater transport performance of rail and ship transport compared to pure road transport – as determined in the previous section – can thus be compensated on the environmental side.

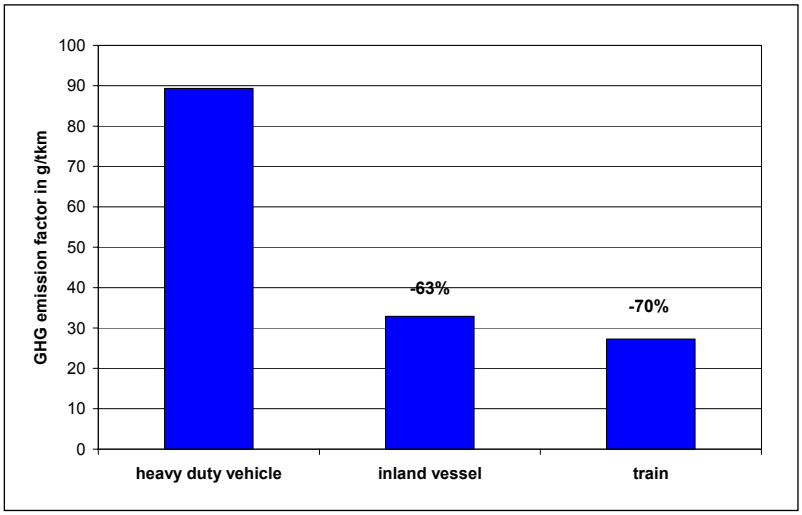
Taking into consideration feeder and distribution traffic, greenhouse gas emissions of around 19,000 tonnes per year arise for ship and rail transport. Transport solely by road would result in greenhouse gas emissions of 46,000 tonnes. All in all, 27,000 tonnes of greenhouse gas emissions could be avoided through shifting transport to train and ship (- 58 %).[107] By

[102] In this case, the dead weight of the container is added to the transport volume (11 tonnes per 100 tonnes of transported goods) (ifeu 2005).
[103] This is equivalent to a distance of 347 km by ship and 280 km by lorry.
[104] The average distance is thus 411 km for lorries and 439 km for trains.
[105] For transport by ship, a distribution route of 10 km is assumed, for rail transport a feeder and distribution route of a total of 20 km is assumed.
[106] Calculated as CO_2 equivalents, including pre-chain emissions.
[107] This balance does not include greenhouse gas emissions arising from the energy consumption of container terminals. Other studies, which have taken such emissions into consideration (for example, ifeu/SGKV (2002); UIRR (ed.) (2003), arrive however at similarly high savings for combined container transport. The influence of container terminals on the overall balance can therefore be regarded as insignificant.

comparison, road transport in Berlin as a whole will account for 720,000 tons of greenhouse gases per year in 2015.[108]

Shifting the Zapf company's 5,000 containers to rail would lead to a reduction in greenhouse gas emissions of around 900 tonnes. Savings per container are thus somewhat smaller, compared to the above figures, which is explained by the lower loading and greater weight of containers.[109]

Figure 32: Greenhouse gas emissions (operation and pre-chain) of different means of freight transport in 2015



Source: TREMOD, ifeu (2005), Gohlisch et al. (2005)

Apart from the reduction in greenhouse gas emissions, shifting transport to rail and ship also contributes to a reduction in emissions of air pollutants in cities. First, because transport by lorry on roads already heavily affected by air pollutants is avoided. Second, even though transport by ship and with diesel engines also generates local emissions, waterways and railway lines are generally not located in or along residential or other areas that require particular protection. Nevertheless, ships generally emit more air pollutants per t-km (in 2005) than lorries and trains, which in turn reduces the positive effects, albeit changes in the local environment can still be noted.[110]

Besides shifting transport to rail and ships, an important component of the inner-city logistics centre measure is the increased use of clean vehicles in feeder and distribution traffic. As already shown in connection with Measure 12.6, under favourable conditions such vehicles would represent a maximum share of 45% of the total number of vehicles by 2015. If natural-gas-powered vehicles are used, direct NO_x emissions (excluding pre-chain) can be reduced

[108] Senatsverwaltung für Stadtentwicklung (ed.) (2003)

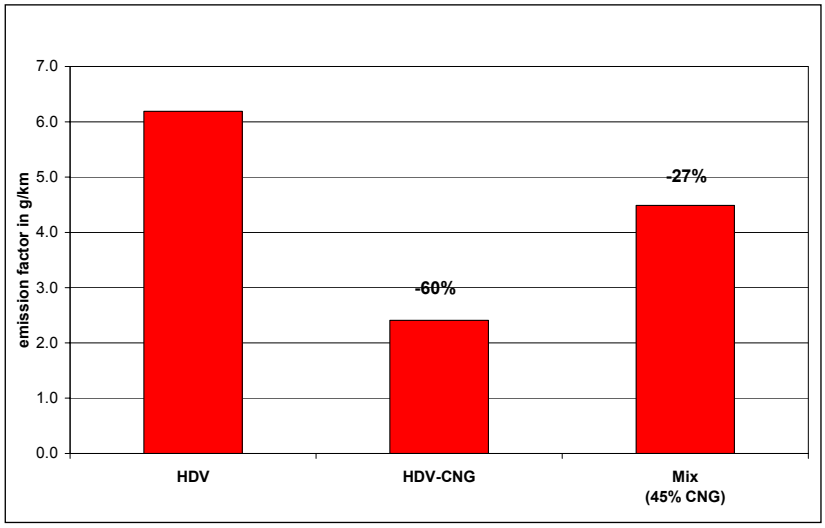
[109] According to Zapf, average loading is 5.5 tonnes/TEU and the dead weight of a container is 3.3 tonnes/TEU.

[110] Gohlisch et al. (2005)

by 27% in comparison to an average HDV in 2015 (see Figure 33). This reduction contributes particularly to easing the burden on the road network surrounding the logistics centres, which is already affected by air pollutants.

Since the transport of 130,000 containers per year involves around 75,000 lorry journeys (about 290 trips per day), with an average one-way journey of 10 km, an overall reduction of 2.5 tonnes of NOx arises (NOx emissions of all HDV in 2015 in Berlin: 2,700 tonnes)[111].

Figure 33: NOx emissions (excluding pre-chain) of HDV in 2015



Source: Handbook of emission factors for road transport 2.1, own estimation

Shifting freight transport to rail and inland waterways contributes to a notable reduction of greenhouse gas emissions. Even when the reductions have little effect within the city, Berlin can still make an important contribution to climate protection.

The use of clean vehicles for feeder and distribution traffic, on the other hand, has an immediate effect in the area surrounding the logistics centres, where it leads to an easing of the burden of air pollutants.

Noise

General comments on the noise effect of shifting transport can not be made. The transport of goods by rail and ship contributes, similar to road transport, to noise nuisance on the part of the public. Through greater concentration of transport on rail networks, however, specific noise-reduction measures (for example, the construction of noise shields) can be implemented.

[111] see Senatsverwaltung für Stadtentwicklung (ed.) (2003)

Society

The inner-city logistic centre measure has no direct social effects.

Economy

Under present conditions, combined container transport by rail and inland waterways is generally more expensive than road transport. This is particular so when long journeys to the logistics centres are involved. Through moving the logistics centres into the city centre, an improvement in services (for example, overnight transport) and an increase in the motorway toll on HDV (see framework conditions), it can be assumed for 2015 that prices for combined transport will be competitive with those for road transport. A detailed analysis of costs is not possible, however, within the scope of the evaluation.

6.5 Resume

Through the inner-city logistics centre measure, combined container transport by rail and inland waterways can be appreciably expanded. A four-fold increase in the number of containers in use – currently 40,000 – can be achieved by 2015. For this purpose, each year three new customers equivalent in size to Zapf Umzüge GmbH must be won over.

The shifting of transport modes generally leads to enhanced transport performance, and at the same time to a considerable reductions in greenhouse gas emissions (-58%). All in all, around 27,000 tonnes of greenhouse gas emissions could de avoided. In inner-city areas, shifting transport to rail and ship can contribute to a reduction in air pollution on heavily-used roads. Moreover, the use of environmentally-friendly lorries can further reduce air pollutants, and this is particularly important for the areas surrounding the logistics centres.

The significance of these effects for the transport of goods as a whole depends to a decisive extent on the volume of goods shifted. Moderate rates of growth have been assumed for the estimate of potentials. This approach takes into account both, current developments in freight transport (see above), and past experience with combined transport.

B.8 Demonstration Measure 9.4 – Financing Contracts for NG Vehicles

1 Introduction

Demonstration measure 9.4 was concerned with developing conceptual approaches including the implementation for a new form of financing contracts for CNG-vehicles. The underlying policy aims at encouraging the use of cleaner vehicles.

The objective of measure 9.4 was modified just in the first phase of the measure with the assistance of the project-partners. The partners were the GASAG (Berliner Gaswerke AG – Berlin Gasworks Corporation) with subcontractor Berliner Energieagentur GmbH (Berlin Energy Agency Ltd). The initial idea had been to newly develop a leasing-contract for CNG-vehicles. However, in the course of the measure it turned out that it was much more suitable to concentrate on fixing vertices for leasing contracts. Finally an innovative leasing model was developed and complemented by a website, which provides information about the advantages of CNG-vehicle leasing and supports potential customers in finding partners.

This measure was related to demonstration measure 12.6, which aimed at the introduction of CNG-powered distribution lorries by financial support to lower extra purchase costs, and by technical assistance for the customers during the introduction phase. So the demonstration measures 9.4 and 12.6 supported one another to enhance the market penetration of CNG-vehicles.

2 Description of demonstration measure

2.1 Demonstration design[112]

The objective of the measure “New forms of financing contracts for CNG-vehicles” was the cost-neutral replacement of diesel powered vehicle fleets with CNG driven vehicles. The introduction of an optimised leasing concept appeared to be a useful means to that end, since it utilises all feasible saving opportunities, such as:

- the purchase of particularly efficient monovalent CNG vehicles,
- the creation of pools for vehicle acquisition and gas purchase,
- the optimisation of vehicle use and optimised central gas filling and service, and
- the exhaustion of all promotion opportunities.

It was planned to carry out the measure in three steps: first, the design of a model contract; second, market stimulation; third, the design of an accounting model.

[112] Description of work, ANNEX A TELLUS Project descriptions, issued 29 October 2001

2.2 Transport Plan context[113]

In the Integrated Transport Plan the TELLUS measure "New forms of financing contracts for CNG-vehicles" is not directly included. But it is an important module of the strategy towards a clean urban freight transport. In particular it corresponds to the Transport Plan measures that aim at reducing vehicle based emissions, since the use of CNG- instead of diesel-engines will result in lower PM- and NO_x-exhaust emissions.

2.3 Objectives

In co-operation with the evaluation team the demonstration measure set itself objectives on different levels addressing short-term outputs and long-term outcomes as well as intermediate steps. Beside the documentation of the implementation process these objectives build the basis for the evaluation of the measure.

IMMEDIATE OBJECTIVES
Design of an innovative leasing model (km-leasing) for CNG-vehicles
Optimise costs for modernisation of vehicle fleet to CNG propulsion
Stimulate the market by supporting the leasing companies with an attractive leasing model for CNG vehicles
Design an accounting model
Find leasing companies which want to implement the concept
INTERMEDIATE OBJECTIVES
Wider introduction of CNG-powered vehicles
ULTIMATE OBJECTIVES
Reduce traffic related CO_2 emissions and energy use
Reduce air pollution and noise
Reduce NO_x emissions from heavy traffic

2.4 Situation before TELLUS / Innovative aspects

Considerable lower fuel costs (due to the lowered rate for the tax on oil) have for quite some time already created advantages in operation costs for CNG vehicles compared to petrol or diesel vehicles. However, higher purchase costs (especially regarding the cost sensitiveness of haulage companies) prevented a wide introduction of CNG vehicles. What is more, the management of vehicle fleets often struggled with uncertainties concerning the possibilities and options of leasing CNG-powered vehicles. This was for the most part due to intransparencies on the supply side, particularly regarding the promotion and marketing

[113] Senatsverwaltung für Stadtentwicklung (ed.) (2003)

activities for CNG-powered vehicles of leasing-companies. Since the range of CNG vehicles and the options for leasing were not known to potential users, only few companies considered CNG vehicle leasing.

The new leasing service was supposed to be based on energy-saving contracting, which had thus far almost exclusively been applied to buildings. However, the contracting approach appeared to be a promising solution to the problem of larger investments needed for the purchase of CNG vehicles. The application of the approach to the field of transportation was regarded as highly innovative.

3 Implementation process

Decision for a reorientation of the objective

The initial idea of a tkm-leasing model (i.e. leasing costs based on tons/kilometre) was developed based on previous experience of the Berlin Energy Agency with energy saving measures in the building sector. However, the demonstrator eventually realised that this concept contained a number of disadvantages. For example, the concept was only suitable for a small part of the leasing market. Additionally, leasing models for tkm-contracting had already been existing, even though they were not focussing on environmental aspects. Moreover it appeared that a leasing-concept for CNG vehicles would reach a larger target group. As a result of these reflections it was concluded that an innovative leasing model would be more useful than the tkm-leasing approach. Consequently, the objective of the demonstration measure was modified in the first phase of the demonstration measure with the assistance of the project-partners. Following this, the idea now was to develop a leasing-contract for CNG vehicles. But it turned out that it is much more suitable to merely fix vertices of a contract instead of developing new ones, so that existing contracts would not have to be completely changed. In addition many companies have their standard contracts, which only have to be changed concerning these vertices - a fact, which came out in a workshop with leasing-providers and users.

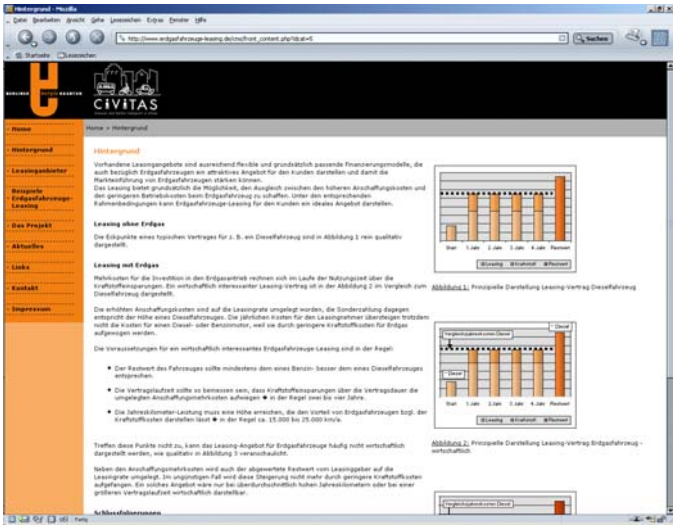
Final design

Market analyses showed that some leasing-companies already offer CNG vehicles. But often these offers are not advertised and the leasing contracts are unattractive for the customer. Generally, the customer takes the entire risk, and particularly the risk of lower residual value. It turned out that many uncertainties exist particularly on the customer side. Therefore, a qualitative analysis of current financing models (leasing, credit financing and the funding situation in Germany) was undertaken, in the course of which 35 representatives of providers and users were interviewed. In a feedback meeting with the interview partners in September 2002 the conclusions for new financing models and a draft of marketing activities were discussed. On this basis a draft of the procedure for the market stipulation by new leasing

models for CNG-vehicles was developed and presented to a professional audience on 21 November 2002.

Conceptual design and publishing of a website

For the purpose of improving the information basis on leasing of CNG-vehicles, the website www.erdgasfahrzeuge-leasing.de was developed and launched in May 2004. The website contains information on leasing providers who, due to their experience with CNG-vehicle leasing, offer attractive leasing contracts that fulfil the specified vertices, and in particular they offer residual values that are equal for conventional and gasoline vehicles. The homepage provides information about the advantages of CNG-vehicle leasing and supports potential customers in finding a partner. Furthermore it points to the advantages and the specialities of CNG-vehicle leasing.



The content of the website is:

- Background information on natural gas vehicle leasing
- Advantages of natural gas vehicle leasing
- Specialities and characteristics in order to compare the offers
- Introduction of experienced leasing providers and contact persons
- Presentation of selected best-practice-examples
- Relevant links

The website has been promoted by mailings, press releases and flyers.
In September 2005 the last company during the TELLUS-time frame was accepted to present themselves on the website.

Outlook

The demonstrator reported that they will continue updating the website after the TELLUS-time frame so that a platform on status-quo will be available for leasing-providers as well as for companies also in future.

4 Results

4.1 Evaluation methods

Between December 2002 and February 2005 regular meetings with the demonstrator as well as the analysis of the TELLUS reporting documents served to up-date information on the

status of implementation as well as on the number of hits on the website. Due to the change in demonstration design the impact-related evaluation could not be carried out as stated in the Evaluation Plan. So impacts, such as “Awareness of leasing companies” and “Ease of use” could not be evaluated.

4.2 Impacts

SOCIETY

Company and customer acceptance

Five leasing providers present themselves on the website www.erdgasfahrzeuge-leasing.de: ASL, FIAT Leasing, masterlease, LHS Leasing and VR-leasing AG. In September 2005 VR-leasing AG was the last company during the TELLUS-time frame which was accepted to present them on the website. They reported that just some days after the link appeared on the website they got the first requests for CNG vehicle leasing.

Moreover, the website presents 13 examples of CNG vehicle leasing, out of which 12 are private companies (most gas providers), and one is a public utility. The website can be reached either directly or via links from other websites. With 72.8 % the developed website is mainly visited by direct request. Other relevant requests have been made via websites containing information about CNG-vehicles. Hits via the TELLUS website had only a share of 0.4 % of the hits on www.erdgasfahrzeuge-leasing.de.

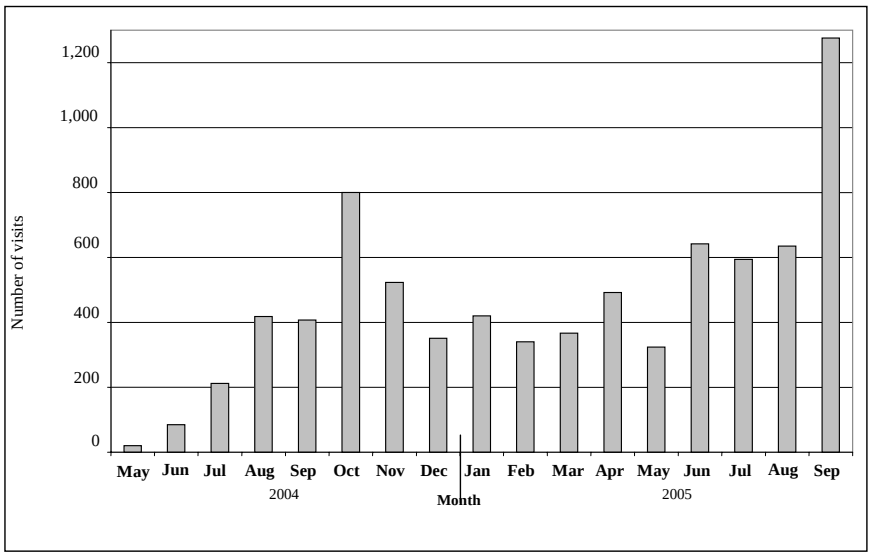
Table 9: Share of hits via website

Website	Share of hits via the named website
Direct Request	72.8%
www.erdgasfahrzeuge.de	12.7%
www.bb-faehrt-erdgas.de	2.6%
www.gasag.de	1.7%
www.bremer-erdgasfahrzeug.de	1.3%
www.google.de	1.1%
www.t-online.de	0.6%
www.beschaffung-info.de	0.5%
www.berliner-e-agentur.de	0.7%
www.tellus-cities.net	0.4%

The usage statistic of the website is shown in Figure 34. After the connection of the website the interest increased slowly resulting in a stabilisation of around 400 visits per month in August 2004. The peak in October 2004 is probably the result of a publication in the journal “Energiespektrum”. The enhancement in April might be the result of the extensive media

coverage on the exceedance of PM_{10}-concentration in numerous German cities. Possible consequences include for example restrictions for vehicles with high particulate emissions, which might in turn contribute to an enhanced interest in and market penetration of CNG vehicles. Impressive is the increase in September 2005 which in all probability is related to the abrupt rise of the prices of crude oil and the intensive promotion for CNG vehicles in the context of the International Motor Show 2005 in Frankfurt.

Figure 34: Number of visits to the website "www.erdgasfahrzeuge-leasing.de"



In how far this enhanced information leads to an increased purchase of CNG vehicles can not be assessed here due to a lack of information concerning the link between the website visits and the number of leased vehicles from the presented leasing companies.

PUBLIC AWARENESS

The launch of the website was announced by mailing to circa 350 addresses (purchasers, multipliers, political decision makers etc.) and by a press release on 28 May 2004 published by the Berlin Energy Agency. Furthermore, the website was promoted in the following press articles:

- "Internetportal zum Erdgasfahrzeug-Leasing", 18 October 2004 GASAG-News
- "Erdgasautos leasen", 14 December 2004 Fuhrpark + Management
- "Internetportal www.erdgasfahrzeuge-leasing.de", 5/2004 Das Erdgasfahrzeug – Themendienst des Trägerkreises Erdgasfahrzeuge
- "Internetportal informiert über das Leasing von Erdgasfahrzeugen", 10/2004 Energiespektrum

Additionally, information flyers (edition 500) were designed and distributed to promote the website during relevant events (disseminated e.g. at Berlin Energy Days in May 2004 and May 2005, as well as during the Purchasing Conference in September 2004).

On a conference on alternative fuels organised by the FAV a presentation was held in October 2005.

ECONOMY

Within the TELLUS demonstration measure the Berlin Energy Agency succeeded in convincing a number of leasing-companies to equate the residual value for CNG-vehicles with the residual value of petrol vehicles. So the costs for the leasing-rates have been lowered.

5 Conclusions

From the analysis of the implementation process described above conclusions can be drawn regarding the factors that promoted or hindered a successful implementation of the demonstration measures.

5.1 Drivers

Participation of leasing companies and their customers: The leasing-provider and customer participation helped to identify barriers to offer CNG vehicle leasing, the need for vertices in contracts and the missing promotion of the provider-offers. So the design of the website could be adjusted to the customer requirements.

Increased acceptance of CNG-technology: Due to the EU air quality directive, which entered into force in January 2005 and the related PM_{10}-limit values, the willingness to use CNG-powered vehicles enhances slowly.

Improvement of CNG-vehicle availability: Recent improvements in engine technology and particularly a wider range of model types of CNG vehicles on the side of the car industry ease the implementation of this demonstration measure.

Status as an EU-project: According to the demonstrator the label of being part of an EU-project was very helpful for a relatively small company such as the Berlin Energy Agency when carrying out a survey among leasing companies and their customers.

Financial aid: The delay of the implementation of the demonstration measure was due to difficulties in finding a supplementary source of financing. Finally the GASAG financed the studies “market analyses and development of financing models of CNG vehicles” and “vehicle procurement by municipalities”. These provided the basis for the start of the measure.

Increasing price of crude oil: The steady rise of the price of crude oil results in an enhanced demand for CNG vehicles. This is due to the reduced tax rate for CNG in comparison with petrol and diesel.

5.2 Barriers

Communication barriers within the leasing companies: One of the main barriers turned out to be problems with internal communication and the allocation of responsibility. In this specific case, the persons responsible for customer contacts did not have the competence to make company-related decisions. This affected the measure in so far as the company's decision makers did not realise that a demand for CNG vehicle leasing already exists, and even though satisfying this demand might not translate into direct financial profits, positive impacts can be expected regarding the image of the leasing company.

Actual offer for CNG-leasing: In the beginning of the project it turned out that the standard available capacity was not attractive enough for offering immediately a tkm-leasing model. So the project design had to be readjusted to the circumstances, it was too ambitious for these initial conditions. The result was the described vertices of an attractive leasing concept and the development of a website providing information for leasing-providers and customers about CNG-vehicle leasing.

5.3 Resume

Given that CNG-vehicles have lower particulate and NO_x-emissions than comparable diesel-vehicles, increasing their share is an important element of the strategy aimed at fulfilling the European air-quality directive. While this was the rationale behind this measure, the specific conceptual approach targeted the promotion of CNG vehicles by improving the conditions for leasing. In the beginning of the project it turned out that the initial project design was too ambitious. The project design had to be adapted to the situation that the standard available offers was not attractive enough for offering immediately a tkm-leasing model. Therefore at first vertices of an attractive leasing contract for CNG vehicles were developed and promoted. Additionally a website was designed and launched, which provides information on the advantages of CNG vehicle leasing and supports potential customers in finding partners. Since a number of companies favour leasing their company cars, the provision and distribution of information as prepared in this demonstration measure was intended to help convincing companies to lease CNG vehicles. So on the one hand the developed website supports leasing providers in promoting their offers concerning CNG vehicle leasing and on the other hand the website provides an important platform for the company-side to get information about CNG vehicle leasing. Due to a lack of the respective information, however, it was not possible to analyse the extent to which the information was taken up by the targeted companies and in how far it contributed to their decision to lease CNG-vehicles.

Achievement of objectives

As already described in Chapter 2.3 the measure aimed initially at different level objectives developed at the start of the measure. But due to the change in demonstration design the objectives were not applicable anymore and their achievement therefore could not be evaluated.

6 Scenario

A scenario addressing CNG-vehicles is included in Chapter B.11 “Introduction of CNG-powered vehicles”.

B.9 Demonstration Measure 10.4 – Customer and User Participation

1 Introduction

The demonstration measures "Customer and User Participation" belongs to the Berlin demonstrations dealing with the implementation of a social, if not organisational innovation. With its approach oriented towards the inclusion of user needs and user perceptions in the design of the other demonstration measures, public participation in the field of transport should be increased. Generally projects in that field often lack an early incorporation of such user perspectives.

Main actor was *P.O.P. Consulting* (Partnerschaftsgesellschaft für Organisations- und Personalentwicklung – Association for organisation and staff development), which was supported by the Senatsverwaltung für Stadtentwicklung (Senate Department of Urban Development).

The evaluation dealt with this demonstration measure in a different manner: "Customer and User Participation" was a horizontal demonstration measure aiming mainly at establishing interactions with all the other Berlin demonstration measures[114] and at improving knowledge about customers of each demonstration.

Therefore please note that a different report structure applies for this demonstration measure.

2 Description of demonstration measure

2.1 Demonstration design[115]

The demonstration measure "Customer and User Participation" aimed at systematically introducing the customer perspective into the implementation process of the TELLUS demonstrations in Berlin. While doing this, several advantages were targeted by its actor *P.O.P. Consulting*. The demonstrators' knowledge base about potential or actual customers was to be increased. At an early stage it was intended to enable the Berlin demonstrations to improve or change details of their particular product or service according to the gained perceptions. It was envisaged that these details may contain reasonable price schemes, specific marketing measures or fitted product names. On the other hand it was expected to increase the customer acceptance of the new products or services by establishing long-term participation opportunities for customers.

[114] Further on we will speak of the Berlin demonstrations in order to maintain a readable text, this includes all measures the "Customer and User Participation" measure dealt with, irrespective of the fact that the latter is part of the Berlin demonstrations measures itself.

[115] Description of work, ANNEX A TELLUS Project descriptions, issued 29 October 2001

In this way the demonstration aimed at making use of the special customer view as (potential) users are regarded as experts for instance on the subject of their daily mobility needs. The demonstration measure attempted to minimise the risk of a demonstration's failure because of mistaken assumptions about customer needs. Promoting this link between the involved companies and (potential) customers or users already before adopting a new product or service was therefore seen as the first step to a fruitful long-term implementation of such co-operative structures.

2.2 Objectives

In co-operation with the evaluation team the demonstration measure identified immediate objectives. As the demonstration measure acted mainly with other demonstration measures or with the city project management the objectives had to be established for the implementation phase of the measures.

IMMEDIATE OBJECTIVES
Identify target group of the respective demonstration measure in question
Establish a direct contact between customers and companies
Improve customer relationship
Get valuable feedback
Improve knowledge about customer needs
Improve the demonstration measures

2.3 Transport Plan context[116]

The measure fits into the bundle of measures of the Integrated Transport Plan that aims at improving information and participation in the field of transportation in Berlin.

2.4 Innovative aspects

The demonstration measure "Customer and User Participation" applies an innovative perspective by intending to methodically involve the user perspective at an early stage of product development in the transport field. Often enough projects in this area are dominated by other factors like technical feasibility, cost efficiency or supposed advantages for a generalised public. Misled assumptions about customer needs or disregard of users can be the cause of failure of otherwise plausible projects.

[116] Senatsverwaltung für Stadtentwicklung (ed.) (2003)

3 Evaluation methods

To gain information on the customer and user participation carried out within TELLUS, at the end of each demonstration measure involved in such activities an interview with the demonstrator was carried out. For that purpose the evaluation team had developed a questionnaire in co-operation with P.O.P at the beginning of the TELLUS project. The demonstrator was asked to give information about the intended change of user acceptance and to assess the improvement of the customer relationships due to the work of P.O.P. Furthermore, on 23 March 2004 and 26 September 2005 interviews with P.O.P. about their work and results with respect to the Berlin demonstration measures were held.

4 Implementation process

4.1 Approach

P.O.P. contacted the Berlin demonstrators regularly. For that purpose persons responsible for marketing or sales/distribution were identified at the beginning of the project. P.O.P. tried to realise a structure for the co-operative participation process in developing and/or implementing the specific product/service with each of the Berlin demonstrations. Some of the Berlin demonstration measures met the P.O.P. activities with considerable scepticism. To overcome this attitude P.O.P. increased the number of consultations and sought the co-operation of the Local Evaluation Manager. As another reaction a pilot project regarding the customer participation was planned and installed. This pilot concerned extensive activities dealing with potential target groups for the Car Modal demonstration measure 8.5, a demand oriented shared taxi service (see Chapter B.6).

Co-operation with other Berlin demonstrations was planned to proceed in a similar pattern. The pilot project should serve as a door-opening example. However, already the contact management with several demonstrators turned out to be difficult. Internal problems and implementation delays of the demonstration measures increased the difficulties and made several rearrangements necessary.

Dealing with the demonstrators, P.O.P. experienced some difficulties regarding the perception of their work, and in particular the “product” that they were aiming to supply, namely the involvement and participation of customers and users. Thus, the product "customer participation" was received as unclear and not easy to communicate. P.O.P.'s contribution to each demonstrator depended largely on the specific conditions and special needs of the demonstrator, who sometimes did not know what exactly their own product would be. In that way it was not easy to specify the possible P.O.P. input at an early stage. The more generalised abstract description of P.O.P. methods could not always fill this gap.

The fact that P.O.P. focused on the incorporation of customer perspectives as an external actor was principally met with two different perceptions. In some cases it was received as an offer for support. In other cases it was understood as some sort of criticism of the

demonstrator's existent customer relations, especially where established enterprises were concerned.[117]

So, many of P.O.P.'s activities had to deal with pure contact management. P.O.P. had to create an own understanding of each partner regarding its specific structure, culture and needs and of possibly occurring modifications of the demonstration design. According to the demonstrator this procedure, which cost time and effort, was a precondition to establish trustworthy relations and to allow P.O.P. to make their strengths known to each demonstrator.

The implementation processes for each Berlin demonstration measure are difficult to generalise. Most of the following phases applied nonetheless to all of them:

Figure 35: Implementation phases of customer and user participation

Contacting	establish contacts; exchange of information about (intended) product or service; clarification of P.O.P.'s role
Conceptualising	create approach to target groups according to intended product or service
Adjusting	extending work to: – reconceptualisation(s); – revised concepts for approach to target groups; – included participation of concerned administrative staff/employees; – management of public relations; – mediation of negotiations; – creation of communication strategies; – search for sponsors
Feedback	on-site workshops (or equivalent activity) with representatives of target groups; reflect results to demonstrators, such as specified ways to address identified target groups or improved means to communicate a product

P.O.P. offered as well long range concepts for customer participation. Yet, mostly the demonstrators had to focus on short-term challenges like an unfavourable legal framework and were therefore not able to appreciate the proposition.[118] Because of such and similar conditions the adjusting phase became of special significance.

According to the demonstrator P.O.P. did not get much input for their participation concept in some cases as several demonstrators focused mainly on technology based applications

[117] Interview with P.O.P. by evaluation team, 26.09.2005
[118] Interview with P.O.P. by evaluation team, 26.09.2005

without having any clear view of potential users. Then, P.O.P. created own accesses to target groups which were not known before. In other cases P.O.P. organised workshops with identified multipliers and (potential) customers, created contacts with directly or indirectly involved actors, including for instance association representatives or administrative staff members to establish a favourable environment for the project.

Since the beginning of 2005 P.O.P. had become involved with the TELLUS Dissemination Campaign "Clean Transport in Berlin". The campaign aimed at informing Berlin citizens about the TELLUS activities. The campaign resulted in several participatory events with media involvement in summer 2005. The main part of that campaign was a youth contest named “Tell us about TELLUS”, in which several hundred young Berliners participated. Awards were given to the best contributions, the first prize being a trip to the TELLUS city Rotterdam. The awards ceremony took place in the Berlin House of Representatives on 24 August 2005 with local politicians and media representatives being present. About 400 young people attended.

4.2 Proceedings

Pilot project Car Modal: CharterCab (8.5)

By applying a systematic method CharterCab's potential target groups were identified. The results showed that the entrepreneur's earliest intuitive assumptions about possible customers had to be adjusted profoundly. Strong involvement of potential users was realised in several workshops, meetings and other forms of direct participation with special focus on perceivable future everyday routines of the users. P.O.P. organised a simulation of the CharterCab service with 70 participants. To overcome the problematic legal situation P.O.P. promoted and moderated the dialogue between stakeholders, concerned transport companies, taxi associations and involved administration departments. This included advising the demonstrator during the negotiation process, and the adaptation of the business plan according to the findings of the customer participation process. P.O.P. systematically organised feedback from participants of CharterCab's Mobilclub, from taxi associations about the concept of CharterCab and from public transport companies concerning a future day-to-day CharterCab service. To realise the CharterCab service on a permanent basis P.O.P. prepared and moderated several meetings with the concerned public and private partners. The idea was to replace four night bus lines with the demand oriented CharterCab service. The corresponding negotiations finally did not succeed. All in all, the CharterCab demonstrator appreciated P.O.P.'s involvement highly (for more details see B.6). P.O.P.'s activities exceeded in this case the original focus on the participation process. P.O.P. broadened its concept according to the specific situation, which required a neutral moderation of somewhat conflict-laden stakeholder meetings due to preceding communication problems.

In the concluding interview[119] the demonstrator stated that he was very satisfied with P.O.P.'s contribution. P.O.P.'s manifold input was evaluated as very helpful and even crucial to bring the demonstration forward. The dedicated analysis of target groups helped the entrepreneur to include the view of the users into his thinking and planning. In addition to that, P.O.P.'s mediation role with respect to concerned associations, enterprises and the Senate Department assisted greatly in establishing and maintaining negotiations.

Teleparking/ Mobile Parking (6.4)

As the Israeli IT-platform provider TPS (see B.2) could only be seldom present in Berlin P.O.P. assisted the FAV in the communication of the project's aims and in obtaining the necessary acceptance among administrative staff and the police authority. According to P.O.P. any of its potential further activities were overshadowed by the unfavourable legal situation which threatened to make any service implementation impossible. One rather unexpected but coherent effect according to P.O.P. was, that sometimes already the presentation of a concept for stakeholder involvement helped to reduce existing resistance to intended changes.[120] The immediate effect of such concepts could be that affected persons felt taken seriously and became positively involved.

The further co-operation with the subsequently altered demonstration measure "Mobile Parking" resulted for instance in the renaming of the product with the German expression "Handy Parken". P.O.P. organised a workshop with representatives of potential target groups, where features of the planned service were discussed. The input information for that was a flyer describing the intended mobile phone based routines for charged parking. As a result of that work a concept for an improved communication strategy regarding the service introduction was developed. The elaborated concept could not be realised due to legal and other problems which led to a serious time pressure for the implementation of "Handy Parken".

In the concluding interview[121] the concerned demonstrator stated that P.O.P. could not effectively improve co-operation as its possible contribution was mainly perceived as unclear. Differing languages between IT-partners and P.O.P. contributed to a difficult understanding. In addition to that, the IT-partners perceived a lack of IT-experience with regard to P.O.P. P.O.P.'s concept was judged as principally capable, but as not very appropriate in the case of an already proven service.

Road Pricing (6.5)

Only a very limited cooperation took place between P.O.P. and the demonstrator of 6.5. Originally it had been envisaged that P.O.P. would organise a stakeholder workshop.

[119] Interview with eloqu-metabasis, 27.01.2004
[120] Interview with P.O.P. by evaluation team, 26.09.2005
[121] Interview with FAV, 24.06.2005

However, this was never realised due to various reasons, which can no be fully retraced at this stage.

Future Management of Urban Public Transport (7.5)

The special kind of the demonstration measure as dealing with strategies regarding anticipated changes of framework conditions for public transport did not really permit the original participation concept to be applied. It was tried to combine the user survey conducted for 8.5 with questions regarding the acceptance of possible changes of the public transport supply in the concerned area. But, as finally 7.5 chose a different Berlin district for its analysis and because the data basis was not a representative one the results could not be further used.

Metropolitan Fleet Car (8.4)

In co-operation with the demonstration measure “Metropolitan Fleet Car” (see B.5) residents, business owners and company employees that lived or were based close to one MFC-car sharing station were interviewed about their level of awareness regarding the station and their interest in car sharing. This survey resulted in a strong recommendation of P.O.P. to implement action to increase the public awareness/knowledge of the station.

Further plans aimed at finding out ideal features of a car sharing station from the point of view of the users. This could not be realised due to a change of contact person and the restructuring of the local car sharing organisation which obliterated reached agreements.

By the MFC demonstrator P.O.P. was perceived as dedicated and willing to support the demonstration measure. P.O.P. could help to establish contacts to a MFC-client (BVG). But, as MFC to the demonstrator's point of view did no deal with the kind of customers conceptualised by the P.O.P. concept it was not possible to apply the approach directly. In addition to that, permanent changes of contact persons (MFC) made repeated renewals of contact management and agreements necessary.

According to the MFC demonstrator, MFC did not primarily need more customer participation input but was more in need of marketing support.

Inner City Logistic Centre (9.3)

The special kind of the demonstration measure did not permit to apply the original participation concept.

Financing contracts for NG vehicles (9.4)

P.O.P. initiated at an early stage a User-Provider-Forum which was held in September 2002. In the course of the Forum, P.O.P. helped with the organisation, moderation and finally the documentation. In that way P.O.P. contributed to the demonstrator’s work by enabling feedback with respect to market potentials and accordingly planned strategies.

The demonstrator of 9.4 judged that contribution as a very valuable one. The Forum was made possible only due to the engaged P.O.P. activities.

Dynamic real time passenger information for trams and buses (11.6)

The demonstrator BVG had its own concept including so called "Kundentester" in its development of the Daisy-interfaces. Any further user participation was not necessary under the special conditions of this demonstration measure.

Introduction of CNG-powered vehicles (12.6)

P.O.P. established contacts with a car manufacturer as a potential multiplier of CNG-powered vehicles. A workshop with car dealers from the area of Berlin and Brandenburg was organised. P.O.P. made use of the knowledge of call centre employees to categorise potential customers of CNG powered vehicles, thus aiming at an appropriate addressing of target groups and adequate marketing activities.

From P.O.P.'s point of view the proceedings with the demonstration measure "Introduction of CNG-powered vehicles" revealed a misunderstanding of roles between them and the demonstrator. To their understanding the demonstrator GASAG is a big, hierarchically organised enterprise, and it perceived P.O.P.'s manner of activities as too autonomous, not agreed upon and therefore even as competing ones. After realising that P.O.P. stopped its action.

It was planned to include the demonstration measure into an information campaign. The already fairly advanced concept for a "TELLUS-convoy" which intended to exhibit for instance a CNG-powered racing car could not be realised due to time pressures and restricted resources.

Dissemination Campaign

The Dissemination Campaign "Tell us about TELLUS" focused on young people as potential multipliers and as especially interested in future transport policies. P.O.P. contributed its experiences regarding the development of a target group oriented design for the campaign. P.O.P. organised in co-operation with the participatory evaluation (CTS TU Berlin) workshops with youngsters, in the course of which they were introduced to TELLUS, its aims and objectives and likely results of the demonstration measures. The young audience was then asked to find attractive ways to communicate these issues. They favoured a contest concept and emphasised that prizes for the best presentations should be provided to give an incentive to participate. According to that concept P.O.P. organised and managed contacts with schools and arranged the professional support to produce reportages and short films. P.O.P. could thereby build on their own experiences with conceptualising the customer participation for Car Modal, where pupils and young people had been recognised as one

target group.[122] In addition to the described activities P.O.P. managed the co-operation of the Berlin partners, schools and administration departments.

P.O.P. contacted over 200 schools and aimed thereby at recruiting pupils with diverse socio-demographic characteristics and different backgrounds according to their participating concept. About 20 schools of different educational types eventually made urban transport in general and TELLUS in particular part of their teaching schedule, for example during project days. Another 20 schools were indirectly involved in the campaign via groups of young people that participated in the contest without direct support by their teachers.

Altogether about 160 pupils handed in posters, articles, presentations and films for the contest.[123] The awards ceremony was held in the Berlin House of Representatives and was attended by 400 pupils along with a number of local politicians and journalists. Moreover, P.O.P. succeeded in finding sponsors for the campaign allowing for attractive prizes like a journey to the TELLUS partner city Rotterdam for the winning teams.

The campaign reached a high degree of attention among schools, parents and families, which was intended, as young people were chosen according to their perceived role as multipliers. As a result of that successful campaign the presentation was repeated in Rotterdam in October 2005.

Outlook

The results will further contribute to a DVD about CIVITAS. P.O.P. works on a possible continuation as participating youths could act as ambassadors for TELLUS themes. Another idea is to pass on the successful contest concept to other participating cities.

5 Conclusions

Conclusions emerge on different levels. These levels regard the fitting between the P.O.P. concept and the progression of the concerned demonstration measure, the kind of enterprise or consortium, the product/service dealt with and the concerned organisational cultures.

Progression of the demonstration measure

Some of the Berlin demonstration measures were delayed or underwent changes as a result of different causes (see for instance 6.4, 8.5). As there is always uncertainty involved when innovative products or services are introduced this is hardly surprising. But for the activities of P.O.P. this can be understood as a clear complication. Problems derived from changed concepts which obliterated first findings on target groups or first concepts for customer participation. Changes of responsible contact persons called for time consuming new contacting.

[122] Interview with P.O.P. by evaluation team, 26.09.2005

[123] Since not all of the young people that were engaged in the TELLUS related school activities took part in the contest, P.O.P. estimates that in total far more than 200 pupils approached the subject.

Enterprises/partners etc.

The Berlin demonstration measures vary greatly regarding the number of involved partners or the size and history of involved enterprises. Big established companies have different views and needs than small entrepreneurs. The P.O.P. participation concept may therefore be seen as a welcome backing due to missing own resources or may be perceived as competing with established marketing or product development routines. In case of consortia finding responsible and competent contact persons can be difficult to the point of impossible.

Products/services of the Berlin demonstration measures

In addition to that the Berlin demonstration measures deal with different “products”. There are more theoretical or conceptual approaches as in for instance 6.5 or 7.5. Other demonstration measures tried to establish new or innovative applications of basically developed products/services as in the case of 6.4 or 8.4. In the former case customers or users remain more or less fictive, rendering the participation approach unnecessary. In the latter case activities regarding the improvement of products through customer participation might be seen as not that important as straight marketing activities.

Organisational cultures

Different partners bring along different organisational cultures regarding e.g. the “language”, logic of thinking, formal and informal habits or entire ideologies. Although the participation concept is very plausible some application problems may simply derive from the actors' belonging to different organisational cultures.[124]

Various difficult attempts to introduce the participation approach proved that such phenomena exist. Entrepreneurs, convinced of their product, who seek after a straight market entry but are sustained by bureaucratic obstacles, may perceive therefore any participation activity as redundant or even interfering. In their view necessary activities should take place elsewhere (for instance 6.4 and 8.4).

The preferred way of the participation concept's approach rests highly on the outcomes of structured meetings of different (potential) users or concerned partners or parties involved. That kind of approach may not be understood from an internal corporate perspective due to a varying logic of action and a differing emphasis on customer relations.

In this context it has also to be mentioned that P.O.P. developed the concept idea according to needs of clients seeking help. In this case the clients do the first step. The acceptability of the concept is uncertain, when the opposite route is taken and enterprises are faced with something they did not choose themselves.

[124] See results of several studies following Niklas Luhmann's system theory like Königswieser et al. (1999) or Willke (1996)

Achievement of objectives

P.O.P. dealt with a range of varying demonstration measures. As its role and potential contribution was not clear to all demonstrators from the beginning P.O.P. had to tackle some challenges. P.O.P. stated that it felt the need to not cling to some ideal participation concept but instead to adjust to actual needs of demonstration measures. This included for example support during the negotiations regarding complicated legal conditions (8.5) or to overcome resistance against the application of new technologies (6.4). It proved to be very able to create an attractive concept for Berlin's TELLUS Dissemination Campaign. According to the conditions of each demonstrations measure – a mix from diverse products, sizes of enterprises and involved cultures – P.O.P. could achieve with some of the demonstration measures most of its objectives and with others not. On a general level all of the original immediate objectives could be achieved partly.

According to these conditions possible and actual contributions of P.O.P. were judged differently by the demonstrators. The demonstrators were asked in the concluding interviews to evaluate the customer participation using school marks. From those who answered that question, P.O.P. received two "excellent", one "good", one "poor", and in one case the demonstrator declined a judgement.

Table 10: Overview of grade of achievement of objectives[125]

IMMEDIATE OBJECTIVES	
Identify target group of the respective demonstration measure in question	PARTLY ACHIEVED
Establish a direct contact between customers and companies	PARTLY ACHIEVED
Improve customer relationship	PARTLY ACHIEVED
Get valuable feedback	PARTLY ACHIEVED
Improve knowledge about customer needs	PARTLY ACHIEVED
Improve the demonstration measures	PARTLY ACHIEVED
Grade of achievement: ACHIEVED – ALMOST ACHIEVED – PARTLY ACHIEVED – NOT ACHIEVED	

6 Scenario

This demonstration measure is not included in the scenario process.

[125] Please note that the table comprehends an assessment that spans over all demonstration measures and brings together successful as well as less successful activities into an average rating.

B.10 Demonstration Measure 11.6 – Dynamic Real-Time Passenger Information

1 Introduction

The demonstration measure "Dynamic Real-Time Passenger Information for Trams (and Buses)" belongs to the type of Berlin measures dealing with the implementation of a technical innovation. Equipping Public Transport with dynamic real time information improves the quality of the service. Improving the quality of passenger information is an important step to change or stabilise a modal split that favours public transport.

The company Berliner Verkehrsbetriebe (BVG, Berlin Transport Corporation) was the main actor in this demonstration measure. BVG co-operated internally with several subcontractors, like the software provider, the provider of the computerised operation control system or the interface provider.

The Forschungs- und Anwendungsverbund Verkehrssystemtechnik Berlin (FAV, Transport Technology Systems Network Berlin) and the Senatsverwaltung für Stadtentwicklung (Senate Department of Urban Development) completed the association.

2 Description of demonstration measure

2.1 Demonstration design[126]

The demonstration measure "Dynamic Real-Time Passenger Information for Trams (and Buses)" aimed at prototyping an interface necessary for expanding BVG's dynamic passenger information system (Dynamisches Auskunfts- und Informationssystem, Dynamic Enquiry- and Information-System – Daisy) from underground to surface public transport. The rationale behind this system was that tram (and bus) users were to be enabled to get information about the actual departure of the next two to five trams or buses and about disruptions as well.

The added benefit of the service was seen in the improvement of journey conditions through limitation of uncertainty and discomfort while waiting for the tram/bus. The dynamic visual displays were supposed to provide information about the route number of the tram or bus, the destination of the arriving vehicle, and about the waiting time with one minute accuracy. As a result of the specific algorithms, which use the location information and travel times to calculate the vehicle's arrival and departure at tram stops, the Daisy information displays the counting down of the arrival times of the next two to five trams (buses). The displayed line for the next vehicle eventually starts to flash, which increases the visibility of the given information.

[126] Description of work, ANNEX A TELLUS Project descriptions, issued 29 October 2001

Figure 36: Trial run of Daisy at tram station

Source: BVG

In order to be able to obtain and display the required information an interface between the existing computerised operation control system (rechnergestütztes Betriebsleitsystem, RBL) and the Daisy-system was needed. The computerised operation control system was meant to contain data about all planned departures, comparing and if necessary updating planned data with data about the actual vehicle position. For that purpose trams and buses were supposed to transmit repetitively information to the computerised operation control system by different means like crossing a defined signal or via axle counting (trams), or via a GPS locating procedure (buses). In doing so it was intended to generate the dynamic data according to the traffic situation and to transmit it to the dynamic information system.

2.2 Transport Plan context[127]

In the Integrated Transport Plan of Berlin the expansion of the dynamic passenger information system from the underground system to the tram and bus system is stated as one of the measures aiming at the improvement of public transport. The improvement of the information of public transport customers is seen as very important for increasing customer loyalty and encouraging a modal shift from cars to trams, buses and trains.

[127] Senatsverwaltung für Stadtentwicklung (ed.) (2003)

2.3 Objectives

In co-operation with the evaluation team the demonstration measure set itself objectives on different levels addressing short-term outputs and long-term outcomes as well as intermediate steps. Beside the documentation of the implementation process these objectives form the basis for the evaluation.

IMMEDIATE OBJECTIVES

Prototyping of an Interface between the Public Transport Operation Control Centre and the dynamic passenger information system (Daisy)

Acceleration of the pilot realisation of Daisy for trams and buses

INTERMEDIATE OBJECTIVES

Full scale implementation of Daisy for all trams and buses

Increase quality of information of PT customers

Increase quality of service

Increase customer satisfaction

Increase customer loyalty

ULTIMATE OBJECTIVES

Increase public transport use

Increase the modal share in favour of public transport

2.4 Situation before TELLUS / Innovative aspects

Dynamic information systems complete or replace traditional static information systems, mainly timetables. Timetables have some drawbacks. They can only inform about planned departures. The departure tables are sometimes rather complex. Customers need to find the tables at stations or platforms before being able to get the required information, often losing precious time doing that. People who do not use public means of transport regularly might sometimes have problems dealing with the tables. The same is true for any static information about disruptions or construction works.

Daisy has been implemented in Berlin at underground stations since 2003 with 764 installed displays at or around 170 these stations.[128] Dynamic information systems for passengers have existed in other German cities for an even longer time. They include solutions for bus or trams. Yet BVG had to solve important preconditions for any introduction of Daisy for Berlin's tram and bus stations, namely the creation of the necessary computerised operation control system which was finished only in 2002. As Berlin's net of tram and bus stations is much bigger and more complex than in other cities standard or already existing solutions could not

[128] Schneider et al. (2004: 191)

be applied. This situation is affected by a very typical phenomenon in Germany. The often municipally owned transport companies tend traditionally to stand-alone solutions regarding technical and technological developments.[129] Former technical acquisitions involve therefore sometimes specific solutions for otherwise standard applications.

BVG planned the new Daisy-system in an innovative, open way. The produced dynamic data can not only provide collective information at the interfaces at tram and bus stations. In addition to that a special application allows an individual text-message or internet service using the same data. Only few other transport enterprises offer such a possibility, among them Deutsche Bahn AG, Dresden's and Magdeburg's transport company.[130]

3 Implementation process

The approach

The demonstrator developed the hard- and software requirements for the interface. This included designing and development of the application software, defining the information to be given by the information panels and defining the panel type to be used. After that check-ups started with tests of 'virtual' information panels. The Daisy-software was implemented at the operation control centre (Betriebsleitzentrale). From the beginning all employees concerned with the new technology – e. g. tramway-control centre staff, other technical and operational employees – were informed about and trained with the new software as well as the use of the interface. Their feedback was an important input for the further software and interface development. For further testing the first information panels of the demonstration tram line no. 6 were installed. Subsequent to that functionality tests under real conditions were carried out and necessary changes applied. Problems regarding the co-ordination of the different interfaces and adjusting of the several internal Daisy components were solved. The technical problems could be eliminated and the remaining information panels were installed.

A problem derived from the fact that the first concept, showing always the departure time as set by the timetable, did not work. The demonstrator had based that concept on a prognosis of the internal experts of the operation control centre. Subsequent software changes solved that problem.

User participation

Planning the Daisy enlargement BVG could benefit from previous experiences with the implementation of Daisy in its underground system. Experiences with that showed a high

[129] Ministerium für Wirtschaft und Mittelstand, Technologie und Verkehr des Landes Nordrhein-Westfalen (ed.) (2000): Marktstudie Fahrgastinformationssysteme

[130] Dynamische Fahrgastinformation on-trip, http://www.fachportal.nahverkehr.nrw.de/fahrgast_mobil/dyn_finfo_ontrip/dyn_finfo_ontrip_druck.asp, access 13.10.2005

customer satisfaction with the underground dynamic information system and supported positive expectations of expanding it to buses and trams. Besides that it could be shown that users rate the frequency of public transport (here: underground) much better where the dynamic information system exists although actual frequencies were not changed. The same effect applied for the evaluation of punctuality.

In addition to those preceding results that BVG mobilised a group of experienced long-time customers as testers ("Kundentester" or "Qualitätstester") of the new interfaces regarding their reliability, functionality and readability.

Outlook

The first implementation phase in 2003 contained 104 panels. This number included four displays at bus stops. The second implementation phase that lasted until winter 2004 included 78 panels, among them 38 bus panels. Altogether 700 displays will be implemented over the next years. Every year 70 panels at most can be installed due to financial restrictions. As in Berlin round about 7,000 bus stops and about 800 tram stops exist roughly 10 percent of the stations will eventually be equipped. Panels will provide the dynamic information at the most frequented stops. When all the panels will have been installed 50 percent of all bus customers and 80 percent of all tram customers will benefit from the improved information service.[131]

For all stops the text message service is already now available. The same information is available from the BVG homepage.

4 Results

4.1 Evaluation methods

The evaluation of the demonstration measure contained its own restrictions. Evaluating the development and implementation of an interface as such is of no particular use in the context of this project. But, the interface development served the aim of realising the dynamic information system for trams and buses. It was agreed to concentrate on statements about the functionality and reliability of Daisy and on the resulting general user acceptance of the system and its overall performance. As concrete example of the demonstration measure a certain tram line was chosen (No. 6).

Regular meetings with BVG persons in charge were held to get the necessary information about functionality and reliability tests of Daisy. Existing data about passenger patronage could not be used being too general. BVG agreed to collect data about the development of passenger numbers and about the travel behaviour of users of the demonstration tram line

[131] Interview evaluation team with BVG, 20.06.2005

no. 6. To be able to evaluate the user acceptance interviews were carried out before and after the instalment of the information displays. For this purpose the evaluation team in co-operation with the demonstrator developed a questionnaire. The users were asked to evaluate specific features of the electronic displays, to give their general assessment of Daisy and to specify some details of their travel behaviour. BVG organised the representative surveys and the data analysis and discussed the results with the evaluation team.

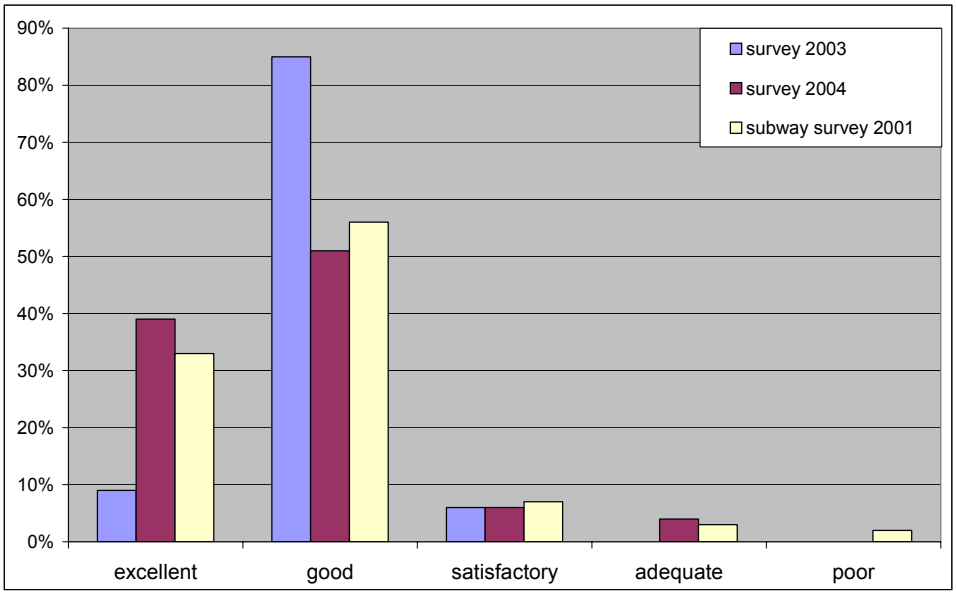
4.2 Impacts

SOCIETY

Customer acceptance

BVG organised several surveys to obtain how customers evaluate the dynamic information system. Two special surveys related to the implementation of Daisy regarding the demonstration measure. In May 2003 about 300 customers at tram stations, where Daisy was not yet implemented, and, following the implementation in May/June 2004 about 400 customers were asked about their opinions. The dynamic information system generally received good marks (see Figure 37).

Figure 37: General Daisy evaluation

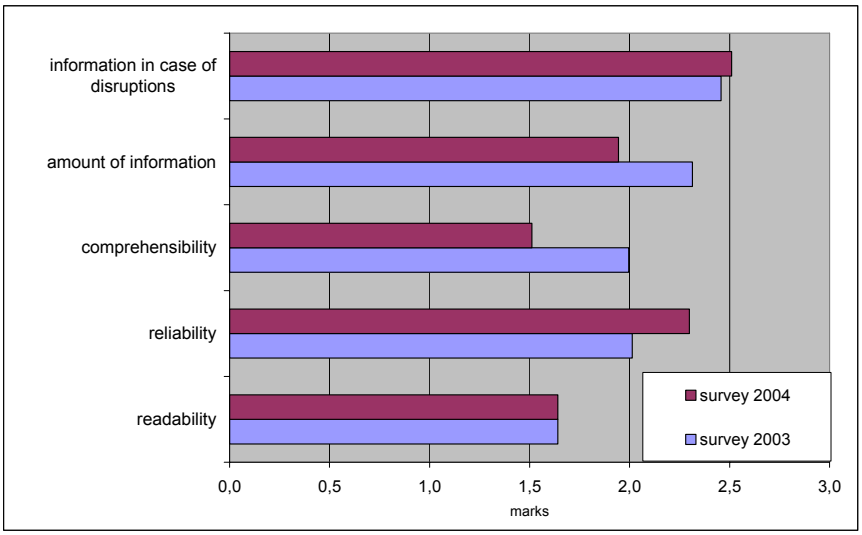


Source: BVG

By comparison the already very good results of the 2001 and 2003 surveys dealing with Daisy at underground stations are continued for the tram version with the highest proportion judging it "excellent" (39 percent). The questioned customers valued especially the readability and comprehensibility of the information panels (see Figure 38: 1.6 and 1.5). Compared with the evaluation of the underground Daisy system (2003) these marks improved (2.0 and 2.3), maybe because of the additional interface line at the tram displays.

The interviewed persons were more critically about information in case of disruptions and the reliability of the tram Daisy system (2.5 and 2.3). A possible explanation for the latter phenomenon is maybe that at the time of the interviews the system was still not yet fully operating. BVG officials reflected that to give useful information in case of disruptions is a serious challenge because of complexity and inherently limited possibilities.[132] Improvements are perpetually sought.

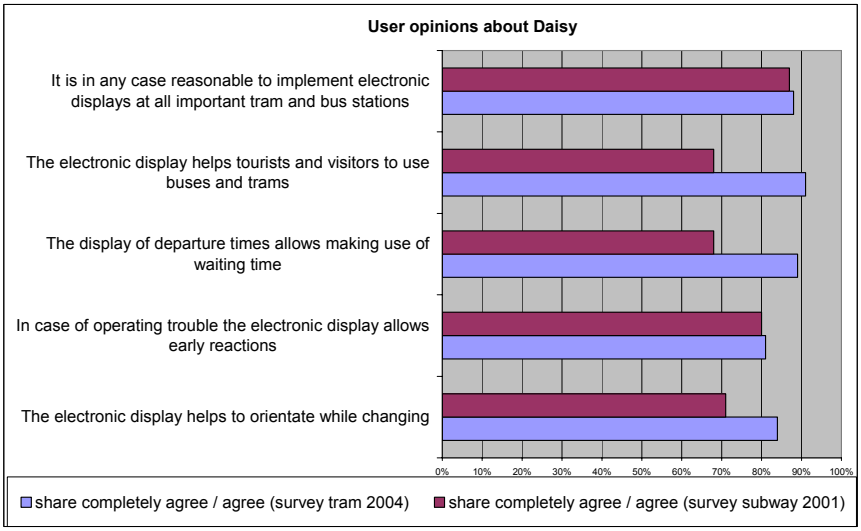
Figure 38: Assessment of specific Daisy features



Source: BVG

On the whole the customers feel better informed (see Figure 39).

Figure 39: Daisy's benefits



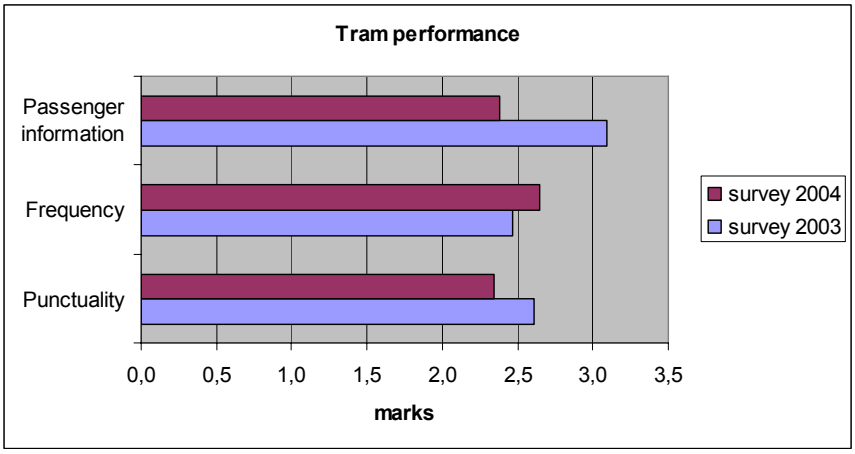
Source: BVG

[132] Interview evaluation team with BVG, 20.06.2005

Daisy helps to orientate while changing means of transport and it helps to react in case of disturbances. Daisy also eases waiting time due to the known effect that waiting periods are subjectively felt to be shorter by the given dynamic information. Further, Daisy improves the usability of public transport for people from other towns or countries.

These results prove the high customer acceptance. One has to keep in mind that in the period of the interface implementation some other changes took place, which aimed at making bus and tram service less unprofitable, and which effectively led to price increases and a decrease in service frequency. Nonetheless, the customers stated that they were more satisfied with a one way or another declined service (see Figure 40).

Figure 40: Satisfaction with tram service



Source: BVG

TRANSPORT

Technical functioning

The demonstration measure had to cope with some technical and resulting software development problems. The tests showed that Daisy displayed a wrong order of the trams next to arrive. In cases of an early arrival the ongoing departure of the specific tram could not be symbolised by the defined flashing of the concerning information. The software development problems caused several delays. The interface management of the different kinds of information proved to be complex and therefore difficult. Reliable solutions for the occurring problems had first to be found, which delayed the subsequent installation and activation of the information panels.

Transport patterns

BVG collected special data concerning passenger patronage of the tram line no. 6 before and after the instalment of the Daisy interfaces.

Passenger counting:

Passengers (seasonally adjusted):

Before: 40,115 (spring 2002)

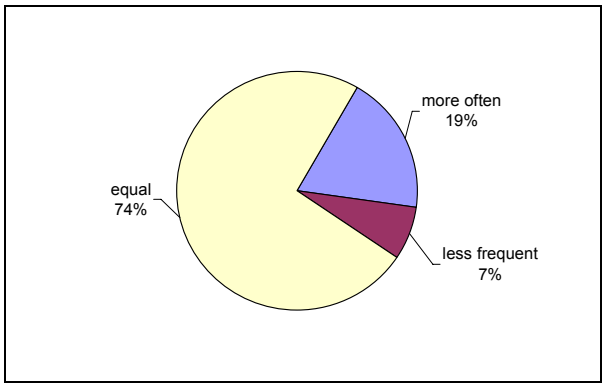
After: 40,074 (autumn 2004)

Balance: -0.1%

Source: BVG

In the customer survey in 2004 19 per cent of the customers stated that they travelled more often 7 per cent said they travelled less frequent and the majority of 74 per cent declared that they did not change their travel behaviour (see Figure 41).

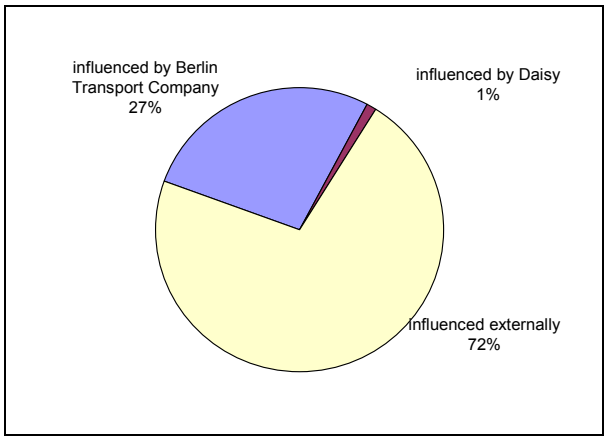
Figure 41: Changes in tram use



Source: BVG

Customers who indeed do use the tram more often gave chiefly external causes, like petrol costs or changes in the private or business sphere (72 per cent) (see Figure 42). Others increased use was influenced by measures of BVG like improved frequencies or improved connections (27 per cent). Only 1 per cent of the customers stated that their increased use is related to Daisy.

Figure 42: Causes for 19% increase in use



Source: BVG

Quality of service

According to the demonstrator's tests the reliability und functionality of the service is high. Misunderstandings of the service can nonetheless occur: The system updates information every 25 seconds. In case of sudden delays or sudden improvements of traffic conditions this can lead to the display of "longer" or "shorter" minutes according to the actual move of the concerned tram or bus.

5 Conclusions

From the analysis of the implementation process described above conclusions can be drawn regarding the factors that promoted or hindered a successful implementation of the demonstration measures.

5.1 Drivers

Single actor: BVG was solely responsible for the implementation of the demonstration measure. They had to organise the co-operation between contractors and tendering procedures for acquiring the information panels. This constellation helped to achieve the successful implementation of Daisy by minimising dependency from other actors.

Previous experiences: The demonstration measure could benefit from experiences with the previous effectual implementation of the underground Daisy system. Knowledge about the general feasibility and about a proven user benefit surely motivated the demonstration members.

Management of the implementation: At an early stage the demonstrator established a training programme regarding the handling of the application software by the operation managers. This increased the internal acceptance of the new technologies. In addition to that qualified feedbacks of the operators during the implementation phase and the operators' ability regarding flexible reactions could be ensured.

Secured additional financial funds: BVG is part of the publicly funded local transport system. Measures which improve the performance of the public transport find support via several financial sources (for instance funds according to the Local Transport Financing Law–Gemeindeverkehrsfinanzierungsgesetz, GVFG). There is no expectation that Daisy should pay for itself. Therefore there was no immediate financial pressure regarding the outcome of the implementation.

User acceptance: The survey about the customer evaluation of the Daisy interfaces conceptualised by the evaluation team and conducted by BVG showed high acceptance rates. These results proved to be beneficial for the demonstrator's internal communication and helped therefore to maintain a favourable atmosphere towards the project.

5.2 Barriers

The demonstration measure had to deal with some organisational and technological problems. Before the Daisy interface could be dealt with results of a previous project had to be awaited. On the technological side there were complications regarding the management of the necessary data resources, a rather complex procedure. To be able to erect interfaces on public ground in cases where no company owned station space existed or was usable, an approval by the responsible public authority was necessary. As the Berlin Senate Department of Urban Development fully supported the implementation the necessary permissions could all be acquired and only some delays were caused. All those problems turned out to be solvable in reasonable time and therefore caused only minor delays.

5.3 Resume

The demonstration measure aimed at the development of a technological interface necessary for implementing a real time passenger information system for trams (and buses). Such dynamic information systems considerably improve passenger information and therefore contribute to the quality and acceptance of public transport. They are seen as soon becoming a standard feature of public transport systems. To realise the Daisy system an intelligent data management of different information sources had to be established. Reliable data about the present location of vehicles had to be gained and needed to be combined with schedules and estimations of the remaining travel time depending on actual traffic conditions.

The demonstration measure faced a friendly general environment as for instance no legal barriers existed. The demonstrator mentioned only some minor problems regarding administrative procedures.

BVG will go on installing additional interfaces at tram and bus lines. Not every stop will be equipped. Busy stops and interchange points have priority and in that way most of the customers gain advantage from Daisy.

Changes in behaviour, such as a wider use of public transport, caused by the introduction of this system, could not be proven. Passenger data hardly changed. As during the implementation phase several further modifications like increased tariffs and changed bus and tram routes occurred it is very difficult to allocate causes for patronage alterations or for other changes in the tram and bus use. The demonstrator does not assume that the Daisy interfaces should cause a serious increase of passenger numbers. More emphasis is laid on the fact of an increased usability of the public transport and a better customer satisfaction which could be proven by the survey.

Achievement of objectives

The demonstrator was able to achieve almost all its objectives. Further interfaces will be installed in the future, especially at busy stops or stops with crossing lines. All the necessary technological requirements have already been developed. Anyway, not all of the thousands

of Berlin bus stations can be equipped with the panels due to the maintenance costs and costs caused by vandalism which do not justify the equipment of less frequently used stops. But, the demonstrator could at the same time implement another type of real time information: For each bus or tram station real time information about the next five rides is available via mobile phone text messages. This service uses the same data source as the Daisy-service. Data can be obtained via Internet, too.

Table 11: Overview of grade of achievement of objectives

IMMEDIATE OBJECTIVES	
Prototyping of an Interface between the Public Transport Operation Control Centre and the dynamic passenger information system	ACHIEVED
Acceleration of the pilot realisation of Daisy for trams and buses	PARTLY ACHIEVED
INTERMEDIATE OBJECTIVES	
Full scale implementation of Daisy for all trams and buses	ALMOST ACHIEVED
Increase quality of information of PT customers	ACHIEVED
Increase quality of service	ACHIEVED
Increase customer satisfaction	ACHIEVED
Increase customer loyalty	[data missing]
ULTIMATE OBJECTIVES	
Increase public transport use	
Increase the modal share in favour of public transport	
Grade of achievement: ACHIEVED – ALMOST ACHIEVED – PARTLY ACHIEVED – NOT ACHIEVED	

For the future, the ultimate objective regarding an increased use of public transport and an increased modal share in favour of public transport must be seen as very ambitious. It is agreed upon that such changes can not be caused by a single measure. Nonetheless, every measure that improves the availability of public transport information and which offers an easy access to this information can be regarded as absolutely necessary for any positive changes.

An existing estimation of any possible positive effects of dynamic passenger information on public transport modal share state the requirement of future availability of such information at additional places like shopping centres or working places.[133] Otherwise no measurable effects on transport are expected.

[133] Prognos AG (2001: 80)

6 Scenario

This demonstration measure is not included into the scenario process.

B.11 Demonstration Measure 12.6 – Introduction of CNG-powered Vehicles

1 Introduction

The demonstration measure 12.6 was concerned with the promotion of CNG-lorries by information provision and creation of financial incentives. The underlying policy aims at encouraging the use of cleaner vehicles. The demonstrator of this measure was GASAG (Berliner Gaswerke AG – Berlin Gasworks Corporation).

12.6 interrelated with measure 9.4 “New Forms of Financing-Contracts for Natural Gas Vehicles”, in the context of which vertices of a customer friendly leasing contract for CNG-vehicles had been developed. Thus, the measures 9.4 and 12.6 support one another in a positive way to force the market penetration of CNG-vehicles.

2 Description of demonstration measure

2.1 Demonstration design[134]

The aim of the measure was to bring at least 100 additional CNG-powered (Compressed Natural Gas) distribution lorries of different weight classes (3.5 – 24 t) onto Berlin’s roads. In order to achieve this objective information material was to be developed and distributed, and it was planned to conduct special information events for target groups and potential customers. In particular the haulage companies operating from the planned new city logistics centre were supposed to be addressed. Improving the information basis of potential users was seen to be of particular importance, since the measure dealt with the application of a new technology, i.e. CNG-vehicles, which had thus far been unknown to the target groups. Additionally, financial assistance for purchasing CNG-vehicles was supposed to compensate for the higher costs of a CNG-vehicle compared to a conventional Diesel driven vehicle. Moreover, it was planned to further support the customers by offering technical assistance during the introduction phase.

2.2 Transport Plan context[135]

In the Integrated Transport Plan the TELLUS measure “Introduction of CNG-Powered Vehicles” can be seen as an important module of the strategy towards a clean urban freight transport. In particular it corresponds to the Integrated Transport Plan measure that aims at reducing vehicle based emissions, since the use of CNG- instead of diesel-engines results in lower PM- and NO_x-exhaust emissions.

[134] Description of work, ANNEX A TELLUS Project descriptions, issued 29 October 2001
[135] Senatsverwaltung für Stadtentwicklung (ed.) (2003)

2.3 Objectives

In co-operation with the evaluation team the demonstration measure set itself objectives on different levels addressing short-term outputs and long-term outcomes as well as intermediate steps. Beside the documentation of the implementation process these objectives build the basis for the evaluation of the measure.

IMMEDIATE OBJECTIVES
Enhance information about CNG-Vehicles
Reduce investment cost of CNG-vehicles
Gain new customers
INTERMEDIATE OBJECTIVES
Increase sale figures
Improve acceptance of CNG technology
ULTIMATE OBJECTIVES
Reduce traffic related CO_2 emissions and energy use
Reduce air pollution and noise
Reduce NO_x emissions from heavy traffic

2.4 Situation before TELLUS / Innovative aspects

A small number of CNG vehicles (passenger cars and vans) had already been operated by the local gas provider, taxi companies and private owners in Berlin. Before TELLUS no buses with CNG-engines were used by the Berlin bus companies[136]. A network of 12 CNG filling stations had been installed until the end of 2001, in order to support a wider use of gas-powered vehicles. Despite these efforts, the dissemination of commercial CNG vehicles (>3.5 t) had been very poor, so that particular emphasis needed to be put on this aspect in order to strengthen their market diffusion.

The innovative aspects of this measure thus relate not only to the promotion of an innovative technology, but also to the applied instruments of information distribution and financial support, which were targeted at bringing at least 100 additional vehicles into operation in the short-term.

[136] 1996-1999 the BVG carried out a first pilot project with CNG-buses, but did not continue to use this engine technology.

3 Implementation process

The first step for the promotion of CNG-lorries was the development of an introduction strategy and the preparation of guidelines for funding. A strategy for introducing CNG lorries was discussed amongst the relevant Senate Department, the Chamber of Commerce and Industry, the "Fuhrgewerbeinnung Berlin-Brandenburg" (Carrying Trade Guild), "Verband der Spediteure Berlin-Brandenburg" (Association of Carriers), and BEHALA (City Port Authority). The guidelines for funding of the lorries were prepared with these partners and the Umweltbundesamt (Federal Environmental Agency). Only new vehicles with a CNG-engine that complied with the EU-exhaust-limit EURO 4 or the EEV-standard were supported. Furthermore, vehicles thus funded had to be operated for at least two years, and the registered vehicle holders were obliged to affix a visible advertising sticker on the lorry, stating that the vehicle contained an environmental friendly CNG-engine and was supported by TELLUS. Additionally, the operator had to report quarterly about the fuel consumption and the mileage for the purpose of evaluation by the project partners.

Due to the financial assistance for vehicle purchase, the difference in purchase costs of a CNG-vehicle as compared to conventional diesel driven vehicles was reduced. The amount of financial funding was dependent on the vehicle size class. The initial intention was to support the purchase of lorries with a gross vehicle weight rating (GVWR) between 3.5-24 t. However, since these vehicles did not have an actual market, the vehicle weight ratings for funding were expanded to 1.3-26 t. Depending on the weight, there were five groups of financial support (Table 12):

Table 12: Amount of funding per vehicle group

	Group A	Group B	Group C	Group D	Group E
gross vehicle weight rating	1,3 t to <1,9 t	1,9 t to <3,5 t	3,5 t <7,6 t	7,6 t to <12 t	12 t and more
financial promotion	On request	2.000 €	3.500 €	6.000 €	8.000 €

The introduction of CNG-lorries was assisted by broad distribution of information about CNG-engines and their advantages. Initially mainly companies with big vehicle fleets were supposed to be addressed. Yet since in Berlin only very few of those exist, the target group was expanded to include all trade branches. Subsequently, an information campaign started in February 2003. A mailing to haulage contractors and transport companies provided by the Chamber of Commerce and Industry was launched, followed by advisory consultations with enterprises interested in purchasing a CNG-vehicle.

Despite these efforts only a few companies were interested to buy lorries with CNG-engines. According to demonstrator there was a general distrust towards the equivalent performance of CNG-vehicles compared to conventional cars. The tax-privilege on natural gas had not

been sufficiently noticed. As a consequence the information campaign was further extended and intensified, and potential companies were addressed directly by public events and expositions. An “advisory session marathon” was held at one of the central markets of Berlin. Between midnight and 8 o’clock in the morning fruiterers, greengrocers and other dealers were informed about the TELLUS-measure.

In June 2004 a special conference on CNG took place within the framework of the Berliner Energietage (Energy Days). Over the course of three days small CNG-powered lorries were presented and substantive information and advice was provided for the visitors. In June 2004 a small conference with car dealers and sales personnel of GASAG was held in order to improve the introduction of CNG-vehicles and especially lorries in Berlin. Furthermore, the car dealers were intensively addressed, since at the beginning of the demonstration measure the demonstrator had realised that more often than not they lack knowledge on CNG-vehicles.

Additionally, articles on CNG trucks and TELLUS were published in trade papers for the purpose of enhancing the acceptance of CNG-lorries. Meetings and conferences with representatives of car manufacturers completed the campaign to first, get information about their planned productions, and second, to communicate the demands that arose in TELLUS regarding particularly the market for CNG-driven lorries.

In addition to the activities aimed at promoting CNG-vehicles for freight transport, in summer 2005 the bus company HARU (subcontractor of BVG, the local public transport company) exchanged nine Diesel driven public transport buses for CNG-powered buses. Additionally a CNG filling station was installed on HARU’s premises. This station is supposed to be open 24-hours per day also to the general public. The nine buses and the fuelling station were included in the contract amendment.

Outlook

In 2005 the demand for CNG-lorries showed a strong increase due to the air quality directive and the high crude oil prices. Due to these circumstances it is assumed that also in future the demand for CNG-lorries will be higher than in the beginning of the TELLUS-project. Additionally, in September 2005 the BVG announced that they will purchase in spring 2006 five CNG-buses for their bus fleet[137].

[137] Tagesspiegel online, 29.09.2005

4 Results

4.1 Evaluation methods

Between December 2002 and July 2005 regular meetings with the demonstrator as well as the analysis of the TELLUS reporting documents served to up-date information on the status of implementation. A questionnaire to reflect on the advisory meetings and to measure the development of knowledge level and acceptance of CNG technology over time was developed by the evaluation team. However, due to company-internal problems it was not filled in by the demonstrator. In December 2004 the Berlin evaluation team carried out a first telephone survey among 19 users of the TELLUS funded CNG powered vehicles that had run for at least half a year. A second survey followed in July 2005 so that the number of overall interviewed users was 44. At the same time the users were obliged to report quarterly on the fuel consumption and the mileage of the CNG-lorry. An analysis of the fuel consumption of CNG-lorries was carried out by the evaluation team.

4.2 Impacts

SOCIETY

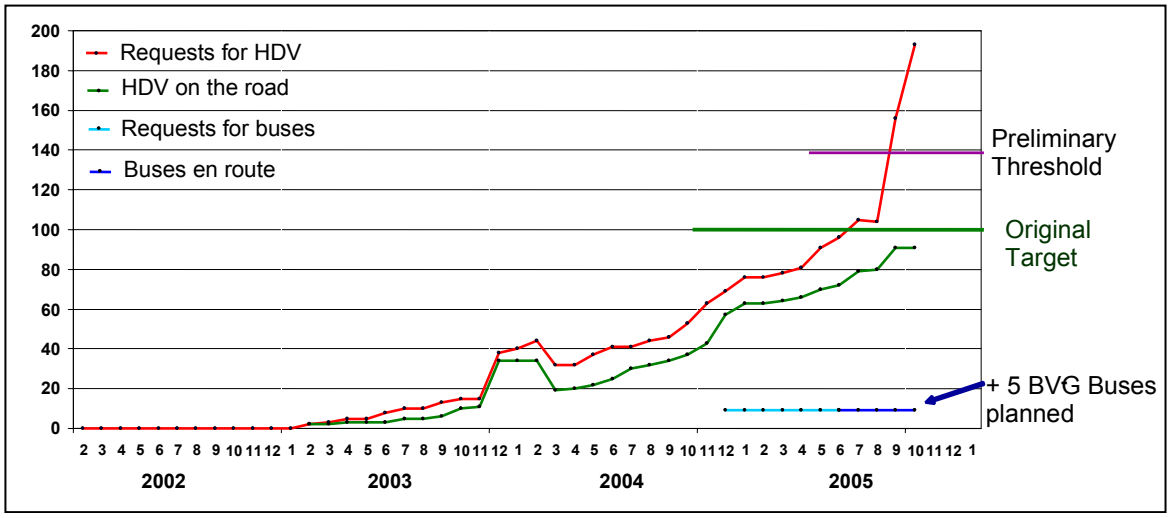
Acceptance

At the beginning of the measure in February 2003 the GASAG contacted about 6,850 companies by mailing to provide information about CNG-vehicles and the TELLUS-measure. In the following, 685 companies were directly contacted via telephone. 511 companies did not show any interest in CNG-lorries whatsoever. But 174 asked for a consultation, out of which 24 resulted in orders of CNG-lorries.

1. ✉ + 2. ✉ Number of letters	Telephone survey Number of calls (partly by Call-Center)	Reaction			Consultation interviews	**Results**
		no interest	Later …	Consultation demanded		**Requests**
6,850	685	402	109	174	174	**24**

In the beginning of the demonstration measure the demand for CNG-lorries was not satisfactory. Due to the information campaigns the demand could be amplified significantly. Figure 43 shows the increase in requests for funding of CNG-lorries during the TELLUS-demonstration measure. In summer 2005 the demand for CNG-lorries enhanced again due to the increase of crude oil prices. So that in the beginning of October it was not clear if all requests for subsidies could be met. On 6 October 2005 the number of demands for subsidies in the context of TELLUS was 155, 91 lorries were already on the road.

Figure 43: Number of funding requests and vehicles in use

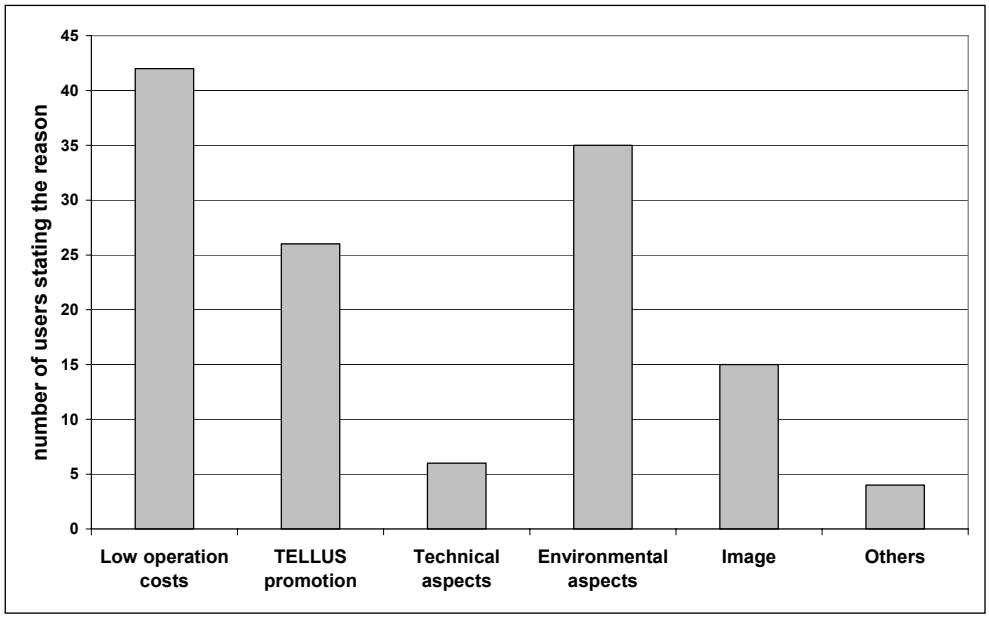


Source: GASAG

Satisfaction with CNG vehicles

The telephone survey carried out by the evaluation team in December 2004 and July 2005 showed a high satisfaction with the operation of the CNG powered vehicles. The survey showed that the main benefit of CNG powered vehicles was seen in the low operating costs compared to diesel powered vehicles, and in the environmental aspects (Figure 44). For all users these were the crucial points for the decision to buy a CNG vehicle. Funding itself was seen as an important means to enhance the use of CNG vehicles, and it was of great relevance especially for smaller companies. Comparing the survey from the users who had their vehicles on the road before December 2004 to the survey of the users who requested their vehicles in 2005 it attracts attention that the environmental aspects get a much higher weight for the decision to buy a vehicle with CNG-engine. That is probably due to the discussions starting in the beginning of the year 2005 about the air quality directive and possible associated restrictions for vehicles with high particulate emissions.

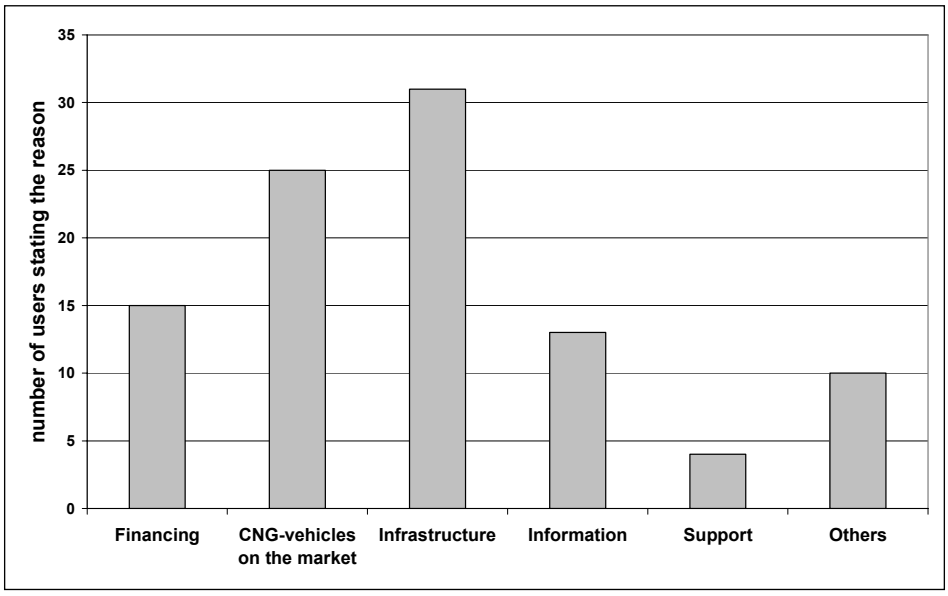
Figure 44: Reasons for the decision to buy a CNG-vehicle (stated by the users)



Source: User survey, WP 4 Evaluation and Verification Berlin, July 2005

Being asked about how the frame conditions for the introduction of CNG vehicles should be improved for most of the users infrastructure improvements, especially an area-wide network of CNG filling stations was an important aspect (Figure 45).

Figure 45: Requirement for improvements



Source: User survey carried out by evaluation team in December 2004 and July 2005

Also the existing range of CNG-vehicle types did not sufficiently meet the requirements of the different fields of work of the companies that maintain vehicle fleets in Berlin. Nevertheless,

nearly all of the companies, which had already used CNG-engines and have had them in operation for at least half a year, were satisfied with the performance. Thus they would buy a CNG-vehicle again and recommend them to others.

Also the bus company HARU was interviewed in the context of the user survey. After two month with CNG buses on the road, they made only very positive experiences. They did not face any problems concerning the maintenance or the reliability of the CNG engines. If they had to purchase new buses they would buy CNG buses again. As reason for this first of all the changes resulting from the air quality directive and the perhaps resulting ban on driving in the centre of Berlin were stated. Moreover the low operation costs, environmental aspects and image issues were named as well as the positive feedback from their passengers regarding the fact that CNG-buses are significantly quieter than conventional diesel buses.

Information/ Public awareness

The demonstrator undertook a good number of activities to make CNG-vehicles known to the public. Presentations of CNG-lorries were given on conferences, and workshops about CNG-vehicles were organised. In the numerous press articles the environmental advantages and also the financial incentives were communicated.

ECONOMY

It is difficult to assess the cost-related evaluation category. The user survey shows that the investment costs of CNG-lorries vary greatly with the offers of the car dealers (for example one user bought an exhibit vehicle which was comparably cheap) and depends additionally on the equipment of the vehicle. So the investment costs for vehicles are not directly comparable. Also the additional costs of the CNG-lorries are difficult to estimate. The subsidies range mainly between 2,000 and 3,500 Euro depending on the vehicle weight class. In the context of the user survey the customers stated the additional cost in a range of “cheaper than a comparable Diesel-vehicle” up to 9,000 Euro.

The low operation costs – one of the main drivers for the decision to buy a vehicle with CNG-engine – are much lower due to the lower fuel tax of CNG compared to diesel.

TRANSPORT

The indicators for the evaluation area transport, the total number of trips per day and the total number of vehicle-km travelled per day, could not be included in the survey so that an evaluation regarding these aspects is not possible here. The analysis of the collected data of the users gives an average mileage for the lorries funded in the context of this measure of 2.500 km per month. If the overall mileage of all these lorries is calculated up to the end of the year 2005, 3.2 millions of kilometres are driven by CNG lorries funded by TELLUS.

ENERGY

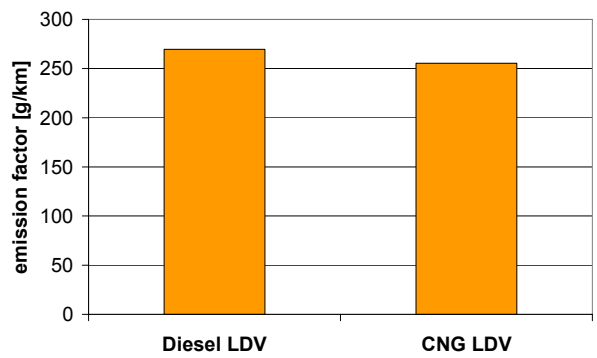
Most of the CNG lorries are bivalent, which means that they are powered with CNG and additionally with gasoline. So the data about fuel consumption could only be analysed for monovalent CNG vehicles, because only for them it is possible to allocate the amount of fuel to the kilometres. The calculations results in an average CNG consumption of about 9.6kg/100km for a 3.5 t-lorry. The survey of the fuel consumption of the 9 CNG buses gives an average fuel consumption of 54.6kg/100km after two month in use.

ENVIRONMENT

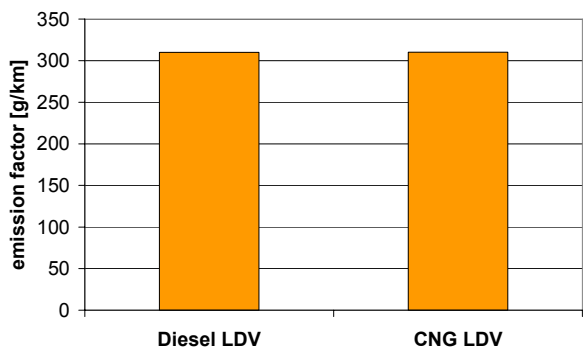
In general CNG-lorries replace lorries with diesel-engines. So the environmental evaluation bases upon a comparison between CNG- and diesel-lorries. Since the condition for the subsidies is the compliance with EURO 4, only lorries with this exhaust-limit are considered. A feasible base for comparing two different types of engine technologies concerning their emissions are the emission factors for real driving behaviour expressed in grams per kilometre as stated in the handbook of emission factors for road transport[138]. In the following table the emission factors for the environmentally relevant gases are shown. Since only light duty vehicles (LDV) were funded due to the insufficient market availability the emission factors for this vehicle category is used. The CO_2- and CO_2-equivalent-emissions include the embodied emissions because the influence on the result is considerable. The evaluation of the global change related indicator “greenhouse gas” shows that there is no advantage for CNG-vehicles mainly due to the leakages and the energy use over the transport chain of the methane. In contrast CNG-lorries have a significant environmental advantage with regard to air pollution when compared with diesel-lorries without an exhaust emission treatment for NO_x and particulates. They have lower NO_x-emissions and nearly no particulate emissions – the two pollutants regulated by the air quality directive. Because benzene and CO are not relevant in the context of CNG-vehicles and do not pose a real air pollution problem in Berlin anymore, these pollutants were not included in the evaluation.

[138] Handbook of emission factors for road transport 2.1, www.hbefa.net

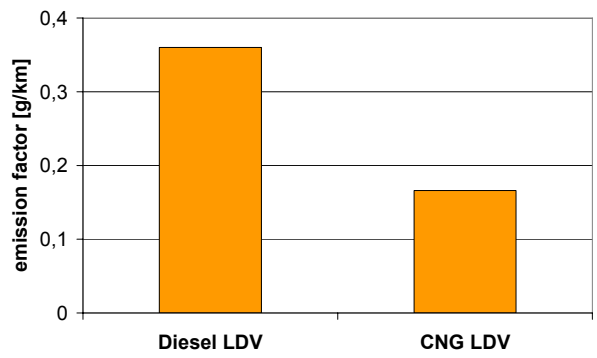
Figure 46: Emission factors for diesel and CNG LDV for different types of emissions



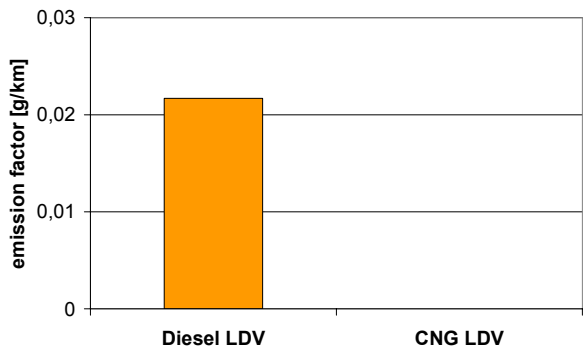
Emission factor of CO_2
Diesel LDV: HB 2.1 and GEMIS 4.3[139] (incl. embodied emissions)
CNG LDV: calculated in the context of TELLUS-survey (see also Chapter 6)



Emission factor of greenhouse gases
Diesel LDV: HB 2.1 and GEMIS 4.3 (incl. embodied emissions)
CNG LDV: calculated in the context of TELLUS-survey plus HB 2.1 for gasoline LDV (see also Chapter 6)



Emission factor of NO_x
Diesel LDV: HB 2.1
CNG LDV: HB 2.1 for gasoline LDV (see also Chapter 6)



Emission factor of particulates
Diesel LDV: HB 2.1
CNG LDV: HB2.1 for gasoline LDV (see also Chapter 6)

By these emission factors and the mileage indicated above the NO_x- and particulate emissions reduced by the TELLUS-funded CNG lorries can be calculated. Compared to the use of diesel lorries the NO_x emissions are reduced by about 620 kg and the particulate emissions by around 60 kg over the whole time frame of this measure.

5 Conclusions

From the analysis of the implementation process described above conclusions can be drawn regarding the factors that promoted or hindered a successful implementation of the demonstration measure.

[139] Gemis (Globales Emissions-Modell integrierter Systeme), Version 4.3, http://www.oeko.de/service/gemis/de/index.htm, 2005

5.1 Drivers

Air quality directive: The European air quality directive supported an increasing demand for CNG-lorries. The directive became effective in January 2005, and in the first six month of the year many measuring stations in Germany reported an exceedance of the PM_{10}-limits. This was extensively covered in the German media. Now municipalities that exceeded the limits are obliged to prepare an action plan, which in most cases will – among other measures to reduce the traffic related PM_{10}-emissions – also include restrictions for vehicles with high particulate emissions, e.g. road-pricing (see also TELLUS-measure 6.5) or a driving ban related to the particulate emissions of the vehicles. Given that CNG-engines have a much lower emission than comparable diesel-engines the demand for CNG-lorries has increased since the beginning of the year 2005, which supported also the TELLUS-measure 12.6.

Price of crude oil: The steady rise of the price of crude oil results in an increased demand for CNG-vehicles. This is due to the reduced tax rate for CNG in comparison with gasoline and diesel.

Integration into a wider strategy: Embedding the TELLUS-measure in other CNG-related demonstration measures in Berlin was very helpful. In this context the TUT-project (Tausend Umwelttaxis, *1000 environmental taxis*) of the Federal Ministry of Environment to promote taxis with CNG-engines and the promotion of private CNG-driven cars initiated by GASAG were of particular relevance.

5.2 Barriers

Market-availability of CNG-lorries: The measure was accompanied by two significant barriers. On one side there are only a few lorry-types with CNG-engines on the market. Since the end of 2002 CNG lorries with EURO 4 or EEV-emission standards became more available. But the main problem during the entire TELLUS-demonstration measure was the deficient supply of heavy CNG lorries, particular in the middle weight class. Additionally the ones that could be purchased were extremely expensive. Because of that, most of the funded vehicles are smaller ones (max. 3.5 t GVWR). The TELLUS-demonstration measure did not suffice to improve the pressure on the manufactures to enlarge their range of vehicle-types with CNG-engines. Even though the measure is still ongoing, it is conceivable that even at its end there will be no lorries with a gross vehicle weight rating of 12 t available on the market. This is of particular concern, since this vehicle class is preferentially used for the distribution of goods in inner-city areas.

Acceptance of CNG-technology: On the other side in the beginning of the measure there was a significant lack of knowledge about CNG vehicles. In addition, there was a general reservation towards the equivalent performance of NGV compared to conventional vehicles. The tax-privilege on natural gas as fuel had not really been noticed. So the start-up phase took much more time than planned in the beginning. At first an intense campaign had to be carried out convincing the companies in Berlin of the practicability of CNG-lorries.

5.3 Resume

The aim of the measure was to bring at least 100 additional CNG-powered distribution lorries of different weight classes (3.5 – 24 t) onto Berlin's roads. In order to achieve this goal information material was developed and distributed, and special information events for target groups and potential customers were organised. In the beginning of the demonstration measure it turned out that there was a general reservation towards the equivalent performance of CNG compared to conventional vehicles, and the tax-privilege on natural gas as fuel had not really been noticed. By an intense information campaign these problems could be partly smoothed out so that the demand for CNG-lorries enhanced during the demonstration measure and the aim – financial support of the purchase of 100 CNG-lorries – could be achieved in August 2005. The demand for the subsidies of CNG-lorries is still ongoing. On the 6 October 2005 91 lorries supported in the context of the demonstration measure 12.6 were on the road, 48 requests were under examination by the demonstrator and 16 requests were postponed to the decision of the next amendment due to the budget limit. It is assumed that the number of requests will further increase up to the end of the measure in January 2006. Helpful in this context were the air quality directive which became effective in January 2005 and the steadily increasing fuel costs due to the reduced tax rate of CNG, two facts encouraging the demand for CNG-driven vehicles.

Achievement of objectives

As already described in Chapter 2.3 the measure aimed at different level objectives. In the following it will be assessed how far these goals could be achieved. Details on the underlying arguments for the assessment can be found in ANNEX 1.

Table 13: Overview of grade of achievement of objectives

IMMEDIATE OBJECTIVES	
Enhance information about CNG-Vehicles	ACHIEVED
Reduce investment cost of CNG-vehicles	ACHIEVED
Gain new customers	ACHIEVED
INTERMEDIATE OBJECTIVES	
Increase sale figures	ACHIEVED
Improve acceptance of CNG technology	ACHIEVED
ULTIMATE OBJECTIVES	
• Reduce traffic related CO_2 emissions and energy use	
• Reduce air pollution and noise	
• Reduce NOx emissions from heavy traffic	
Grade of achievement: ACHIEVED – ALMOST ACHIEVED – PARTLY ACHIEVED – NOT ACHIEVED	

As shown in Table 13, the demonstration measure reached all of its immediate and intermediate objectives. Furthermore in principal even the ultimate objectives are achieved when the demonstration measure is finished.

6 Scenario

6.1 Introduction

The aim of the two TELLUS measures concerning CNG vehicles in Berlin was the reduction of NO_x- and greenhouse gas emissions from road transport due to an improvement of the use of cleaner vehicles. In order to estimate the potential long-term impacts of a realistic increase of the CNG vehicle stock, the results of the promotion in form of information provision, creation of incentives and the development of a new form of financing contracts for CNG-vehicles during the life cycle of TELLUS were used as starting point for further assessment. Likewise, supplement data and information derived from statistics were also incorporated into the upscaling exercise and in the calculation of the environmental impacts.

6.2 Description of the measure characteristics in 2015

CNG engines are an accepted and widely used alternative to conventional diesel vehicles.

6.3 Framework conditions

Based among others on the lessons learned in TELLUS, the urban transport policy of the year 2015 will have experienced some major changes, resulting in the provision of necessary preconditions for a wider introduction of CNG vehicles, such as:

- **Reduced fuel tax up to 2019:** The reduced tax rate of CNG is an important condition for the diffusion of CNG engines. Although the investment costs for the vehicle itself are higher due to the lower fuel costs the economic balance starting at a certain mileage will be positive.
- **Adequate network of CNG filling stations** [140]
- **Broad range of CNG vehicles available:** At the moment one of the barriers to use CNG vehicles is the insufficient range of CNG vehicles. It is supposed that on the side of the automotive industry the range of CNG vehicles will be significantly enlarged so that for each application a vehicle with CNG engine is available.
- **Intense policies for CNG, e.g. user advantages or environmental zones**: The backup for CNG on the part of political and industrial stakeholders will be intensified and – in the

[140] The user survey in the framework of TELLUS showed, that one of the most important requirements is an area-wide network of CNG filling stations

context of the air quality directive - flanked by measures like environmental zones or road pricing reducing the PM_{10} and NO_2 concentrations by restrictions for vehicles with high emissions.

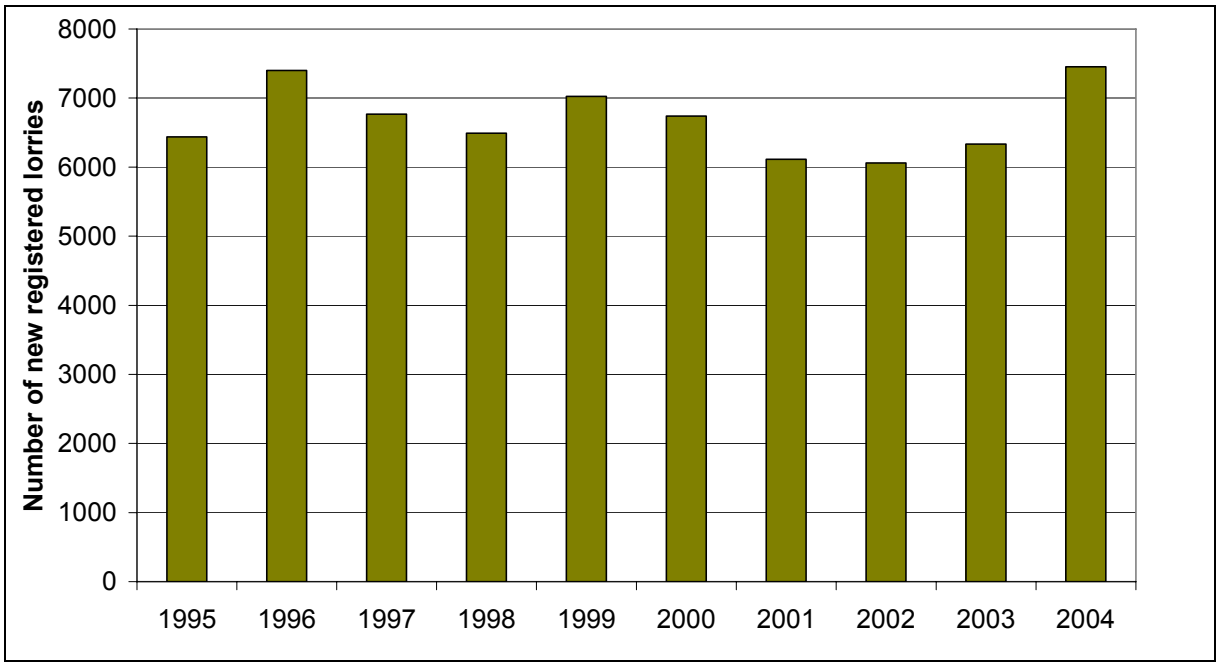
6.4 Analysis of potentials

Transport

Vehicle stock development

The main focus for calculating the environmental impacts of CNG vehicles in 2015 are CNG light duty vehicles (LDV) because the TELLUS measure focused mainly on CNG lorries up to 3.5 t. So a forecast for the development in CNG lorry stock for Berlin should be made. Starting point will be the current stock of CNG LDVs. The share of CNG-powered lorries in Berlin was about 0.14% in the beginning of 2005, equalling a total number of 119 lorries. In Germany the number of registered CNG lorries increased in the last years. Within 5 years the CNG lorry stock tripled.[141] The approach for the forecast of CNG lorry growth up to 2015 is based on the number of new registrations of lorries in Berlin.[142]

Figure 47: Number of new registered lorries in Berlin in the years 1995 to 2004



Based on these figures it is assumed that in the next ten years the number of registration per year will be around 6,500. About 80% of the lorries are light duty vehicles up to 3.5 t.

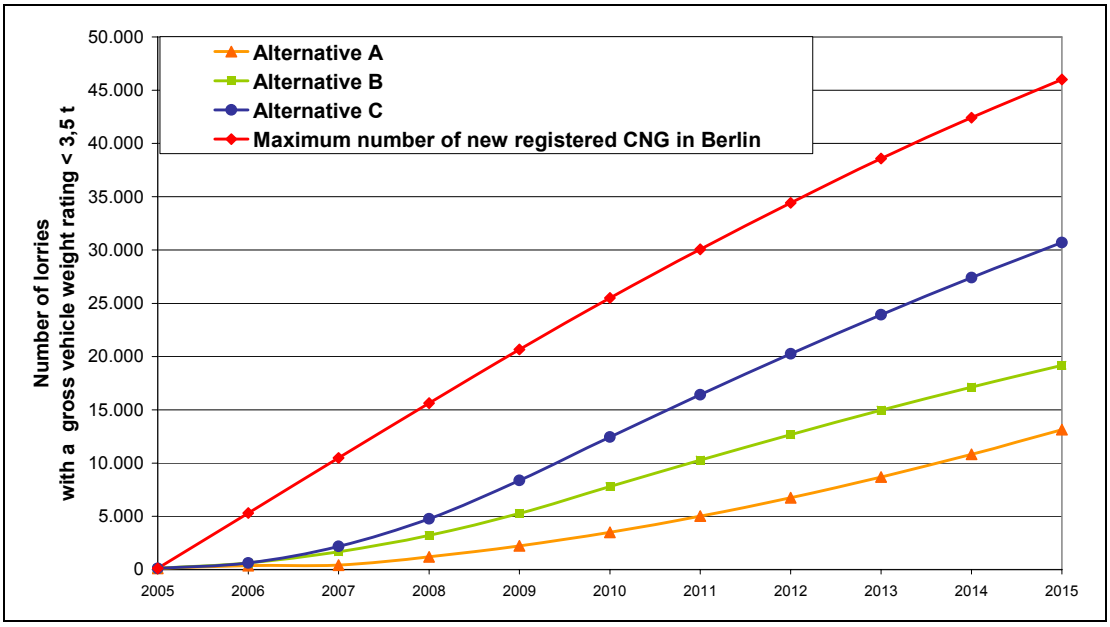
[141] www.erdgasfahrzeuge.de

[142] Senatsverwaltung für Stadtentwicklung: http://www.stadtentwicklung.berlin.de/verkehr/verkehr_in_zahlen/index.shtml

Based on these assumptions, the number of CNG LDV in 2015 could be at a maximum 47,000. For a more realistic forecast the scenario was made for 3 different cases:

- **Alternative A**: Share of new registered CNG LDV in 2006 5%, in 2010 50%. This assumption results in a share of 20% of CNG lorries compared to all registered LDVs in Berlin in 2015.
- **Alternative B**: Share of new registered CNG LDVs in 2006 10%, in 2010 50%. This assumption results in a share of 30% of CNG LDVs compared to all registered LDVs in Berlin in 2015.
- **Alternative C**: Share of new registered CNG LDVs in 2006 10%, in 2010 80%. This assumption results in a share of 45% of CNG LDVs compared to all registered LDVs in Berlin in 2015

Figure 48: Evolution of the market penetration of CNG LDVs up to 2015 for different scenarios



A further assumption is that the main share of lorry mileage in the inner city of Berlin is taken up by vehicles that are registered in Berlin.

The **maximum number of CNG LDVs in 2015** could be around **47,000**. Different alternatives of market penetration of CNG LDV are possible, considered are a share of 20%, 30% and 45% in 2015.

Environment and Energy

As a general rule mainly diesel vehicles will be replaced by CNG vehicles. So the environmental benefits results from a comparison of the emissions of diesel and CNG LDVs. The emission factors for these two kinds of engines are generated as follows:

The emission factors for diesel LDVs are taken from the handbook of emission factors for road transport (HB 2.1[143]).

For CNG lorries the emission factors of

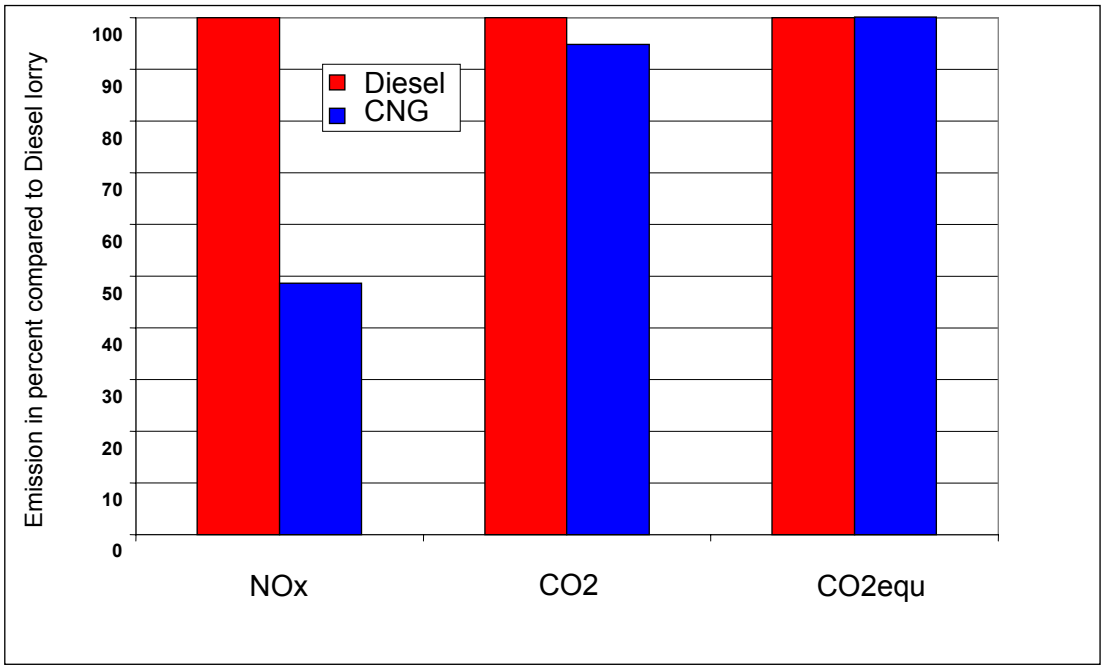
- NO_x and N_2O are set equal to the emission factors of gasoline engines taken from HB 2.1,
- CH_4 are set equal to 95% of total hydrocarbons of gasoline engines from HB 2.1,
- CO_2 are calculated by the fuel consumption reported in the context of TELLUS measure 12.6.

Additionally the embodied emissions are included. They are based on GEMIS 4.3[144] for CNG and on TREMOD 3.1[145] for diesel fuel.

Figure 49 shows, that CNG LDVs have a significant advantage compared to diesel LDVs concerning their NO_x-emissions. It has to be remarked that this advantage is only prevailing if the diesel vehicle does not have an exhaust aftertreatment for NO_x-emissions like SCR technology (selective catalytic reduction). In 2005 no LDVs with this kind of exhaust aftertreatment are regularly on the market. But it has to be kept in mind that in 2015 probably diesel vehicles will be equipped with a NO_x-aftertreatment. Concerning the greenhouse gas emissions the CNG engine does not have a great advantage in comparison to diesel engines. That is due to the embodied emissions which are generated during the transport process of the CNG and the related methane emissions resulting from leakages. For this reason and the negligible advantages of CO_2-emissions only the NOx-emission benefits due to a wide introduction of CNG vehicles will be considered in the following scenarios.

[143] Handbook of emission factors for road transport 2.1, www.hbefa.net
[144] Gemis (Globales Emissions-Modell integrierter Systeme), Version 4.3, http://www.oeko.de/service/gemis/de/index.htm, 2005
[145] Information by Umweltbundesamt/ Institut für Energie- und Umweltforschung: Verkehrs- und Emissionsdaten des Daten- und Rechenmodells TREMOD 3.1., May 2005

Figure 49: Comparison of the NO_x-, CO_2- and greenhouse gas emissions of Diesel and CNG LDVs

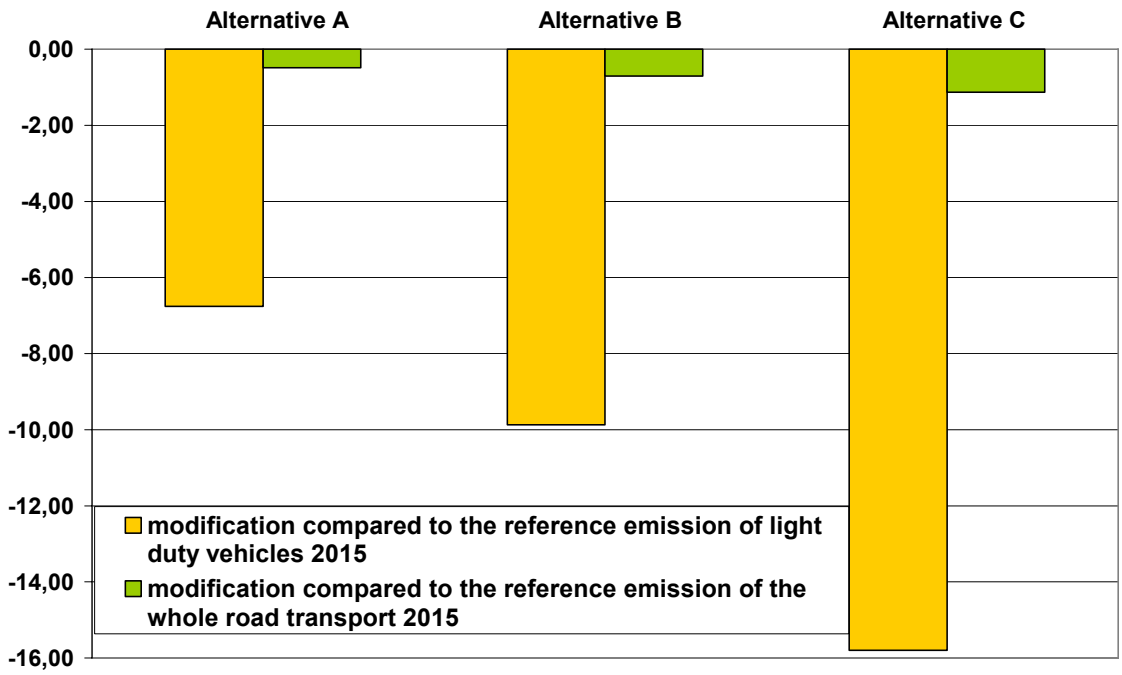


CNG vehicles have a clear advantage in comparison to diesel vehicles (without NO_x-aftertreatment) **concerning the NO_x-emissions**. Regarding **the CO_2- and greenhouse gas** emissions **the advantage is nearly negligible.**

The NO_x-emission calculations base on the mileage foreseen in the StEP scenario 1[146]. Starting from the mileages proposed for LDV and the discussed emission factors the reduced amount by the described three alternatives concerning the market penetration by CNG LDVs compared to the base scenario are pictured in Figure 50. In the alternative scenario A 7%, in the alternative scenario B nearly 10% and in the alternative scenario even 16% of the total NO_x-emissions of the LDVs could be reduced. Compared to the NO_x-emissions of the total road transport in Berlin the NO_x-emissions could be reduced depending on the market penetration by 0.5-1.5%.

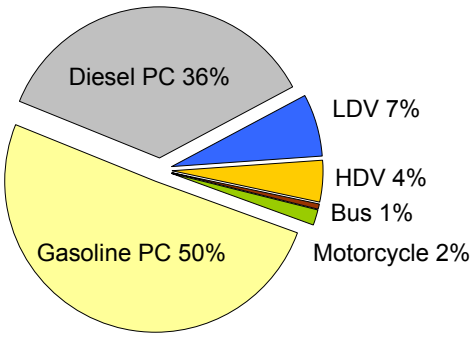
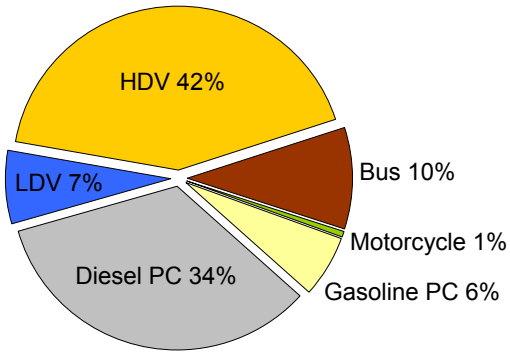
[146] Senatsverwaltung für Stadtentwicklung (ed.) (2003)

Figure 50: Reduction potential of NO_x-emissions in percent by CNG LDV in 2015 in the city of Berlin



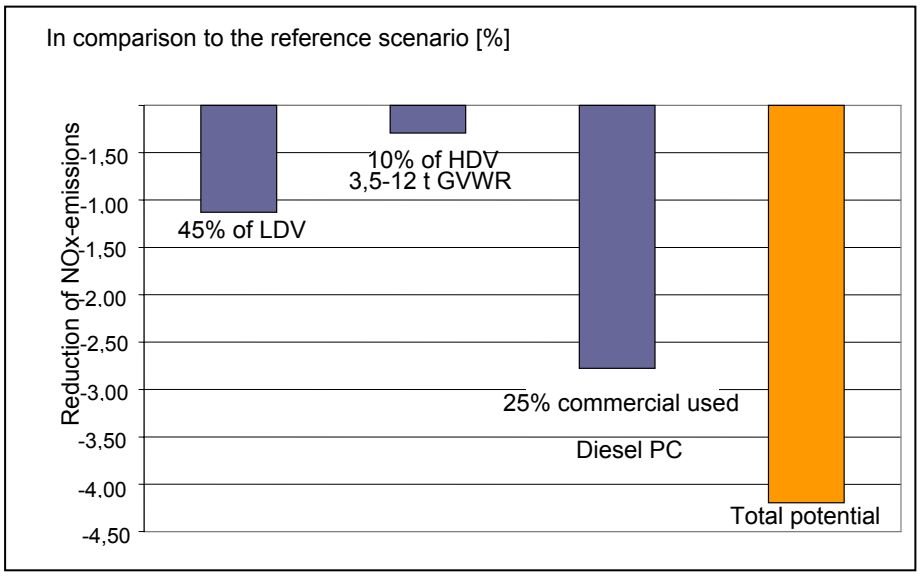
The introduction of LDV with CNG engines has a **positive impact due to reduced NO_x-emissions**; however **compared to the total NO_x-emissions of road transport in the city these are only minor**.

So the overall impact of CNG LDV on the NO_x-emissions of road transport is relatively low. The reason for that is the low proportion of mileage of LDVs in Berlin, pictured in Figure 51. Due to the small share on mileage also the NO_x-proportion is not very high. Figure 52 shows that the main part of the NO_x-emissions produced by road transport is caused by heavy duty vehicles (HDV) and diesel-powered passenger cars (PC). So if the NO_x-emissions should be reduced effectively not only LDVs have to be equipped with CNG engines but also mainly HDVs and diesel passenger cars.

Figure 51: Share of mileage for the different vehicles in road transport in the city of Berlin in 2015 – STEP scenario 1	**Figure 52: Share of NO_x-emissions for the different vehicles in road transport in the city of Berlin in 2015 – calculations by evaluation team based on the mileage STEP scenario 1**
	

With regard to the commercial car fleets a substitution of 25% of the diesel passenger cars with CNG cars is assumed up to 2015. That seems realisable with the backup of the Berlin State since just the vehicle fleet of the city of Berlin itself has a share of 40% of the 25% considered. More difficult seems to be the substitution in the case of HDVs. At the moment it is not foreseeable that the range of HDV with CNG engines will be considerably enlarged. According to the information achieved, HDV with a gross vehicle weight up to 12 t will be offered in the next year. So the assumption made for 2015 is a share of 10% with CNG engines of the HDV stock. If these market penetrations are realised a much larger share of NO_x-emissions can be reduced as shown in Figure 53. Compared to the base case a share of CNG engines in the LDV sector reduces the NO_x-emissions by 1.2%, a share of 10% in the HDV sector 3.5 – 12 t by 0.25% and a share of 25% of the commercial used diesel passenger cars by 2.7%. So the total potential due to a wider introduction of CNG is some more than 4%.

Figure 53: NO_x-emission reduction potential by CNG for LDV, HDV and commercial cars in 2015



Compared to the basic case a share of 45 % of CNG engines in the LDV sector reduces the NO_x-emissions by 1.2 %, a share of 10 % in the HDV sector 3.5-12 t by 0.25 % and a share of 25 % of the commercial used diesel passenger cars by 2.7 %. So the total potential due to **a wider introduction of CNG** is more than **4 % reduction of the total NO_x-emissions of road transport** in Berlin.

Society

No effect of the broad introduction of CNG vehicles on society can be pictured here.

Economy

The use of CNG as fuel is related to lower operating costs due to the reduced fuel tax up to 2019 so that each individual CNG-vehicle owner can get an economic benefit by using a vehicle with CNG engine. But a broad introduction of CNG-vehicles does not have a direct influence on the overall economy.

6.5 Resume

The analysis of the potentials and possible emission reductions by a wider introduction of CNG vehicles showed that positive impacts concerning the NO_x-emissions are to be expected. Calculations indicate that the environmental effects by a substitution only in the light duty vehicle sector are on a much lower scale than one would expect, which is due to the comparable low mileage of LDVs. If the introduction is extended to commercial personal cars and heavy duty vehicles the scenario calculations show that the NO_x emissions of road transport can be reduced by about 4 %. But it has to be kept in mind that this is only the case if the CNG vehicles are compared with diesel vehicles without a NO_x aftertreatment.

C EVALUATION ON CITY-LEVEL

C.1 General approach

The first part of Chapter C of the TELLUS Final Evaluation Report presents the results obtained in the evaluation of TELLUS Berlin on city level from the start of the project in 2002 until the end of 2005. This evaluation consists of the following parts:

- An assessment of the TELLUS objectives and the related key indicators,
- An analysis of the implementation process of TELLUS Berlin and the recommendations derived from it,
- An assessment of the experiences made in TELLUS Berlin from the point of view of the Senate Department of Urban Development,
- The participatory evaluation and
- The contribution to the METEOR cross-site evaluation.

The second part of the chapter contains a look into the future. It examines ex-ante the potential of the TELLUS measures for the time after the termination of the TELLUS project.

Assessment of TELLUS objectives and key indicators

The TELLUS project set itself transport-related, environmental and social objectives on city level (see Chapter C.2) that were to be achieved by implementing the TELLUS measures in Berlin. For each of the objectives based on the established monitoring instruments of the city one or more indicators had been developed to compare the state before and after the implementation. Moreover the project formulated target quantifications not only for the project life cycle but also for 2010. This should emphasise the process character of the project not ending with its financial promotion but bringing effects for the city beyond this phase.

An analysis of the demonstration measures and their potential impacts done by the evaluation team in the initial phase of the project showed that the quantifications of the TELLUS objectives are very ambitious. The demonstration measures were expected to contribute to the achievement of the objectives but the small scale of the measures and the implementation context clearly showed that solely by the implementation of the TELLUS project the target values of the objectives could not be reached, particularly within four years. Rather most of the impacts were expected to be visible after the end of TELLUS.

Furthermore the development and proof of cause-effect relationships posed a challenge. The measures were an integrated part of a bigger transport strategy and landscape not being the only ones working towards the achievement of the objectives set. So the outcomes and even more the impacts of the measures are difficult to detach from others.

After discussing the consequences of that for the approach of the evaluation with the evaluation team and management on Berlin and TELLUS[147] level the conclusion was to further monitor the key indicators but not to assess the success of TELLUS Berlin against them. It was decided to rather put the focus of attention on the measure level and the analysis of the implementation process. This was also communicated to METEOR and the European Commission.[148]

The developed key indicator monitoring system since in line with the direction of the local transport strategy was interpreted as an instrument to monitor the development of the Berlin transport and related environmental conditions as a whole beyond the TELLUS project. So with help of the monitoring system areas for future action can be identified.

Thus in this report the values of the indicators are presented even though on city level no quantitative assessment of the contribution of the TELLUS measures can be provided.

Implementation analysis

As mentioned above the analysis of the implementation process had an important role in the TELLUS evaluation. The aim was to analyse the drivers that promoted successful implementations, and the barriers that hindered the demonstration measures in reaching their potentials.

On the city level the results of the process evaluation on measure level are summarised and general conclusions regarding implementation processes of innovative transport demonstration measures in Berlin are derived.

Furthermore recommendations are given drawn from this analysis. The recommendations address politicians and planners on EU and local level that are responsible for shaping the transport policy of the future as well as implementers that want to learn and benefit from the experiences made within TELLUS Berlin.

Assessment of TELLUS project by Senate Department of Urban Development

Head and initiator of the TELLUS project in Berlin was the Senate Department of Urban Development. This chapter gives a summary of their view on the implementation process and the results of the TELLUS project in Berlin. The assessment comprises positive and negative aspects as well as final conclusions and recommendations addressing potential improvements when carrying out a project alike in the future.

[147] At PMG Meeting in Bucharest 22/23 April 2004

[148] At the regular evaluation meetings on TELLUS and CIVITAS level as well as at the Mid Term Assessment meeting in Brussels on 16 June 2004

Participatory evaluation

Within the framework of the evaluation of the TELLUS measures in Berlin, the “Centre for Technology and Society” (CTS) of the ”Technical University Berlin” carried out a participatory evaluation. Citizens that were not involved in the TELLUS project were asked to assess the TELLUS measures from their point of view as “every day life mobility experts”.

Contribution to METEOR evaluation

METEOR is responsible for the cross-site evaluation of the CIVITAS projects. The indicators used for this evaluation are called Common Core Indicators and were to be provided by the city. Furthermore METEOR used its model ITEMS to estimate the impacts of the transport measures. For that purpose input data additional to the Common Core Indicators was required describing the urban and transport development of Berlin in the past and the present.

A do-nothing scenario was calculated for Berlin with the ITEMS model as a so-called frozen scenario. Based on that it was calculated what effects an upscaled introduction of CNG vehicles would have had from 2000 to 2005.

C.2 Evaluation for 2002 - 2005

1 TELLUS objectives

TELLUS Berlin formulated transport-, environment/energy- and society-related objectives that were to be reached by the implementation of the demonstration measures. They are stated for two time periods: for 2002 until 2005 and for 2006 until 2010 and are mostly quantified (Table 14). Exceptions build the social objectives which address co-operation and awareness issues in a qualitative way.

In the TELLUS Inception Report, the objective "Reduce NOx emissions from heavy traffic" is not stated for Berlin. Nevertheless, since it proved to be an important issue addressed by the Berlin demonstration measures (particularly the freight transport measures) it has been included.

Table 14: TELLUS quantified objectives 2006 / 2010 for Berlin

TELLUS OBJECTIVES	Quantification for 2006	Quantification for 2010
TRANSPORT		
Increase the modal share in favour of public transport	by about 3 %	by about 5 %
Increase public transport use	by 5 %	by 10 %
Reduce congestion	by 5 %	by 10 %
Reduce road casualties and injured persons	by 10 %	by 20 %
Reduce car kilometres	by 3 %	by 5 %
ENVIRONMENT/ENERGY		
Reduce air pollution and noise to levels below national and EC directives	to be specified	to be specified
Reduce NOx emissions from heavy traffic	by 5 %	by 10 %
Reduce traffic related CO2 emissions and energy use	by 5 %	by 10 %
SOCIETY		
Improve intra-organisational co-operation at the city level	-	-
Achieve extensive political and public awareness for TELLUS	-	-
Improve public-private co-operation	-	-

2 TELLUS Key Indicators

From each of the TELLUS objectives at least one key indicator had been derived (Table 15). For this selection process the evaluation team built on established sources of data on transport and related environmental issues collected and provided by the Senate Department

of Urban Development, the Senate Department of Economy and the Regional Statistics Office. Moreover it made use of data obtained by applying new innovative methods like the floating car data generated by the German Aerospace Center (DLR).

In order to provide a detailed description of the indicators, their sources, methods and timetable of measurement as well as their relation to other indicator systems such as the METEOR Core Indicators, the evaluation team elaborated Indicator Fact Sheets. These fact sheets can be found in ANNEX 2.

The Indicator Fact Sheets have been up-dated on a regular basis and provide an instrument to monitor the development of the Berlin transport and related environmental conditions.

They reflect the changes caused by policies, strategies and measures implemented to improve urban transport as well as the related environmental, energy and society conditions in Berlin. Moreover they can be used to monitor the achievements of the transport policy objectives stated in the Integrated Transport Plan (if complemented by economical and further society-related indictors) and are therefore understood as a foundation for the establishment of a monitoring instrument for urban transport planning.

In Table 2 the baseline values and latest data collected for the TELLUS Key Indicators are shown. If available, for the baseline year data from 2001 was chosen. Where this was not possible the closest available information was taken.[149] The same applied for the reference value. The latest monitoring data could often only be obtained for the year 2004 and partly for 2005. A final assessment of the achievement of the objectives would therefore need a continuation of data collection beyond January 2006.

[149] If data from any other than the base year was used, this is stated and explained accordingly.

Table 15: Monitoring data of key indicators in Berlin

TELLUS objective	TELLUS Key Indicator	Unit	Specification	Base year value *	Latest value
TRANSPORT					
Reduction of road casualties and injured persons	**Fatalities**	**Number of fatalities**		82 (2002)	70 (2004)
	Road accident-related injuries	**Number of injured persons**		17,522 (2002)	16,529 (2004)
Reduce congestion	**Average vehicle speed**	**Km/h**	all vehicles morning peak	31.8 (2002)	32.0 (2004)
			all vehicles evening peak	31.3 (2002)	31.2 (2004)
Reduce car kilometres	**Car kilometres**	**Car-km/a**		11,028 (mio.) (1999)	11,377 (mio.) (2004)
Increase public transport use	**Public transport passenger movement**	**Number of passengers**	including light-rail, subway, bus, tram	1,227 (mio.) (2001)	1,269 (mio.) (2004)
Increase the modal share in favour of public transport	**Average modal split**	**Number of trips**		PT 27% walking 25% bicycle 10% car 29% car (fellow-passengers) 9% (1998)	not yet available
ENVIRONMENT					
Reduce air pollution to levels below national and EC directives	**PM_{10} levels**	**µg/m³**	annual mean (roadside)	35 (2001)	35 (2004)
			24h average (50 µg/m^3)[1]	not kept, exceedings at 4 measurement stations (2001)	not kept, exceedings at 3 measurement stations (2004)
			annual mean (40 µg/m^3)	kept (2001)	kept (2004)
	NO_2 levels		annual mean (roadside)	49 (2001)	46 (2004)
			1h average (200 µg/m^3)[2]	kept (2001)	kept (2004)
			annual mean (40 µgm^3)	not kept, exceedings at 5 measurement stations (2001)	not kept, exceedings at 6 measurement stations (2004)
	Benzene		annual mean	3.1 (2001)	2.3 (2004)
			annual mean (5 µg/m^3)	not kept, 1 exceeding (2001)	kept (2004)
	CO	**mg/m³**	annual mean	0.5 (2001)	0.5 (2004)
			max daily 8 h concentration (10 mg/m^3)	kept (2001)	kept (2004)
Reduce traffic related CO_2 emissions	**CO_2 emissions**	**t/a**	Primary energy related	4,955,000 (2001)	4,811,000 (2002)
			Final energy related	5,753,000 (2001)	5,737,000 (2002)
Reduce NO_x emissions from heavy traffic	**NO_x emissions** (transport related)	**t/a**		10,455 (2002)	8,876 (2005)
Reduce noise to levels below national and EC directives	**Noise level dB(A) road length**	**Equivalent noise level L_{aeq} in dB(A)**	days	937 km road length with 165,500 people exposed to > 65dB(A) (1998)	913 km road length with 218,081 people exposed to > 65dB(A) (2004)
			nights	1227 km road length with 206,852 people exposed to > 55dB(A) (1998)	1,218 km road length with 281,383 people exposed to > 55dB(A) (2004)
ENERGY					
Reduce energy use	**Final energy use by traffic**	**Terajoule/a**	including air traffic	71,222 (2001)	69,351 (2002)
			urban traffic	59,741 (2001)	58,300 (2002)

* Due to data availability problems concerning the base year 2001 some values are presented for other years.

[1] 35 exceedings allowed [2] 18 exceedings allowed

3 Indicator development

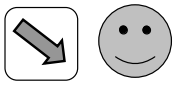
3.1 Introduction

In the following the development of the key indicators during the life cycle of the TELLUS implementation will be described and evaluated. This is carried out against three variables: The direction of the indicator development, the quality of this development (i.e. if the development was positive, negative or neutral) and the achievement of the related TELLUS objective.

Direction of the indicator development	**Quality of the indicator development**
increase, decrease, stagnation	positive, negative, neutral
	

Furthermore for each indicator it will be stated if the TELLUS demonstration measures contributed to the development of the indicator.

3.2 Transport-related indicators

Fatalities and road accident-related injuries 

Method: Data is collected continuously by the Regional Statistics Office and published in annual reports.

Indicator development:

i) Number of fatalities (in 2002/ in 2004): 82 / 70;

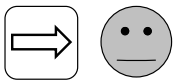
ii) Number of injuries (in 2002/ in 2004): 17,522 /16,529.

Assessment: There are remarkable reductions within the reporting period: the number of fatalities decreased by 15 % and the number of injuries by 6 %.

Nevertheless in 2005 a special programme “Berlin safe and mobile” was initiated. This transport safety programme aims at reducing the number of fatalities and seriously injured persons. Since cyclist and pedestrians suffer in particular from accidents (63% of all fatalities in 2004) the programme focuses on increasing transport safety for non-motorised users and especially for children and elderly.

Reference to TELLUS: TELLUS objective: “Reduce road casualties and injured persons by 10% until 2006”. For fatalities this was already achieved in 2004, but the decrease of injuries did not reach the target value. Preliminary figures for 2005 confirm this trend. None of the TELLUS measures contributed to the increase of safety.

Average speed



Method: Floating car data – measurements by German Aerospace Center (DLR) (Institut für Verkehrsforschung).

Indicator development:

i) Average speed – weekday – morning peak (in 2002/ in2004): 31.8 km/h / 32.0 km/h;

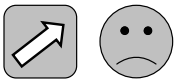
ii) Average speed – weekday – evening peak (in 2002/ in2004): 31.3 km/h / 31.2 km/h.

Assessment: The average speed in Berlin is quite high and there is no significant year-to-year trend for morning peak and evening peak. Both daily and weekly course have remained almost unchanged over the monitoring period. Regional differences can be observed regarding the time and duration of the peak hour periods in the Western and Eastern part of Berlin.

Congestion in Berlin is a temporary and regional problem only that occurs for example by closing of roads for official visits, demonstrations and other events (15,000 events on urban roads per year; up to 5 official visits per day, 2,000 traffic lights).

Reference to TELLUS: TELLUS objective: “Reduce congestion by 5% until 2006”. The objective could not be achieved. None of the TELLUS measures contributed to the achievement of the congestion objective.

Car kilometres



Method: Calculations were carried out by Senate Department of Urban Development, on the basis of the household survey (1998).

Indicator development:

Average car kilometres per working day (in 1998 / in 2004): 32,960,796 / 34,003,740 car-km. The annual mileage sums up to 11,028 million car-km (1999) and 11,377 million car-km (2004).

Assessment: The car kilometres increased by about 3%. According to the ‘Air Quality and Action Plan 2005 – 2010’ the main reasons are increased motorisation and growth of travel distances.

Reference to TELLUS: TELLUS objective: “Reduce car kilometres by 3% until 2006”. The objective will not be achieved, the trend moves into the opposite direction. Evidence does not

show a significant contribution to the achievement of the objective by the TELLUS measures for the life cycle of the project.

Passengers, passenger kilometres

Method: Statistics were provided by the public transport company BVG and compiled data was provided by the Senate Department of Urban Development.

Indicator development:

i) Public transport passengers (in 2001/ in 2004): 1,227 million / 1,269 million;

ii) Public transport passenger-kilometres per year (in 2001/in 2004): 6,874 million / 7,086 million.

Assessment: There is a slight increase in the number of passengers as well as in passenger kilometres (3%) over the reporting period. According to the 'Air Quality and Action Plan 2005 – 2010' the reasons for the slow development are manifold: increased motorisation, economic development and increased number of inhabitants without jobs, decline of student numbers, increase in public transport tariffs as well as changes in transport demand.

Reference to TELLUS: The TELLUS objective: "Increase public transport use by 5% until 2006" was not reached in 2004. Evidence does not show a significant contribution to the achievement of the objective by the TELLUS measures for the life cycle of the project.

Average modal split

Method: Household survey carried out in 1998 by the Senate Department of Urban Development.

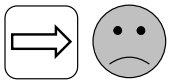
Indicator development:

Mode	**1998 (in %)**	**2004**	***2015 (in %, estimation)***
Walking	25	No data	*23*
Bicycle	10	No data	*13*
Car and fellow-passengers	38	No data	*32*
Public transport	27	No data	*30*

Assessment: There is a weakness in monitoring due to lack of data for the last years. Modal-split figures are based on the household survey carried out in 1998. Scenarios in the Integrated Transport Plan were calculated for 2015 and estimate modal-split figures on the basis of the household survey from 1998. It is intended to carry out a new household survey but due to high survey costs the time is not yet fixed (see Mobilität der Stadt (2005)).

Reference to TELLUS: TELLUS objective: "Increase the modal share in favour of public transport by about 3% until 2006". Due to the lack of data the achievement of the objective can not be assessed. Evidence does not show a significant contribution to the achievement of the objective by the TELLUS measures for the life cycle of the project.

3.3 Environment-related indicators



Level of PM_{10}

Method: Measured data (BLUME air quality measurement net) taken from yearly air quality reports compiled by the Senate Department of Urban Development. An air pollution model is used to calculate concentrations of air pollutants on all main roads (model: IMMIS-Luft).

Indicator development:

i) Annual limit value to be kept: 40 µg/m^3;

Roadside measurement points (in 2001/ in 2004): 35 µg/m^3 / 35 µg/m^3;

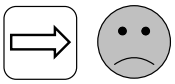
ii) 24-hours limit value to be kept: 50 µg/m^3 with 35 exceedances allowed.

Roadside measurement points (in 2001 / in 2004): more than 35 exceedances at 4 measurement stations / more than 35 exceedances at 3 measurement stations.

Assessment: The average annual PM10 value stagnated over the last years on a level below the limit value. However the 24-hour values of PM10 constitute a serious problem in Berlin. In 2004 more than 35 exceedances were noticed at all main road stations. Road transport and regional background load are the main sources. To tackle the problem of imported and locally caused emissions, actions on city, national and European level are required.

Reference to TELLUS: TELLUS objective: "Reduce air pollution below national and EC directives". The objective could only be partly achieved. Within the TELLUS project demonstration measure 12.6 "Introduction of CNG vehicles" contributed to the reduction of PM_{10} (for details see Chapter B.11)

Level of NO_2



Method: Measured data (BLUME air quality measurement net) taken from annual air quality reports compiled by the Senate Department of Urban Development. An air pollution model is used to calculate concentrations of air pollutants on all main roads (model: IMMIS-Luft).

Indicator development:

i) Annual limit value to be kept: 40 µg/ m^3:

Roadside measurement points (in 2001 / in 2004): 49 µg/ m^3/ 46 µg/ m^3;

ii) 1-hours limit value to be kept: 200 µg/ $m^3$with 18 exceedances allowed:

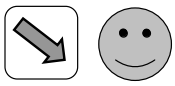
Exceedances (in 2001/ in 2004): 3 exceedances at 2 measurement stations only / 2 exceedances only.

Assessment: The NO_2 immission load has stagnated over the last years. The average values at measuring stations (main roads) still exceed the annual limit value of 40 µg/ m^3 whereas the one-hour limit value is kept. The technological improvements (catalysts, replacement of old cars and alternative fuels) are overcompensated by (i) an increase of contingent and mileage of diesel vehicles (private and commercial); (ii) a change in emission trait of diesel vehicles in the last few years; and (iii) an increase of directly discharged NO_2 even though NO_X decreased at the same time.

NO_2 immissions constitute a serious problem in Berlin. Traffic, especially the diesel vehicle fleet, is the most important source of the immission load (80%). According to the 'Air Quality and Action plan 2005 – 2010' the improvements are slow. It is estimated that the number of inhabitants exposed to NO_2 will be reduced from 90,000 (in 2002) to 70,000 (in 2005). Considerable improvements can be reached by additional efforts only.

Reference to TELLUS: TELLUS objective: "Reduce air pollution below national and EC directives". The objective could not be achieved. However, demonstration measure 12.6 "Introduction of CNG vehicles" contributed to the reduction of NO_2.

Level of benzene



Method: Measured data (BLUME air quality measurement net) taken from annual air quality reports compiled by the Senate Department of Urban Development.

Indicator development:

Annual limit value to be kept: 5µg/ m^3

i) in 2001 the maximum value was 5,4 µg/ m^3 and limit value was exceeded at one station;

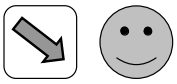
ii) in 2004: the maximum was 3,4 µg/ m^3 and no exceedances occurred.

Assessment: The immission load of benzene has decreased due to technology improvements (catalysts, combustion technology). There were no exceedances in 2002,

2003 and 2004, and measures established in the transport sector are sufficient to keep limit values.

Reference to TELLUS: TELLUS objective: “Reduce air pollution below national and EC directives”. The level of benzene in Berlin is below the level stated by the directives since the first year of the project (2002).

Level of CO



Method: Measured data (BLUME air quality measurement net) taken from annual air quality reports compiled by the Senate Department of Urban Development.

Indicator development:

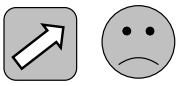
8-hour limit value to be kept: 10µg/ m^3;

In 2001 the maximum value measured was 6 µg/ m^3 and in 2004 it was 5 µg/ m^3.

Assessment: The EU limit value of 10 mg/m^3 to be met in 2005 has not been exceeded at any measurement station in the city since 2002. The low level has been achieved by improved engine technologies and the replacement of coal-based heating with gas heating. Air quality standards of this pollutant are met.

Reference to TELLUS: TELLUS objective: “Reduce air pollution below national and EC directives”. The level of CO in Berlin is below the level stated by the directives since the first year of the project (2002).

CO_2 emissions



Method: Calculations by the Senate Department of Economy compiled in annual energy balance reports.

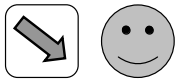
Indicator development:

	2001	**2002**
CO_2 emissions (Primary energy related in tons)	4,955,000	4,811,000
CO_2 emissions (End energy related in tons)	5,753,000	5,737,000

Assessment: There is a weakness in monitoring due to lack of data for the last two years. Calculations for 2003 and later will be published by the Regional Statistics Office at the end of 2005. However, the traffic related CO_2 emissions have shown a slight increase since 1995. The emission level amounts to about 5,700,000 tons per year. Moreover, the CO_2 emissions originate mainly from households - traffic contributes with about 23 per cent.

Reference to TELLUS: TELLUS objective: “Reduce traffic related CO_2 emissions by 5% until 2006”. Due to the lack of data the achievement of the objective cannot be assessed. Evidence does not show a significant contribution to the achievement of the objective by the TELLUS measures for the life cycle of the project.

NO_X emissions



Method: Model calculation carried out by the Senate Department of Urban Development based on the emission module of the model “IMMIS-Luft”. The calculation combines traffic-specific (e.g. number of vehicles, driving mode) and vehicle-specific emission-factors.

Indicator development:

	2000	**2002**	***2005 (estimated)***
NOx in tons	12,400	10,455	*8,876*

Assessment: From 1994 to 2005 the road traffic-related NO_X emissions have decreased by 50%, however for the period 2002 to 2005 the decrease is less pronounced (15%). The main reason for the improvement is the modernisation of the whole vehicle fleet. In addition it should be considered that other traffic sources such as diesel driven light trains also contribute to the traffic-related NO_X emissions (factor: 1.1). Nevertheless, road traffic is the main source of NO_X emissions in 2005 in Berlin; its share amounts to 45% of the total NO_X emissions.

High road traffic-related emission values are reached along the urban highway system and the inner city area.

Reference to TELLUS: TELLUS objective: “Reduce NO_x emissions by 5% until 2006”. According to estimations the objective will be achieved in 2005. Within the TELLUS project demonstration measure 12.6 “Introduction of CNG vehicles” contributed to the reduction of NO_x (for details see Chapter B.11)

Noise level

Method: Model calculation carried out by the Senate Department of Urban Development based on the emission module of the model "IMMIS-Luft". The calculation combines traffic-specific (e.g. number of vehicles, driving mode) and vehicle-specific emission-factors.

Indicator development:

year		Day (>65 dB)	Night (>55 dB)
1998	Inhabitants exposed	165,000	206,854
	Road length exposed	937 km	1,227 km
2004	Inhabitants exposed	218,000	281,383
	Road length exposed	913 km	1,218 km

Assessment: Although there is a slight reduction in road length exposed to 65/55 dB and higher noise levels, the share of inhabitants living at main roads exposed to those noise levels is with about 2/3 still high. Hence a great need for action to abate noise remains.

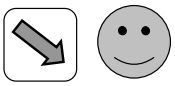
Speed limits of 30 km/h do exist already for about 70% of the urban road network in residential areas. In addition speed limits will be introduced on 16 main road sections in November 2005, covering a total length of 5.4 km. In 2006 additional sections will be considered.

As a first step to translate the EC directive noise-level reduction plans are currently being prepared in four pilot projects on local level commissioned by the Senate Department of Urban Development.[150]

Reference to TELLUS: TELLUS objective: "Reduce noise to levels below national and EC directives until 2006". The objective will not be achieved. Evidence does not show a significant contribution to the abatement of noise by the TELLUS measures for the life cycle of the project.

[150] Senatsverwaltung für Stadtentwicklung (2005): Digitaler Umweltatlas, Themenbereich Verkehr/ Lärm, Ausgabe 2005

3.4 Energy-related indicators



Energy use

Method: Statistics compiled by the Senate Department of Economy and published in annual energy balance reports.

Indicator development:

	2001 (in Terajoule)	**2002 (in Terajoule)**
Final Energy use including air traffic	71,222	69,351
Final energy use urban traffic only	59,741	58,300

Assessment: There is a weakness in monitoring due to lack of data for the last three years. Calculations for 2003 and later will be published by the Regional Statistics Office at the end of 2005. Nevertheless the trends for the final energy use for the period up to 2003 show the following picture:

Source of Energy	**Petrol**	**Diesel**	**Electricity**	**Gas**
Trend	Decrease	Stagnation	Slight increase	No data

The up-take of cleaner and alternative fuels is still difficult to assess. Nevertheless, there is a decrease in traffic related energy use and a trend towards the use of cleaner fuels. Already since 2000 only unleaded fuel is used. Electricity plays an important role for mass transport such as tram, underground and light rail. The consumption of compressed natural gas has been increasing during the monitoring period due to increased number of CNG taxis, commercial vehicles, buses and communal vehicles but is still only on a low level.

Reference to TELLUS: TELLUS objective: “Reduce traffic related energy by 5% by 2006”. Due to the lack of data the achievement of the objective can not be assessed. Evidence does not show a significant contribution to the achievement of the objective by the TELLUS measures for the life cycle of the project.

3.5 Society-related indicators

Public and political awareness

Acceptance of transport and environment policies correlates positively with availability of information and awareness of environmental problems. Public awareness and knowledge of environmental problems are therefore central to the development of appropriate transport policies.[151]

Political and public awareness for TELLUS had two dimensions: awareness for the several demonstration measures of the TELLUS Project and awareness for the TELLUS objectives on the city level, which should have been reached by the implementation of the demonstration measures:

- Awareness for demonstration measures: The rationale behind this was that the better people were informed about the new measures the more likely they were to take advantage of the measures and the better the measure performance would be.
- Awareness for TELLUS objectives: Beside awareness for the demonstration measures TELLUS was also supposed to raise awareness for the necessity of a more environmentally friendly and a more efficient transportation system.

In turn it was also believed that if politicians were more aware of such topics, the chances for implementation of a sustainable transportation policy and planning would be.

Because of budget limitations and the amount of time and effort that would have been necessary for such an undertaking, a citizen survey regarding the awareness level of TELLUS could not be carried out. Thus, the assessment of this TELLUS objective was done based on an analysis of the media exposure and the dissemination activities of the demonstration measures. This was carried out mainly based on the information provided by the demonstrators themselves, which is compiled in various TELLUS reporting documents, such as the Progress and Management Reports.

One difficulty associated with this method of analysis is that neither the absolute number of persons reached nor their perception of the articles can really be analysed. Instead, intended target groups and persons as well as the scope of the respective media have been used to generate information about the effectiveness of the TELLUS media activities. As can be seen in Figure 54 the overwhelming share of the media reporting was carried out in newspapers with predominantly regional focus. A number of strictly local newspapers as well as some national reporting could also be attained. Regarding radio and TV reporting, also the regional, generally Berlin based stations, broadcasted news on TELLUS. Scientific

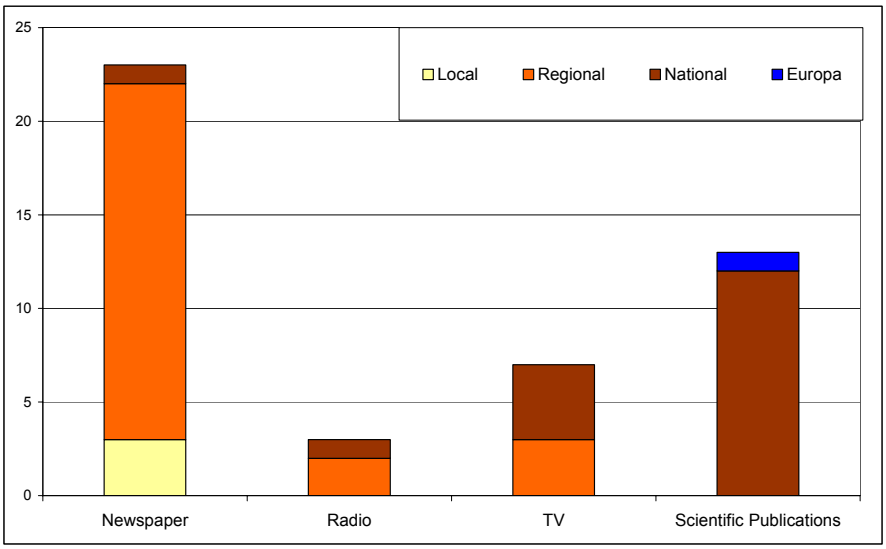
[151] EEA (2000), p. 123.

publications, however, contributed to the spreading of information on national and European level.

The analysis was carried out according to the following criteria.

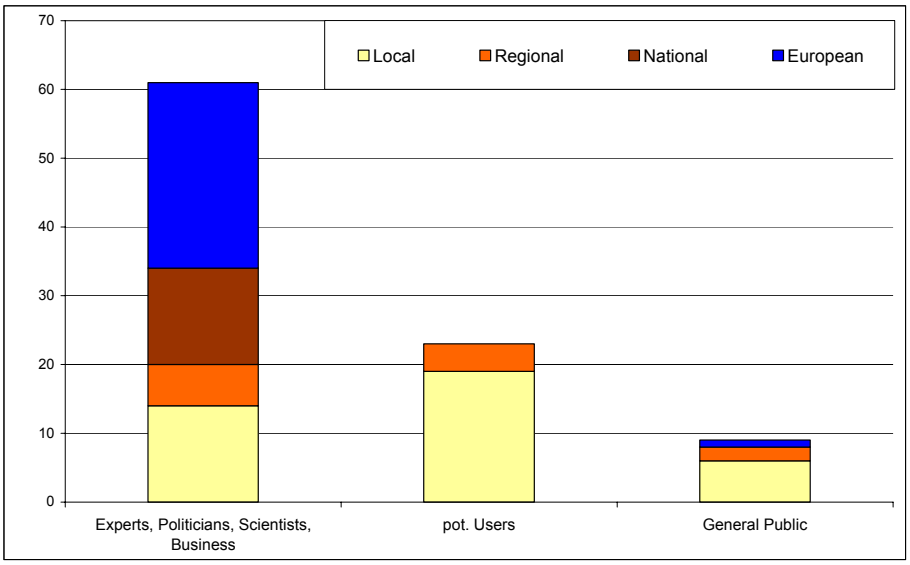
- for media exposure: target groups, spatial coverage
- for events organised: main focus (local, national, international), target groups (internal or public meeting)

Figure 54: TELLUS media reporting and spatial coverage



Other dissemination that was carried out addressed specific target groups. Depending on the character of the event, different target groups were invited. The graph in Figure 55 must not be misunderstood in that it does not provide any information on the actual amount of people reached. For example, the events that targeted the general public were often quite big, also because in some cases the TELLUS presentations were embedded in a broader context. For example, the demonstrator of 7.5 participated in the Long Night of the Sciences, which is a very popular event that attracts not only Berliners but also a great number of tourists, resulting into several thousands of visitors in total. For the TELLUS-related presentation in the course of this event it is stated that more than 100 people were reached and informed about TELLUS at once, which emphasises the need to exercise caution when judging the impact of the events considered in the graph below merely by the their number.

Figure 55: TELLUS public events and target groups



From the figure above it appears obvious that activities directed at experts, potential partners, politicians and scientist made up the largest share of the events. Also, they took place on all levels – from local to European. Additionally it has to be taken into account that the people thus reached often act as multipliers, so that it appears to be reasonable to conclude that the respective activity was thus communicated to a larger number of people. Potential users were also intensively addressed. This was mainly done as part of the demonstration measures, so that the focus was naturally on the local level. A lot of these activities also attracted the attention of journalists, which reflects in the number of articles that relate directly to such a specific TELLUS event. Additionally, a number of press conferences were held and press releases were published, so as to spread the news on the latest TELLUS developments. Because of its special character, the TELLUS youth competition is not included in the figure above. The competition generated a lot of attention with the participating young, their schools and families as well as politicians and the media.

Referring back to the original intention of the media analysis it can be concluded that the TELLUS all members of the TELLUS consortium strove to make the project, its contents, rationale and results known to the public. However, in how far the attention thus achieved translates into public awareness and eventually into public and individual behaviour can not be assessed here.

Political awareness was assessed by means or collecting information on the number of and types of occasions that politicians on various levels were involved in the project and / or participated otherwise in TELLUS related activities. Again, from the information thus collected no final conclusions on the perception of the project on the side of the political level can be drawn. However, what becomes obvious is that it was attempted to address the political sphere in a number of activities. Thereby, four types of political related activities can be distinguished:

- Press conferences with the participation of Ms. Junge-Reyer, Senator for Urban Development and/or Ms. Krautzberger, State Secretary for Urban Development: Some of these press conferences were carried out in relation with public events, like for example the opening of a CNG filling station or the delivery of the 1,000th CNG-driven vehicle in Berlin (which also was the 50th TELLUS funded CNG vehicle). Moreover, other TELLUS measures, like MFC or Mobile Parking, were also promoted through press conferences attended by politicians.
- 'Tell us about TELLUS' youth contest: Some of the young people included interviews with politicians in their contributions to the contest Moreover, for the awarding ceremony and the exhibition of the contributions in the Berlin House of Representatives, the Senator and the State Secretary were present. Part of the event was moderated by Mr. Momper, who is the President of the Parliament and the highest-ranking politician in the federal state of Berlin. Furthermore, the exhibition was located at a highly visible spot of the House of Representatives, where it was also visited by other members of the Parliament.
- Parliamentary requests for information in the House of Representatives: In the course of the last two years, four requests for information were issued during parliamentary meetings at the House of Representatives. These requests often referred to the activities within TELLUS, financial issues as well as the record of success of the project. By and large, these requests made by the opposition party were often critically formulated and directly and indirectly questioned the project. However, it appears that the information provided as a reaction to these requests was sufficient.
- Involvement of district representatives: In various measures, administration and politicians on district level where involved in TELLUS activities, for example when it came to the designation of areas for the application of the Mobile Parking technology, the activities carried out within the conceptual approaches relating to Future Management of Urban Public Transport, etc.

From these four categories it can be concluded that TELLUS as a project, but with its far-reaching objectives also as part of a wider and more strategic transport related context, was acknowledged by politicians on various levels. Thereby, it raised awareness for the problems and solution approaches that constituted the projects main focus.

Public Private Co-operation

New transportation concepts like new forms of vehicle use, new ideas for the distribution of goods in the Project-context or initiatives on clean fleets require public-private co-operation. Public-private co-operation refers to any kind of co-operation between the administration and the project demonstrators.

From the beginning of the project it was clear that good public-private co-operation is a pre-requisite for a successful implementation of many TELLUS demonstration measures. This referred for example to the risks that could affect an effective implementation of the TELLUS demonstration measures, such as legal restrictions and obtaining of the permits necessary for the implementation.

Out of the 10 TELLUS demonstration measures in Berlin, three were engaged in a public-private co-operation. In addition to that, two measures could be described as public-public co-operation. In the case of the former, in order to assess the quality of public-private co-operation, face to face Interviews with identified key persons were carried out. Topics of the interviews were the kinds of co-operation, improvements of the co-operation, instruments of the co-operation, problems, estimation of the maintenance of the co-operation etc.. In the case of the latter, the quality of co-operation was one of the topics that were approached in the process interviews.

No coherent picture regarding the quality of public-private co-operation in TELLUS can be drawn. The co-operational partners differed according to the specific requirements of the respective demonstrator. The different entities that were joined together in public-private initiative will therefore be looked at separately.

In general, co-operation with the Senate Department was described as good. The political support that was granted by the administration – together with the status of the measures, being part of an EU-project – helped in some cases to overcome difficult situations. Furthermore, the Senate Department was judged very open minded when it came to the provision of data and information as well as with regard to the establishment of new contacts. Nevertheless, this view was not shared by all demonstrators. In a case, where not political support and mediation / co-ordination activities but active involvement was requested, it was perceived that no appropriate reaction followed.

Co-operation between the demonstrator and Berlin's public transport company, BVG, was overall described as difficult. Main reasons appeared to be the hierarchical structure of the company, which led to a situation where decisions made on one level were not acted upon on a different level. Also, possible competition between the BVG and a TELLUS demonstrator was seen as a potential threat, which made collaboration difficult. Again, this picture was not a uniform one. Co-operation in the Management Business Game, for example, was characterised as open-minded and fruitful.

Co-operation with public entities from the neighbouring federal state of Brandenburg was rated unsuccessful, which, however, might have been due to a number of factors, including the fact that the concerned demonstration measure had encountered legal uncertainties, which apparently affected the attitude towards involvement in the measure.

From the information provided by the demonstrators, the conclusion can be drawn that the determining factor deciding on success or failure of the co-operation was the (political) will to work together with the demonstrator. Personal commitment might have played an additional role. Also, it appeared that big meetings involving a great number of persons were usually less productive then direct contact between the persons involved.

In order to complete the picture, the side of the public entities and their view on the co-operation process and the factors that influenced it must also be considered. However, since only anecdotic information on the view of the public authorities, etc. exists; it is not possible to assess the role that the demonstrator himself played in the process of working together.

Intra-organisational Co-operation

The TELLUS objective "improvement of intra-organisational co-operation at the city level" refers to the quality of co-operation between the different departments of the Senate Department. TELLUS aimed at contributing to an improved communication and co-operation within the local administration of which not only the TELLUS Project was expected to benefit from but also future projects in the field of sustainable transport in Berlin.

To gain information on the quality and improvement of the intra-organisational co-operation in the course of TELLUS Berlin, surveys were carried out by the evaluation team in June 2003 and September 2005. Every survey consisted of two steps. First, with help of a telephone survey the structure of co-operation inside the administration was analysed. In a snowball system employees of the Senate Department were asked to state with whom they work together in the frame of TELLUS. In this way, a picture of the co-operation network could be developed and the departments involved could be identified.

Second, key persons of each department engaged in TELLUS related issues were asked to answer questions on the quality, quantity, durability and instruments of their co-operation with other members of the Senate Department.

In 2003 the questionnaire was sent to 8 persons and returned by 7. In 2005 the questionnaire was sent to 7 persons and returned by 4.

In the survey 2003 in 9 cases persons named each other as co-operation partners, in 8 cases only one of both stated that there was a co-operation with the other person. In 2005 this proportion was 10 to 3 what can be interpreted as an improvement in the quality of co-operation even the quantity of co-operations was less.

Altogether the appraisal of the co-operation improved from 2.7 in 2003 to 2.0 in 2005[152]. In particular the information flow was perceived to be improving.

In three cases it was stated that new co-operations could be developed. The other persons perceived the co-operation not to be different to before.

Improved co-operations could be identified particularly between the environmental and the integrated transport department. These are expected to last after the termination of the project.

The survey showed that there was a strong fluctuation of employees taking place during the time frame of TELLUS. Half of the employees identified in 2003 were not working in the TELLUS context anymore in 2005. Reasons for that were that their department was not involved in the project anymore or the employees left their unit. Seven new persons were identified in the TELLUS context 2005. According to a statement in the survey 2005 this fluctuation was perceived as a barrier for co-operation. Another statement emphasised the importance of personal continuity for the durability of the established co-operation in the future. Moreover the limited human resources in the departments combined with a lot of additional effort caused by the project were seen as a problem.

The work within TELLUS was mostly concentrated within one department and the answers of the survey show that only few persons were strongly involved in the TELLUS project. Related to specific tasks or problems other departments were called in. The survey moreover showed that those co-operations stopped when the issue was not current anymore.

The respondents named two kinds of meetings that were established to ensure the information flow within the project work:

- Problem-related meetings addressing mostly one demonstration measure.
- Horizontal steering and information meetings addressing the management level.

The TELLUS steering meetings, which took altogether place 17 times and involved also TELLUS members from outside the administration, were seen to be the most valuable institution for co-operation.

Nevertheless according to some respondents there is still potential for improvements, particularly regarding the information flow between the different hierarchical levels.

[152] Scale from 1 very good to 6 very bad

4 Implementation Analysis

The measures implemented in the context of TELLUS Berlin were mostly innovative pilot projects. This means that a concept for a new service or technology was implemented into "real life". The assumptions made by TELLUS Berlin before the start of the project regarding the successful implementation process encountered users, authorities, legal restrictions and competitors. Often difficult implementation processes led to delays and had the effect that impacts of the measures did not become visible and measurable during the project time.

The aim of the process evaluation is to analyse the drivers that promoted successful implementations, and the barriers that hindered the demonstration measures in reaching their potentials. Furthermore, recommendations are drawn from this analysis. The recommendations address politicians and planners on EU and local level that are responsible for shaping the transport policy of the future as well as implementers that want to learn and benefit from the experiences made within TELLUS Berlin.

4.1 Drivers and Barriers

A detailed analysis of the drivers and barriers for the implementation of TELLUS Berlin was carried out on measure level (see Chapters 5 in B2 – B11). In the chapter at hand the results are presented in a summarised way. In order to do so, the promoting and hindering factors were clustered in seven categories: institutional, legal, financial, structural, communication, user orientation/acceptance, and commitment related drivers/barriers. If none of these categories applied for a certain driver/barrier it was assigned to the category "others".

Table 16: Barriers for the implementation of TELLUS Berlin

Barrier / Demonstration measure	Institutional	Legal	Financial	Structural	Communication	User orientation / acceptance	Commitment	Others
6.4 Mobile/Tele Parking	■	■	■		■	■		■
8.4 Metropolitan Fleet Car	■		■	■		■	■	
8.5 Car Modal	■	■	■		■	■		
9.3 Inner City Logistics Centre			■	■				■
9.4 New Forms of Financing-Contracts	■			■				
11.6 Dynamic Real-Time Passenger Information								
12.6 Introduction of CNG-powered Vehicles				■		■		

Only the demonstration measures that were concerned with "real" implementations were considered, i.e. the conceptual measures were not included in the analysis. In the following

for each of the cluster categories the drivers and barriers that were the most significant ones are described.

Table 17: Drivers for the implementation of TELLUS Berlin

Driver / Demonstration measure	Institutional	Legal	Financial	Structural	Communication	User orientation / acceptance	Commitment	Other
6.4 Mobile/Tele Parking	■	■			■	■	■	
8.4 Metropolitan Fleet Car	■		■			■		
8.5 Car Modal	■				■	■	■	
9.3 Inner City Logistics Centre							■	
9.4 New Forms of Financing-Contracts	■	■	■	■		■		■
11.6 Dynamic Real-Time Passenger Information	■		■		■	■		■
12.6 Introduction of CNG-powered Vehicles	■	■				■		■

The Tables 16 and 17 provide an overview of the drivers and barriers of the individual measures. Looking at them it becomes clear that an easy answer to the question which categories were the most important ones on city level cannot be found. For that the demonstration measures are too heterogeneous.

Nevertheless what becomes obvious is that the measures revealed a wide range of barriers that are being faced when innovative measures are implemented to create a more sustainable urban transport in Berlin. Moreover, an important result are the experiences that have been made on how to overcome these barriers and make implementations a success.

Institutional

It showed that a factor of success was to build on existing systems and rather integrate the measures into those than creating new stand alone solutions.

Although CharterCab (demonstration measure 8.5) was meant to be a feeder for the local public transport system it was not an integrated part of it. This led to negative consequences regarding user friendliness, acceptance and cost efficiency. When the demonstrator saw that integration into the local public transport system was the only way to come to a permanent implementation the public transport provider was reluctant to integrate the innovative service.

As a driver for the implementation it proved to be that the demonstration measures were embedded in an EU project headed by the Berlin Senate Department of Urban Development. This status gave a stronger position especially to smaller companies. In particular this was

helpful for measures that were striving for exceptional permits from regulations and where the creation of a “customised solution” was essential for the testing of a new service.

A barrier that was of distinctive importance was the discontinuation of established co-operation structures. So for example during the implementation phase a reform of administrative responsibilities took place in Berlin. For demonstration measure 6.4 “Tele Parking/Mobile Parking” this made time consuming new negotiations necessary, for which first the responsible contact persons had to be identified. As in some cases the now responsible districts needed time to employ those persons additional delays were caused. In this situation it proved vital that the Austrian demonstrator included a partner familiar with the local administration.

It showed that the present structure of the public administration in regard to their accounting system and responsibilities makes it difficult to implement measures that address cost efficiency e.g. by a new fleet management.

Moreover it became obvious that public organisations follow different rationales than private companies. These different logics of action and interests can be a barrier for the co-operation especially between promoters of innovative technologies and services and public administrations.

Legal

The legal framework proved to be a crucial factor for the TELLUS demonstration measures and a major barrier for the implementation of innovative services in the parking management and public transport field. The successful (wider) implementation of the demonstration measures 8.5 “Car Modal” and 6.5 “Tele Parking/Mobile Parking” was dependent on changes of existing legal regulations on national and federal state level. Since this was difficult to achieve in the limited project time complicated procedures to obtain provisional approvals had to be carried out, which led to delays in implementation.

On the other hand for the introduction of clean vehicles regulations on EU level, i.e. the Air Quality Directive, which became effective in January 2005, had a strong promoting effect. Since municipalities will have to introduce measures for the reduction of traffic related PM_{10}-emissions which might also include restrictions for vehicles with high particulate emissions, the demand for CNG-lorries increased.

Financial

Particularly the small companies taking part in the TELLUS project encountered economic difficulties that made the implementation process sometimes difficult. Problematic in this regard were the long and resource intensive payment procedures for the EU funds that challenged the budgets of the demonstration measures.

In the case of 6.4 Tele Parking/Mobile Parking various changes in the project design and consortium made a contract amendment necessary. It took a long time until it was clear that the new provider was accepted, which challenged the financial security of the implementation and therewith the operability of the demonstration.

For 8.5 Car Modal the revenues of the implemented CharterCab service could not cover the costs. For permanent operation, additional subsidies would have been required which could not be obtained since CharterCab did not match the legally defined description of permissible transport (see legal barriers).

Another obstacle for implementation was that the demonstration measures had not budgeted marketing activities needed to raise public awareness for the services in a sufficient way.

A crucial driver for the innovation of fleet management and the related implementation of Metropolitan Fleet Car (demonstration measure 8.4) was the cost pressure on the companies' side. Acceptance could not be gained until the fleet of DB needed to be rationalised.

Structural / Framework conditions

Several TELLUS demonstration measures faced barriers hindering their implementation that were of a structural kind.

In one extreme case (9.3 Inner City Logistic Centre) the implementation of one part of the demonstration measure was brought to a halt. Since the newly built logistics centre in Berlin Westhafen was only put into low-capacity operation it was not attractive for haulage companies to make use of its facilities for transshipping. For another part the discontinuation of freightliner connections to and from the inner city was the reason for the demonstrator to abandon its plans of a further shift of container transport from road to rail which in turn led to the situation that the container tracking system was not implemented beyond the pilot.

For the measure that dealt with the introduction of clean vehicles (12.6) the low market availability of CNG-lorries was a major barrier for implementation. There were only a few lorry-types with CNG-engines on the market, and the supply of heavy CNG lorries, in particular in the middle weight class is deficient. The vehicles available were extremely expensive. The TELLUS-demonstration measure did not suffice to improve the pressure on the manufactures to enlarge their range of vehicle-types with CNG-engines. This is of particular concern, since this vehicle class is preferentially used for the distribution of goods in inner-city areas.

A better situation applied for demonstration measure 9.4 “Leasing Concepts for CNG Vehicles” for which the recent improvements in engine technology and particularly the supply of a wider range of model types of CNG passenger cars eased the implementation.

Demonstration measure 8.4 “Metropolitan Fleet Car” faced the barrier that the company fleets and locations were incompatible with the requirements of car sharing. Furthermore, the structure of fleet organisation in public institutions hindered the implementation of the concept.

Communication

A crucial factor of success for the demonstration measures proved to be a good and continuous communication both between the measure partners as well as with the public authorities involved. The latter was especially important for the demonstration measures where the legal conditions did not allow a smooth implementation and made it necessary to find a “special way” of dealing with the arising problems (provisional approvals). In one case the authority responsible for the exceptional permit had not been involved from the very beginning which made later co-operation difficult. Whereas in the case of 6.4 “Tele Parking / Mobile Parking” the establishment and maintaining of contacts to several public administration actors over a long period of time promoted the finally successful introduction of the service.

Thereby, especially for the smaller companies the label of being part of an EU-project helped to open doors and ease communication with public authorities as well as with potential users of the service.

The actors of the demonstration measures were from different backgrounds (small companies, big companies, consultants and authorities). Due to differences in their communication cultures misunderstandings sometimes made co-operation difficult. In those situations it proved to be helpful for the process to have an independent player to moderate in the discussion process.

User orientation / acceptance

It became evident that several of the demonstration measures focused in the beginning very much on the technical side of the measure and did not have a clear view of their potential customers (e.g. carried out no user / market survey). So in the process of implementation assumptions about the needs and demands of those groups had to be adjusted and the original measure designs had to be adapted.

For some of the measures the customer and user participation (demonstration measure 10.4) gave assistance in that process, helped to identify target groups and to integrate them into the development of the products. In this way for example the CharterCab design could be adjusted to the users needs.

In demonstration measure 8.4 “Metropolitan Fleet Car“ the process of adapting the approach to the preferences of the customers took place after contacts with companies in the course of

the acquisition process had shown that companies preferred an “all in one solution” to making their own cars available to car sharing. Changing the approach led to an increased acceptance.

The experiences made with the introduction of CNG vehicles demonstrated that higher acceptance can be achieved by increasing the information level of the target group. In the beginning of the measure there was a significant lack of knowledge about CNG vehicles and a general reservation towards its equivalent performance compared to conventional vehicles. Also the tax-privilege on natural gas as fuel had not really been noticed. An intense campaign addressing different target groups was carried out. The acceptance of the persons that actually tested the CNG vehicles was very high.

The barrier of lack of information was of distinctive importance in demonstration measure 8.5 “Car Modal” where only little money was spent on marketing so that the service was not visible to those who did not use it on a regular basis. Consequently potential customers did not know about the service and therefore could not use it.

The case of demonstration measure 8.4 “Metropolitan Fleet Car” showed that the acceptance of a new service in many cases is dependent on a change of long established behaviour. To get the acceptance for the implementation first this change would need to take place. In 8.4 the company employees often handled the company cars like “unofficial private cars” and were therefore reluctant to make them accessible to other users. This could only be overcome by the economic pressure coming from the controlling department and led to a more rational handling of the fleet that enabled the implementation of the MFC service.

Commitment

During the implementation process also personal, institutional and political commitment was a strong driver. In turn, the lack of commitment could block the implementation.

Personal commitment was especially important in those measures that faced difficult framework conditions. There it was essential that the actors had staying power, kept on negotiating and looked for a possible solution. For the success of the demonstration it was also essential that individuals in the public authority backed the implementation.

4.2 Recommendations

Derived from the analysis of the drivers and barriers recommendations can be drawn regarding both, framework conditions for successful wider implementation of the measures that have to be provided by the policy makers, as well as crucial elements that should be part of future measure designs and implementation processes.

RECOMMENDATIONS FOR WIDER INTRODUCTION OF CNG VEHICLES

Upholding of reduced fuel tax up to 2019: The reduced tax rate for CNG is an important condition for the diffusion of CNG engines and should be hold on to.

Provision of an area-wide network of CNG filling stations: The user survey in the framework of TELLUS shows, that one of the most important requirements is an area-wide network of CNG filling stations. So the dialogue with the CNG-supplier should be retained.

Availability of a broad range of CNG vehicles: At the moment one of the barriers to using CNG vehicles is the insufficient range of CNG vehicles available. A dialogue on the part of policy makers with the relevant stakeholders, especially the car industry, could help to enlarge the number of CNG vehicle types, so that for each application a model with CNG engine is available on the market.

Accompanying measures: In the context of the Air Quality Directive the introduction of cleaner vehicles including vehicles with CNG engines should be enforced by measures like environmental zones or road pricing linked to the PM_{10} and NO_2 emissions. Another incentive for the purchase and use of cleaner vehicles could be special parking areas with for example lower parking fees for vehicles fulfilling low emission standards. Here it has to be noted that from an environmental point of view the incentives for cleaner cars should be designed on the basis of their emission levels and not for a special technology.

PROMOTION OF COMBINED FREIGHT TRANSPORT

Upholding of inner-city logistic sites. In order to allow for a stronger use of inner-city logistics centres, both inner-city sites at Westhafen and Treptow-Neukölln should be maintained in the long term. The infrastructure of both sites (this includes the waterways and railway lines) should be regularly adapted to the current demands of combined container transport.

Attraction of new customers: Inner-city logistics centres can only contribute to an appreciable easing of the burden on the environment if they are used by as many customers as possible. New customers can only be won over if the services offered are greatly improved. And this, again, is only possible, if a large number of new customers are acquired. All competent parties in government and industry must work together to make decisive progress in the shifting of freight transport to rail and inland waterways. In this respect, the Senate of Berlin should involve itself actively as mediator.

Information and marketing campaign: To gain new customers – for example, from the capital and consumer goods segments – a large-scale information and marketing campaign addressing all industrial and business sectors is necessary. Activities of individual companies can only have a limited effect.

Accompanying measures: Through accompanying measures (for example a motorway toll on lorries), the shift to environmentally-friendly means of transport can be furthered. This is primarily a task for the government. At the same time, in order to reduce the environmental burden potentially posed by the inner city logistics centre on local level (because of increases road traffic from distribution) appropriate planning and the use of clean vehicles should be promoted.

NEW MOBILITY SERVICES AS PART OF URBAN PUBLIC TRANSPORT

Re-adjustment of legislative framework: The conventional and flexible public transport needs to have the same legal statues and to be subject to the same legal requirements and opportunities (e.g. public funding) as new and flexible services.

Equal access to tendering procedures: New mobility services can only become successful on a larger scale if they obtain equal access to tendering procedures, which as a prerequisite, need to be carried out openly and transparently in the future.

Comprehensive and coherent transport policy: Mobility services fit in with other measures of transport policy that support an intelligent use of the existent transport infrastructure. It is only when complementary measures are implemented that they can work together with the new services, for example by favouring access to the inner city with the public transport over car dominated accessibility. Examples for that include the integration of flexible services into public transport, the provision of reserved parking spaces for shared cars, etc.

MEASURE DESIGN AND IMPLEMENTATION PROCESS

Involvement of stakeholders: In order to streamline the process of implementation, all relevant stakeholders for a specific transport area – public, private, scientific, etc. – should be involved from the start. This will help to identify potential barriers before they become acute, and in turn it will also help to overcome them. At the same time, co-operation between stakeholders, and particularly between public and private entities, should be subject orientated and adequately close to support implementation.

Integration into wider strategies and with other measures: Different transport measures often aim at achieving the same ultimate goal. Therefore, it is sensible to identify and make use of possible synergies. An appropriate instrument that might provide and care for coherence is an integrated transport strategy, which must be open enough though to also include new approaches.

Consideration of legal framework conditions: Current legal provisions often prove to be a barrier for innovative mobility service, however in some cases local support can help to overcome or at least diminish these problems. Communication and co-operation with various stakeholders therefore needs to be undertaken.

Building on past experiences: Various kinds of new mobility services have already been probed and partly successfully implemented in different cities. It can therefore be beneficial for implementers to learn from these experiences.

Market analysis / Target group identification: Thorough investigations into existing and potential markets as well as the identification of specific target groups are indispensable for a successful implementation of services. The time and financial resources set aside for this thus need to be sufficient.

Realistic goal setting. The expectations linked to the implementation of small scale demonstration measures must not be overambitious, but realistic and suited to fit both the measure itself and the overall context of the strategy in which it is embedded. It should be considered that one of the purposes of such projects is to indicate possible developments, identify drivers and barriers, relevant stakeholders, necessary courses of action and possible target groups as well as to give first hints as to possible outcomes. Thus, these “soft” outcomes should also be included in the target identification process.

Orientation phase: It appears that integrated projects often need an orientation phase, i.e. a certain amount of time at the beginning of the project, in the course of which a mutual understanding of project goals and objectives as well as appropriate procedures of involvement and participation can be achieved.

Allocation of sufficient resources for management: The management of integrated projects is a complex task, which requires the setting aside of appropriate financial, personnel and time resources. While this holds true for all project stages, especially in the beginning of a project when relevant processes and developments are initiated, a lot of attention and effort is needed.

Personal dedication: Actors involved should show a certain amount of personal dedication for the project as a whole in order to fulfil the requirements posed by integrated approaches.

Political support: Support of the actors involved by the political sphere is important for overcoming barriers and also for generating an atmosphere of sincerity and significance. At the same time, only through the involvement of local policy it can be ensured that a potential for continuation of pilot projects can be explored.

Foresighted planning: In case of pilot projects, the consideration of what will happen after the end of the pilot phase should start once the potential for the continuation becomes obvious. Therefore, implementers and operators should prepare plans that support the measure beyond its pilot stage.

Intensive marketing and dissemination activities: Outreach activities are crucial for raising public awareness for transport related activities. The visibility of transport projects should be increased, for example through marketing and highlighting of activities. This might also help to generate greater acceptance through more transparency.

Framework conditions: (National) financial, legal and other framework conditions do not only influence the course of a pilot implementation, yet they also set the margins for future utilisation. Therefore, explicit formulation of framework requirements coupled with dedication and (political) efforts to achieve them are some of the most important outcomes of such projects, which should be taken up and passed on to the appropriate levels and administrative and political levels.

5 Overall Assessment of TELLUS Berlin by the Senate Department of Urban Development

The Senate Department of Urban Development was the initiator and head of the implementation of TELLUS Berlin. Moreover it is the authority responsible for the development of the Berlin transport strategy and the elaboration of the related Integrated Transport Plan. Therefore the further integration of the experiences made in the course of TELLUS Berlin into the transport policy of the city will depend on this institution.

This chapter gives a summary of the view of the Senate Department on the implementation process and the results of the TELLUS project in Berlin based on a presentation held at the TELLUS conference “TELLUS Berlin Lessons Learned – Sustainable Urban Transport in Berlin”[153]. The assessment comprises positive and negative aspects as well as final conclusions and recommendations addressing potential improvements when carrying out a project alike in the future.

5.1 Critical points

Integration: The Senate Department experienced that due to the heterogeneity of the ten Berlin demonstration measures it was not possible to integrate them to a full extent and make them one project with a “common vision”. The Integrated Transport Plan though helpful could not provide a sufficient integrational framework for that purpose. The complexity proved to be too high.

Ambitious objectives: During the implementation process it showed that the quantified objectives stated in the beginning of the project were by far too ambitious to be reached within the time frame of the project even if more money would have been spent. This, from the point of view of the Senate Department, hindered an understanding of process achievements.

[153] By Dr. Friedemann Kunst (Senate Department of Urban Development) on 19 October 2005

Assumptions about frame conditions: Another barrier to a successful implementation was seen in unrealistic assumptions regarding the supporting frame conditions (e.g. provision of rail services by DB AG to the inner city) some of the measures based on.

Resource investment: The resources and effort that had to be invested by the site management particularly regarding co-ordination tasks were much higher than expected/budgeted. The same problem from the point of view of the Senate Department applied for the private partners. They had to put a lot of (may be too much) effort and resources into reporting and the attendance at meetings. Particularly when taking into account that the payment of the funding rates was often delayed and contract amendments were difficult.

Lobbying: Common performance of the demonstration measures to communicate demands and problems towards the European Commission were so far perceived not to be very successful.

5.2 Positive points

Public private partnerships: The public private partnerships implemented within the TELLUS project is seen as being quite successful. From the federal state's point of view this was true particularly with regard to their financial multiplier effects: For every Euro spent by the federal state, 4 Euros were subsidised by the EU and further 5 Euro invested by private project partners.

Successful demonstration measures: From the point of view of the Senate Department most of the demonstration measures could reach their objectives. If this was not the case for the quantified objectives they could give important impulses for further development processes. Many products developed could reach the state of readiness for marketing. The demonstration measures are seen as a successful contribution to reaching the goals of the Integrated Transport Plan strategy.

Exchange of experience: For Berlin the exchange of experience with the other European partners was perceived as being motivating and enriching.

5.3 Conclusion

Based on the positive and negative experiences made with the implementation of the TELLUS project the Senate Department formulated the following recommendations similar projects should consider:

- A new project needs a clear common integrating vision.
- Process-related qualitative objectives should complement quantified objectives and products.

- To lower the coordination overhead future projects should include a smaller number of partners and demonstration measures.

Weighing the positive against the negative aspects of taking part in a European project, all in all TELLUS is seen as a success and a valuable experience for Berlin. For the future the aim is to continue using the financial and political support and the potential knowledge transfer EU-Projects can provide for Berlin.

6 Participatory Evaluation

6.1 Approach of the participatory evaluation

Within the framework of its evaluation of the TELLUS measures in Berlin, the "Centre for Technology and Society (CTS) of the Technical University Berlin (TUB) carried out a participatory evaluation. In relation to the target groups described below, this meant a linking of evaluation and participation: participation serves as a means for supporting evaluation and, conversely, contributions to evaluation also generate activating and participatory effects. Hence, "participation" in this context means: persons completely independent of the TELLUS structure were integrated into the evaluation and implementation of the TELLUS measures in a fruitful manner.

The possibility of a real participatory evaluation was principally derived from the self-image of the TELLUS evaluation: It is a summative evaluation, but also a process evaluation, and thus a formative evaluation. The evaluation can and should intervene in the measures. A participatory evaluation also makes sense for the evaluation team, because it can further enrich its work with completely independent competence, from both expert and everyday sources. This approach was based on the assumption that participatory elements could enhance the level of rationality in policy and planning, and so the quality of the evaluation itself. With the instrument of participatory evaluation, the evaluation team has the possibility of gaining results that are more objective.

Whose competence should be activated for the evaluation and thus for the implementation and improvement of the TELLUS measures in Berlin? Participation can be organised in different ways. Traditionally though the concept of participation is connected with the idea of activating citizens on a local or communal level. For our purposes, citizens are on the one hand independent transport experts and, on the other hand, non-experts. In question here is not the user fixed for specific measures, nor the person affected (for whom the individual maximisation of use is important). Rather, we address the competent citizen who is aware of public welfare. As regards transport and mobility, their experience is based either on day-to-day life (non-expert) or on this as well as a professional-intellectual affinity (expert).

The participatory evaluation pursues practical goals:

- Optimising the measures: assistance in implementing in the sense of a process evaluation;
- Dissemination for TELLUS;
- Information on the acceptance of the TELLUS projects among experts and non-experts (with the prospect of applications of certain measures in future);

- Use of the TELLUS game as a means for evaluation and participation;
- Control and optimisation of the work of the evaluation team.

The research goals point beyond the local evaluation in Berlin:

- Verification of the participatory evaluation approach;
- Opens up a discussion on the use of the TELLUS game (a computer simulation) as an instrument for evaluation and participation.

In order to reach these goals we used different methods, first of all focus groups, interviews and the TELLUS-game, simulating the basic ideas of seven out of ten TELLUS measures in Berlin. For a more detailed look concerning the methods see ANNEX 4.

We organised focus groups with transport experts. These experts gave their opinion on the measures. By this we got a lot of different statements. See below a list of the most important comments. Non-experts got to know the TELLUS-measures through the TELLUS-game and by reading texts. They gave their comments and ideas in interviews and focus groups. See below a list of the most important comments as well.

These comments are very heterogeneous. Clear tendencies are not obvious. Hence, we decided to show the most popular comments, divided into three groups: “positive statements”, “negative statements” and “proposals for improvements”.

It must be noted that the work carried out in the course of the participatory evaluation was based on the original measure descriptions. The statements do therefore not consider changes in the measure design.

6.2 Results

Tele Parking System - new telematics-based system for city parking (6.4)

<u>Positive Statements:</u>

Experts: In principal, this kind of parking-space-management supports reaching the TELLUS goals. The Tele Parking System helps minimising the fees, because the monitoring through the police becomes dispensable. - The today’s technology, GPS, allows a temporally differentiated parking-space-management and a better control. - It would make sense to divide the limited parking-space with a different price system.

Non-experts: The annoying search for change can be avoided by the adoption of a cashless paying system. - In terms of an accurate accounting by minutes the advantages and facilities are clearly evident for the drivers of cars. – The information when and where a parking lot is not in use and the ability to make a reservation on this parking lot reduces the park-search-traffic. Thereby the pollutant emissions and the noise exposure sink.

Negative statements:

Experts: There is the risk of trying some technical fooling which has nothing to do with the achievement of the TELLUS goals. – Only if one knows how to deal with this parking-space-management in an integrated traffic concept, it makes sense to think about a more efficient solution. – To be freed of the walk to the park-automat is not a great advantage.

Non-experts: The introduction of this measure is connected with an enormous costliness, which is shifted again upon the users. - The aspect of monitoring and data security plays an important role. Not everyone wants to abandon the information about him, when and where he is at what time. – Indeed the park search traffic in particular is reduced, but the overall traffic rises, since the attractiveness of driving into the city by car increases. This again interferes with negative effects on the goals of this measure.

Proposals for improvements:

Experts: It is important that the driver recognizes before the travel, where parking lots are not in use and where they are occupied. – It would be important to develop some attractive combinations, for example, the possibility of combining parking tickets with the use of public transport, so that transferring becomes attractive. – The orientation at existing fees for parking lots is important.

Non-experts: The system should operate in a wide spread area. At least in entire Germany and perhaps Europe, so that it is not required to purchase new equipment for each city. In this manner, it would not just be interesting for commuters, but also for short trips in other regions. – It might be possible to combine this system with GPS or other traffic control systems, which are already implemented in cars. - A connection of this measure with the incentive to use the public transport would make sense, regarding the achievement of the TELLUS goals.

Concept for HD vehicles road pricing (6.5)

Positive Statements:

Experts: An ecological effect would arise because of the CO2-addicted distinction of controlling the fees. - Regarding the decrease of the environmental impact such a project could contribute to reduce the emigration from the city.

Non-experts: This measure is one possibility to control the traffic within a city and to displace redundant traffic from housing areas onto appropriate roads. In this way, the removers are forced to plan their routes again. – The noise and pollution in housing areas can be reduced by this measure. That could be particularly interesting for areas, which are crossed by drivers with the intention to avoid Maut-fees.

Negative statements:

Experts: Regarding to discharge the roads of traffic, the effects are not that high. – In view of the eastern enlargement of the EU, it is important to think beyond regional models in superior contexts. – The question is whether planned systems (technical and juridical) are not too complex. - Control measures for restraining an individualistically orientated society do not function, because our juridical system offers the possibility of an exception repeatedly and again. – If the taxes and fees are raised, the acceptance decreases more and more.

Non-experts: To avoid noise might be possible in certain areas, but instead of decreasing pollutant emissions, it is just transferred from smaller roads to larger roads. In some cases, it might even increase, since the trucks usually select the most direct connections at present and by implementing fees and taxes the routes might be extended. - The supply traffic cannot be avoided largely, since large cities must be supplied in any form and in the majority of the cases, therefore a truck is required.

Proposals for improvements:

Experts: Alternative routes could be indicated to the drivers, dependent on ecological criteria and certain times, which are provided with determined fees. – Regarding the goals of a differentiated control, the project must be integrated into an entire urban concept. – The conversion in Berlin has to refer to the area of Berlin and Brandenburg. – The fees should depend on different factors (e.g. weight, environment-friendliness, time of day, charge).

Non-experts: Instead of linear control systems or isolated solutions, it requires a political and entire urban concept. It is also worth to think about other visionary systems, like a pipeline for goods.

Future Management of Urban Public Transport (7.5)

Positive statements:

Experts: A project for achieving better communication is important, because many participants do not talk with each other, for example in form of unusual meetings in order to break up the old structures. – It is necessary to arrange planning processes in a cooperative manner.

Negative statements:

Experts: As long as the Deutsche Bahn AG is involved with its monopoly position, a project with the achievement to conceptualise a lasting and liberalised public transport system seems not reliable. – It is to be doubt that this projects helps to negotiate the subjective regional existential orientation. – It is not the function of a government to organise such meetings. - The principle problem is the federal state policy or the policy of both countries. – The image of the local public transport system is problematic. It is actually the means of transportation for the poor people. - In Berlin-Brandenburg, it is a completely specific

situation and in this case, a supra-regional comparative evaluation of public transport systems is not required. – The government of Berlin has to define at first, what exactly is the traffic-political goal. Only if this is done a debate about what is needed and what should be done makes sense. – A scientific fundamental research is not necessary at this point. More important would be to force the concrete realisation of the measures.

Proposals for improvements:

Experts: If the positions have become entrenched, mediation talks are needed. - For the consideration of all interests, more participants from different business trades should be involved, for example the taxi trade, the air traffic and customer agents. - Regarding possible resistance on the part of the citizens the traffic plans should be discussed more frequently in public. Instead of organising Business-management-games, communication platforms might be organised. - The results of the customer questionnaire have to be fed into the Management-Business-Game. - The offers of the public transport systems must be aligned target-group-specific (e.g. for households in Berlin without cars and seniors with specific needs regarding their mobility).

Metropolitan Fleet Car (8.4)

Positive statements:

Experts: If car sharing was working better, if more people are changing from private property to car sharing, altogether less traffic would be produced. - The project can stabilise or reduce the stock of cars and lead to a more efficient use of cars. – This project might change the relation between drivers and their cars: Away from the right of property of the car to a purely use-orientated utilization.

Non-experts: This measure is a very good approach to lower the resting traffic. – If people would be aware of the costs that are caused by an own car, it might happen that some of them tend to access to a car sharing model. Therefore, the amount of public transport occupants altogether could increase. – Thus the available cars are new and therefore frequently ecological compatible models the environmental burden can be reduced.

Negative statements:

Experts: Service-car-fleets are not necessarily ecologically friendly. - It is to doubt that administrations engage in such an innovative project. – Even if a change away from the right of property of the car towards a purely use-orientated utilization would occur, it would be more desirable that traffic participants use the public transport systems. - Even if this measure succeeds, the extent auf change would be somewhat small. – A positive ecological effect might only occur, if the fees for car sharing would be lowered and the acceptance and the number of users (the critical mass) would increase.

Non-experts: Such a model would require a fundamental reorientation. Humans are very reluctant to abandon their own cars. - Total flexibility by having a car on command would not be warranted in such a model. – Having a car as a matter of prestige is still common and is an argument against car sharing. – Treating the own car is another thing as treating a rent car. You never know in what kind of shape the car is left afterwards.

Proposals for improvements:

Experts: This measure must be integrated in an overall context, in an entire system in which all single components are supported. – Within this project, it would make sense to change the fleets towards ecological friendliness. – It would be important to promote the measures with image-campaigns.

Non-experts: The advantages of having an own car have to be balanced, for example by combining tickets, optimal maintenance and good service. – The costs that cars cause have to be clarified for people usually do not reflect upon these costs.

Car Modal (8.5)

Positive statements:

Experts: An establishment of these offers would lead to an increasing acceptance of public transport systems and new forms of public transport systems. – If this measure works out, the TELLUS goals, namely the reduction of traffic jams, overall driving kilometres and pollution could be reached. It is to approve that not every traffic participant drives his own car, if the extent of utilization of the cars is thus increased. Who is able to use a hailed shared taxi – especially at night – might consider whether he needs a car or not.

Non-experts: This measure brings out an ecological and flexible alternative to the individual traffic. – The technical implementation is quite feasible. - In thinly settled areas, it might work out. The only areas you can exclude from the first are centres of big cities. – The measure is a meaningful temporary solution between public and private traffic: It is more rigidly and for more persons than private and more flexibly and for fewer persons than public offers.

Negative statements:

Experts: For the project an appropriate political-administrative organisation will is still missing at present, for instance regarding the juridical framework - This measure, in default of an appropriate extent, will not lead to a broad effect in the sense of reaching the ecological TELLUS goals. – People on their ways are rather searching for a direct connection to the public transport systems. – In Berlin, the hailed shared taxi would compete with the 3-euro-tarif of cabs.

Non-experts: The more persons call the hailed shared taxi, the longer the route will be. The coordination of the different stops must be well elaborated. – The drivers of cars want to be alone and not close to strangers. – On the back land, the car often is indispensable and the

only possibility to get away. – This kind of ride is not profitable – People owning cars have to pay for maintenance in any case. Therefore, they would have to pay a higher price for the hailed shared taxi, than for fuel for their own cars.

Proposals for improvements:

Experts: The project must be embedded uncomplicatedly into an entire public transport offer. - The driver needs reliability and an attractive price system. – If this offer is accepted, the ability of presenting a more positive image of public transport systems is possible. – Such projects should not be offered in cities but in thinly settled areas.

Non-experts: It would make sense to offer this service during events like concerts or theatre, especially if the parking lot situation is difficult. – It is important that the fees are substantially cheaper in comparison to normal cabs. – There might be markers at selected stops with "hailed shared taxi" on it.

Inner-City Logistics Centre (9.3)

Positive statements:

Experts: Berlin is a good location for this project: Things that are working out in Berlin, can also be implemented in other spheres. – If this project works out, the ecological TELLUS goals (for instance a change of the Modal Split) could be reached. – The amount of transported goods at all would not change by implementing this measure but it would be possible to transfer the same amount of goods with fewer transportation containers, which leads to discharge by bundling.

Non-experts: This system might work out regarding goods, that are time-bounded but do not have to be delivered exactly by minute. - Berlin is largely and wide-ranged and therefore well suitable for this measure. – The air would be discharged if not that, many trucks would drive through. – Especially in Berlin, this measure makes sense because the burden of truck traffic here is particularly strong.

Negative statements:

Experts: The consideration is missing: What happens at the other end of the chain? If it is displaced from Munich to Berlin: What happens here, what happens there? - Within this project for an optimised transportation regarding the traffic of goods there are problematically boundary conditions: The conditions of the Deutsche Bahn for the traffic of goods (e.g. the policy and market strategy of DB-Cargo) are doubtful. This measure might lead to conflicts between the traffic of goods and the adjacent residents

Non-experts: For many years, the Deutsche Bahn has not been able to realise this measure. The problem is that reloading is more expensive than transport. - The just in time supply is problematic. - In close, smaller cities with large cars where it is almost impossible to get in the goods must be supplied with small trucks. – From ecological view, the question is

whether this measure causes travels without charge. From this view, it is doubtful if this measure leads to a favourable ecological balance.

Proposals for improvements:

Experts: Various existing city-logistic-concepts did not generate substantial changes. The appropriate results must be evaluated before. – By the use of an additional reloading time gets lost and the costs increase. - The project only makes sense if it can compete with the today's concepts: Either it has to be made cheaper or the price in today's concepts has to be raised. – The cooperation with other logistic-centres in Berlin has to be coordinated.

Non-experts: Trucks have to be more strongly taxed. Nevertheless, who dares that? - If transportation by ship and train takes a longer time, it has to be cheaper. – Because of the high amount of foreign trucks this measure must be organised across entire Europe. - This measure should be combined with others, for example with subsidisations of the railway and the charge of tolls for using the motorway.

New Forms of Financing Contracts (9.4)

Positive statements:

Experts: Berlin is, due to the acceptance of natural gas, an adequate site for this project. "CNG" is a psychological question: How is it possible to minimise prejudices against alternative propulsion technologies? Therefore, it is important to make many investments. – With the aid of this representative project, entrepreneurs could be informed that it is possible to act both ecologically and economically. – It could be demonstrated that considering all costs, a natural gas vehicle is cost neutral for its span of life. – This demonstrating project creates acceptance and operates step for step as a multiplier. - The natural gas technology is a key technology without pollution, a step towards production by gas technology and solar power. -The large fleet operators need a financial incentive. A favourable price is important due to business characteristics and quickness.

Negative statements:

Experts: Still, one important question remains: Who will finally bear the extra costs that are given in spite of the leasing concept? – It is just a simple leasing concept, where is the innovation at? - This leasing concept is a meaningful measure, but it is actually the homework of those, which make it to money. - The flexible mobility of the fleets may not be limited. – What attracts attention is the fact, that the gas vehicles are mainly promoted by power plants, namely the operators of gas, but the car manufacturers are not involved. – If you see it in a purely technical view, natural gas does not represent a real transition strategy towards a hydrogen infrastructure because every gas station has to convert into hydrogen anyway. – When does the public support stops? Either a system establishes at the market by itself or it does not.

Proposals for improvements:

Experts: There have to be more natural gas vehicles on the market. In addition, these vehicles must become clearly better. For example, particle filters are required. Further necessary is educational information. – A strategy would be to talk to single enterprises and offer them incentives. For example, evidence that there are no extra costs and the positive image of natural gas.

Customer and User Participation (10.4)

Positive Statements:

These measures might work out, if they are open and flexible enough to handle and incorporate critical arguments. – Feedback can optimise the measures. If someone talks about it in a good manner, it will be good (like a self fulfilling-prophecy. – The participants of the project could act as multipliers in user circles.

Negative statements:

Experts: A discussion between marketing specialists and users requires a translator, because the use of language is not compatible. – The range of project participants could be wider, it might be necessary to involve various participants. Not each user-participation is lasting. Lastingness should be used ubiquitous. The user participation should be independent. – User participations should be integrated in everyone's life. – The fact that the user perspective is permanently presented gets ignored. It is either shown by migration to other means of transportation or in form of traffic parliaments etc. The statement that there is just few knowledge about customer- and user interests, is simply a marketing joke. They got lots of works and data about it. - Such a package of work has actually to be integrated within a research project. Who wants to place a product in the private sector on the market considers before whether he is able to sell it or not. This step is necessary and should stand at the beginning as a preparation of the entire programme: Analysis of the market, checking the need for action, where to put the focus on.

Proposals for improvements:

Experts: The mobility research section of BMW is doing the same, why would not it be possible to work on it together. – To save costs different projects should be combined. This project might be combined with measure 7.5 to fill up the business-game with realistic input. – If there was not organised any participatory elements regarding the goals and priorities of this measure, in a later participation principle discussions will arise repeatedly. – In the beginning, there has to be a basic meeting to discuss which goals can be reached for the TELLUS measures. – Different interest groups have to be integrated into the process.

Dynamic real-time passenger information for trams and buses (11.6)

Positive statements:

Experts: This system informs the user at what time the next train will arrive and enables him to decide what he is going to do with the remaining time. The customer satisfaction increases and makes the public transport system more attractive. – This measure could lead to optimised transfers between different transport modes.

Non-experts: It is a good approach to install the service at places where most people step in and out and where the station with the highest frequency is. – It is an appropriate comfort because the timetables are frequently torn up and destroyed. – It would make sense in thinly settled regions with a badly developed public transport system.

Negative statements:

Experts: This is an arbitrage effect of subsidies, a waste of public means. - Other cities and countries are much more beyond (except the underground). - Regarding the introduction of a dynamic passenger information system, it is necessary to be aware of the fact that customers might get lost. If the customers are informed about a very late arrival of the train, they could decide not to use this means of transportation to reach their destination.

Non-experts: It is important that there is a good transportation network with low prices. The passenger information would not increase the customer satisfaction substantially and is not a way to attain new customers. – The information indeed is quite pleasant, but the costs are enormous and are finally transferred to the customers. – It should be rather more invested in service stuff.

Proposals for improvements:

Experts: The best way would be to place the information not just down on the departure platform but already before on top, so the customer could take a decision how to go on before. – If the customers get involved in the development, the operators could learn a lot. It would be important to promote the communication. – There is the risk that the real-time display is destroyed repeatedly. – Bus stops must offer an additional benefit so that customers accept some waiting periods.

Non-experts: It is to be considered whether it would be possible to call up that information from home. Nearly everyone got a mobile phone today. It would increase the customer satisfaction a lot und would make it much more comparable to a car. - Information about transfer possibilities should be announced.

Introduction of CNG-powered Vehicles (12.6)

Positive statements:

Experts: Berlin is well located: Many natural gas stations and enough space. – The project makes sense, where the range is shorter, namely for the distribution of fine goods. – Within the industry, some people have to fight for the implementation of natural gas against strong resistance in their own house. They would be grateful for this project. The more people make occupational experiences – active or passive or by multiplicators - with alternative operating vehicles the better it is.

Non-experts: The financing plan, pre-financing and participation on profits afterwards are coherent. If the total amount of costs for the operator are less than before and he has no prejudices against natural gas, he would do it. If this measure works out, the TELLUS goals, e.g. reduction of noise, could be achieved.

Negative statements:

Experts: Maybe this measure is based on some private interests. – Regarding the noxious pollutant emissions, a natural gas car is equal to a “Euro-IV-Benzin-PKW”. It also offers no substantial advantage towards a diesel-vehicle with particle filter and NOx Kat. Regarding the implementation of natural gas as fuel, the industry was and particularly still is in a denying position. – The gas station net gets thinned out and monopolised, thus the establishment of natural gas stations is quite difficult and often dependent on private initiatives from the bottom. The leaseholders are hardly supported. – Many people worry about finding gas stations outside the centres. – As long as natural gas cars are considered exotic it is not easy to promote the acceptance.

Non-experts: At some vehicles there are technical problems concerning the back fitting. - Because natural gas is also an infinite resource, it would be wiser to promote renewable energies. – The large extent of the gas tanks leads to a loss of loading space. – It might be a problem to sell those trucks after a while. - It makes sense to wait how liable to break down the natural gas trucks are and how expensive and complex the maintenance will be.

Proposals for improvements:

Experts: Regarding ecological friendliness, it is important to be an example for Eastern Europe. – The measure has to be promoted: There are many lacks of knowledge and prejudices. – It makes sense to talk to individual enterprises and offer them incentives, e.g. with the reference of cost saving and the positive image of natural gas.

Non-experts: Natural gas is not as well known so far, therefore, it must be informed more broadly. - The prejudices that natural gas is dangerous and expensive must be fought. – The net of natural gas stations must be further extended.

7 Contribution to METEOR evaluation

7.1 Monitoring of Common Core Indicators

METEOR is responsible for the cross-site evaluation of the CIVITAS projects. The indicators used for this evaluation are called Common Core Indicators and are listed in the METEOR "Assessment Framework and Evaluation Guidelines for Data Collection". They reflect the wide range of measures in the CIVITAS projects but show different relevance for the Berlin situation. In the table below the indicators for which data was available are stated for a base year and for the latest available date. Moreover information on their relevance is provided. The indicators with high relevance are congruent with the TELLUS Key Indicators or are addressed by almost all measures, the ones with medium relevance are only covered by some measures and the one with low (no) relevance are not in line with the impact areas of the demonstration measures in Berlin.

Table 18: METEOR Common Core Indicators

No	Common Core Indicators	Relevance HR = High relevance MR = Medium relevance LR = Low (no) relevance	Baseline	Latest value
4	Fuel mix	MR	petrol: 33,267 TJ diesel fuel: 23,112 TJ electricity: 3,362 TJ natural gas: no data available (2001)	petrol: 31,525 TJ diesel fuel: 23,284 TJ electricity: 3,491 TJ natural gas: no data available (2002)
5	Co levels	LR	annual mean: 0.5 mg (2001)	annual mean: 0.5 mg (2004)
			Max. daily 8 h concentration (10 mg/m^3): kept (2001)	Max. daily 8 h concentration (10 mg/m^3): kept (2004)

No	Common Core Indicators	Relevance	Baseline	Latest value
6	NO_x levels[1]	HR	annual mean (roadside): 49 µg/m^3 (2001)	annual mean (roadside): 46 µg/m^3 (2004)
			1h average (200 µg/m^3): kept (2001)	1h average (200 µg/m^3): kept (2004)
			annual mean (40 µgm^3): not kept, exceedings at 5 measuring stations (2001)	annual mean (40 µgm^3): not kept, exceedings at 6 measuring stations (2004)
7	Particulate levels	HR	annual mean (roadside): 35 µg/m^3 (2001)	annual mean (roadside): 35 µg/m^3 (2004)
			24h average (50 µg/m^3): not kept, exceedings at 4 measuring stations (2001)	24h average (50 µg/m^3): not kept, exceedings at 3 measuring stations (2004)
			annual mean (40 µg/m^3): kept (2001)	annual mean (40 µg/m^3): kept (2004)
8	CO_2 emissions	HR	Primary energy related 4,955,000 t/a (2001)	Primary energy related 4,811,000 t/a (2002)
			Final energy related 5,753,000 t/a (2001)	Final energy related 5,737,000 t/a (2002)
10	NO_x emissions	HR	10,455 t/a (2002)	8,876 t/a (2005)
12	Noise perception (no data for this indicator is available, therefore here data for noise exposure is provided)	HR	during days: 165,500 (of 351,905) people exposed to > 65dB(A) (1998) during nights: 206,852 (of 351,905) people exposed to > 55dB(A) (1998)	during days: 218,081 (of 351,905) people exposed to > 65dB(A) (2004) during nights: 281,383 (of 351,905) people exposed to > 55dB(A) (2004)

No	Common Core Indicators	Relevance	Baseline	Latest value
20	No of injuries and deaths caused by accidents	HR	number of fatalities: 82 (2002) number of injured persons: 17,522 (2002)	number of fatalities: 70 (2004) number of injured persons: 16,529 (2004)
21	Vkm by vehicle type – peak[3]	HR	Total average daily car mileage in Berlin (in km): 32,960,796 (1998)	Total average daily car mileage in Berlin (in km): 34,003,740 (2004)
23	Average vehicle speed – peak	HR	all vehicles morning peak: 31.8 km/h (2002) all vehicles evening peak: 31.3 km/h (2002)	all vehicles morning peak: 32.0 km/h (2004) all vehicles evening peak: 31.2 km/h (2004)
25	Total no. of goods vehicles moving in demo areas[4]	MR	In: 18,108,00 t (2001) Ou:t 14,079,00 (2001) Internal: 24,760,000 t (2001)	In:18,762,000 t (2003) Out: 13,116,000 t (2003) Internal: 19,572,000 t (2003)
26	Average Modal Split – passengers[5]	HR	PT 27% walking 25% bicycle 10% car 29% car (fellow-pass.) 9% (1998)	not yet available

[1] Data available for NO_2 level.

[3] Only total average daily car mileage available.

[4] Only tonnage for moving into Berlin (in), moving out (out) and moving internally (internal).

[5] Data available as number of trips.

7.2 ITEMS

METEOR used its evaluation component ITEMS, a model developed to estimate the impacts of transport measures for medium sized cities, to calculate a do-nothing-scenario and a CIVITAS scenario for Berlin. Therefore input data additional to the Common Core Indicators was required describing the urban and transport development of Berlin in the past and the present. Berlin appointed an ITEMS city contact person who, in co-operation with the evaluation manager, delivered the available data to METEOR.

The implementation of the ITEMS model was accompanied by some problems. There were uncertainties regarding the usefulness and appropriateness of the model for Berlin since it was developed for medium sized monocentric cities. So there was doubt if it was able to represent the Berlin polycentric situation. Furthermore the workload to put up the model was compared to the expected output very high.[154] Since Berlin was not the only city with these concerns this was communicated to METEOR in the Liaison Group Meetings of the European Evaluation Managers. Nevertheless the results of the calculations carried out by Enerdata are presented here.

7.3 Do-nothing scenario

A do-nothing scenario was calculated for Berlin with the ITEMS model as a so-called frozen scenario. The purpose of this frozen scenario was to first, produce a view of what will be the consequences, for the whole urban area, of current socio economic and technological evolutions, as well as the current urban transport policies:

- The transport demand.
- The modal repartition of trips and traffics.
- The stocks of vehicles.
- The associated energy consumption and the related emissions.
- The externalities resulting of the traffic.

Second, the frozen scenario was to provide the background for the evaluation of the change induced by policy measures, particularly the CIVITAS measures, as compared to the "do-nothing" situation.

The socio-economic background of the scenario was provided by assumptions made with regard to the population and household figures as well as employment and motorisation for the year 2005 in the city centre and the periphery. The purpose of these assumptions was to link (expected) transport developments back to their sources, i.e. the demography and

[154] Particularly because the co-operation in the field of ITEMS was in addition to the actions agreed upon in the contract.

economic development of the city. Based on these hypothesises as to the transport demand regarding trip purposes, traffic volumes and modal split development were generated. Main trip purposes are shopping and work related trips with a large remaining proportion of undefined trip purposes.

The calculations thus carried out for trip generation resulted in a total of 10 bn trips per day, equalling 53 bn pkm/day. 30% of trips are taken with public transport, out of which 27% are by bus and 74% by tram and metro. A spatially differentiated view on the modal splits clearly emphasising the role of public transport for the inner city: while in the periphery 68% of the mileage is based on the car, the share of private transport in the inner city is only 34%. Regarding the vehicle stock apart from quantitative calculations the composition regarding use of fuel was closely looked at. It was estimated that 93% of the private cars will be gasoline-powered and 7% will run on Diesel. All of the buses are supposed to be diesel-powered. Based on fuel consumption and vehicle fleet concluded in the following emission calculations:

Table 19: Total emissions by mode according to ITEMS frozen-transport scenario for 2005

	CO2		CO	
	t/year	%	t/year	%
Private car	1.908.187,83	91	17.085,00	98
Gasoline	*1.795.448,66*	*94*	*16.801,89*	*98*
Diesel	*112.739,17*	*6*	*283,11*	*2*
Other	*0,00*	*0*	*0,00*	*0*
Buses	187.651,92	9	333,99	2
LDV	0,00	0	0,00	0
Trucks	0,00	0	0,00	0
Total	2.095.839,75	100	17.418,99	100

	Nox		PM	
	t/year	%	t/year	%
Private car	2.188,56	66	36,90	44
Gasoline	*1.796,63*	*82*	*0,00*	*0*
Diesel	*391,93*	*18*	*36,90*	*100*
Other	*0,00*	*0*	*0,00*	*0*
Buses	1.132,21	34	46,99	56
LDV	0,00	0	0,00	0
Trucks	0,00	0	0,00	0
Total	3.320,77	100	83,88	100

In order to estimate the calculation's closeness to reality, one would now have to compare the ITEMS results with actual developments in Berlin. This would also serve to assess whether or not the model, which had been developed for utilisation on a profoundly different scale and most importantly in a different spatial context, and the model re-calibrations is now fitted to the Berlin circumstances. A first attempt to do so shows that compared with the actual developments ITEMS overestimated employment and private car figures and

underestimated unemployment and the number of retired people as well as mileage of individual motorised transport and the resulting emissions; however the latter also results from the non-observance of commercial transport.

7.4 Scenario "Promotion of CNG vehicles"

One TELLUS Berlin measure was considered to be suitable for a scenario. Based on the do-nothing scenario it calculated what effects an upscaled promotion of CNG vehicles would have had from 1998 to 2005. The input assumptions were as follows:

- 10% of the new cars sold between 2000 and 2005 are CNG cars, substituting all size categories of both gasoline and diesel cars; replacing 70,000 cars.[155]
- 50% of buses purchased between 2000 and 2005 are CNG buses. This would have replaced about 700 buses.

As it can be seen from the actual development of market conditions and market penetration of CNG-powered vehicles in Berlin (see reports on TELLUS measures 9.4 and 12.6), these input assumptions had been somewhat overoptimistic. While this is clearly in the line of thinking the "what if" way, i.e. what would happen if the assumed market penetration was achieved, it must nevertheless be seen as far removed from real conditions. In particular the attitudes of private car owners to CNG cars was not taken appropriately into account, i.e. their willingness but also their ability (from a financial point of view) regarding the replacement of a conventionally fuelled with a CNG powered vehicle. Also, the dynamics of bus fleet renewal were clearly overestimated. Apart from these general problems with the model's input assumptions, the calculations produce only moderate results:

Table 20: ITEMS emission development in the CNG-scenario compared to the frozen scenario

	kilo per pers		kilo per kpkm		tons per km2	
	Absolute	Percent	Absolute	Percentage	Absolute	Percentage
CO2	-26,64	-4,0%	-4,31	-4,0%	95	-4,0%
NOx	0,03	-2,4%	0,00	-2,4%	0	-2,4%
CO	0,08	1,4%	+0,01	1,4%	0	1,4%
PM	0,00	-13,0%	0,00	-13,0%	0	-13,0%

[155] A cross-check of this estimation has shown a mistake in the calculations, resulting in an overestimation of the number of replaced cars. In fact, according to the model's logic a replacement of 10% of diesel and gasoline powered cars with CNG-driven cars would add up to only 47,000 cars in total. Thus, the following results regarding environmental impacts have to be interpreted carefully, keeping in mind that the effects would be somewhat lower if the correct number of replaced cars was used. This holds particular relevance for the assessment of CO emissions.

Table 21: ITEMS overall energy efficiency: difference between CNG- and frozen scenario

	whole city
MJ / Pers	-3,4%
MJ/ pkm	-3,4%
MJ/km2	-3,4%

Table 22: ITEMS energy efficiency of transport modes: difference between CNG and frozen scenario

	MJ/ pkm	MJ/ veh-km
Private car	-0,8%	-0,8%
Bus	-30,0%	-30,0%

ITEMS estimates a 2.4% reduction of NO_X, 4% reduction of CO_2 and 13% PM-reduction. At the same time, CO is estimated to increase by 1.4%.[156]

Comparing these results with the ones generated for the scenario developed by the evaluation team for the TELLUS measure 12.6 reveals interesting parallels, even though it has to be kept in mind that the measure-related scenario was carried out considering the year 2015 as horizon.

The maximum market penetration option of the TELLUS scenario as described in Chapter B.11 assumed a substitution of about 25% of diesel-driven cars in the commercial fleet, 45% of LDVs and 10% of HDVs If these market penetrations are realised, it is calculated that about 4% of the NO_X emissions can be reduced. This figure is based on the mileage calculation in the Integrated Transport Plan of the city. While a direct comparison between the two calculations seems to be difficult due to their varying input data, it appears one could conclude that the overall direction is similar. However, this is not surprising, considering that the environmental advantage of CNG-powered over conventionally driven vehicles without after treatment is undisputable, and that the exact amount of the reduction merely depends on the amount of CNG vehicles that get onto the road and how many conventional (diesel) vehicles are in turn being replaced.

7.5 Conclusions

Since this is not the appropriate place to draw conclusions on the suitability of the ITEMS model to the specific conditions in Berlin and also not to make suggestion as to the further model refinement and use, attention should be drawn to the main statement of the calculations. In fact, ITEMS showed that the achievement of the TELLUS objectives for air

[156] Again, these results have to be interpreted carefully, keeping in mind the miscalculation of replaced cars as outlined in the previous footnote.

pollution is difficult, even if the introduction of a considerable higher number of clean vehicles and a more consequent replacement of the existing fleet are being realised.

C.3 Evaluation for 2006 - 2015

1 Introduction

The TELLUS project was implemented from February 2002 until January 2006. However the time frame of its objectives was set beyond that point to 2010[157]. This emphasises the process character of the project as well as the integration of its measures into the overall transport strategy of the city.

Moreover during the implementation of the project it appeared that for the majority of the measures wider (measurable) impacts can only be expected for the time after the end of the demonstration phase. In particular for the measures that try to influence long established mobility routines of people or measures the implementation of which demands a change of the legal framework TELLUS is only the start of a longer process.

A precondition for achieving the impacts mentioned above is a certain durability of the implemented measures beyond January 2006, i.e. the end of TELLUS. In the following chapters this potential will be assessed and an overview of how the potential long-term impacts have been estimated will be given.

2 Future potential of the measures implemented in TELLUS

2.1 Durability

The aim of TELLUS working towards a more sustainable urban transport was to test and implement durable technological and organisational solutions.[158] During the project the measures developed products, provided services and disseminated information to different target groups. This chapter will give an overview of the durability of that work and will answer the question of what will happen after the funding of the EU will come to an end in January 2006. For most of the measures this will not be the end. Some of them will go on in the way they were conceptualised for the project; others will continue in a modified way, taking parts of the developed solutions and use them for example for a different target group. The third group will pass on knowledge and experience gathered within the project period.

[157] The chosen target year for the evaluation is deviating from the time frame of the TELLUS objectives. The reason for this change is that the target year of the Local Transport Plan Berlin which is an important data source is 2015.

[158] TELLUS Final Inception Report, issued 25 October 2002, p. 5

6.4 Mobile Parking

During the life cycle of the TELLUS project the service could prove its acceptance and functionality (see Chapter B.2). However, the major implementation barrier, the unfavourable legal framework condition still exists.

The test phase was extended to March 2006, whereby the demonstrator has offered to cover the cost for the period January to March 2006 himself. Furthermore, negotiations between the demonstrator and the Berlin districts are underway with the aim to further extent the availability of the service up to the end of 2007, i.e. as long as the special permit issued by the federal ministry is in force.

6.5 Road Network and Concept for HD Vehicles Road Pricing

According to the Senate Department of Urban Development road pricing for HDV will most likely not be implemented in the city of Berlin within the next ten years.

However the scientific results of this measure will be used by the demonstrator in a project commissioned by the Federal Ministry of Transport, Building and Housing concerning road pricing schemes in Germany.

7.5 Future Management of Urban Public Transport

The measure formulated quality criteria for Local Public Transport Plans, which are likely to be implemented, especially because the demonstrator is taking the chair of the transport planning group of the German Council of Cities. In this position it will continue a dialogue oriented process with authorities in Berlin and in other communities on the subject, thereby acting as a multiplier of the generated results and insights.

There will be no publicly organised tendering procedures in Berlin up to the year 2020. So the TELLUS results regarding the tendering procedures will not be implemented unless the BVG itself will commence to organise tendering for certain transport services in the city.

8.5 Car Modal

The CharterCab service as provided within TELLUS was discontinued after the end of the demonstration phase in January 2004 as it was not possible to integrate it into the service of the local public transport provider. This would have been essential to make the service cost-efficient, legally allowed and widely accepted.

Since July 2005 the CharterCab disposition technology was being used for a door to door taxi service for disabled persons in Berlin provided by the CharterCab partner TaxiRuf, commissioned by the Berlin Senate Department. Due to legal restrictions the service can only run for a demonstration phase with an exceptional permit. At present an EU-wide tendering is carried out for the taxi service.

TaxiRuf would like to develop a product that could be disseminated to other cities via franchising.

9.3 Inner City Logistics Centre

The container tracking system developed and implemented in TELLUS will go on running with the five test containers. The technology of the tracking system is functioning and showed to be reliable. An equipment of containers with the tracking system on a larger scale level and the implementation of the software is depended on the availability of a regular container rail transport line to and from the inner-city logistic centre.

9.4 New Forms of Financing-Contracts for HG Vehicles

The demonstrator stated that they will continue updating the website after the TELLUS-time frame so that a platform on status-quo will be available for leasing-providers as well as for companies also in future.

10.4 Customer and User Participation

The customer relationships established within the TELLUS project will not continue after the end of the TELLUS demonstration measure.

P.O.P. works on a possible continuation as participating youths could act as ambassadors for TELLUS themes. Another idea is to pass on the successful contest concept to other CIVITAS cities.

11.6 Dynamic Real-Time Passenger Information for Trams and Buses

After the end of the demonstration phase BVG will continue with implementing information panels. Altogether 700 displays will be implemented over the next years. Every year 70 panels at most can be installed due to financial restrictions. As in Berlin round about 7,000 bus stops and about 800 tram stops exist roughly 10 percent of the stations will be equipped. Panels will provide the dynamic information at the most frequented stops. When all the panels will have been installed 50 per cent of all bus customers and 80 per cent of all tram customers will benefit from the improved information service.

12.6 Introduction of CNG-powered Vehicles

The measure was designed as a pull approach. By providing financial assistance for the purchase of CNG vehicles for a limited period of time and number of vehicles the demand as well as the supply of CNG vehicles was to be stimulated. So the measure as conceptualised for TELLUS will not go on after the end of the project. However it is assumed that the impulses given by the demonstration measure at least on the demand side as well as the activities of the demonstrator will be of a durable nature. In the survey the users stated that they would buy a CNG vehicle again and that they would recommend them to others. For instance the Deutsche Post World Net which purchased CNG vehicles within the TELLUS

project wants to buy another 100 CNG vehicles in 2006.[159] Additionally, in September 2005 the BVG announced that they will purchase the first CNG buses for their bus fleet in spring 2006.

Moreover in 2005 the demand for CNG-lorries showed a strong increase due to the Air Quality Directive and the high crude oil prices. Due to these circumstances it is assumed that also in future the demand for CNG-lorries will be higher than in the beginning of the TELLUS-project.

2.2 Upscaling

The TELLUS objectives are formulated not only for the life cycle of the project but also for the period after its end i.e. until 2010. In order to estimate the potential long-term impacts of the TELLUS measures in Berlin the evaluation team in co-operation with external transport experts upscaled five of these measures to a city level. Those were:

- Mobile Parking (demonstration measure 6.4),
- Metropolitan Fleet Car (demonstration measure 8.4),
- Car Modal (demonstration measure 8.5),
- Inner City Logistic Centre (demonstration measure 9.3) and
- Introduction of CNG-powered vehicles (demonstration measure 12.6).

Thereby the chosen target year for the scenarios was deviating from the time frame of the TELLUS objectives. The reason for this change was that the estimations done for the Integrated Transport Plan in Berlin are carried out for the year 2015.

In order to develop the assumptions for the scenarios the results of the measures' implementations during the life cycle of TELLUS were used as starting point for further assessment and were supplemented with data and information derived from other studies and projects as well as from the Integrated Transport Plan.

Since all the selected measures belong to different fields of intervention (like public transport, freight transport, parking management etc.) and the resources of evaluation were limited it was chosen to develop separate scenarios for each of the measures and not combine them on a city level. The scenarios therefore can be found in the measure level part of the Final Evaluation Report in Chapter 6 of the respective measure.

[159] Press release by Senate Department of Urban Development „Erdgasfahrzeuge verbessern Berliner Luft“ from 14 November 2005, http://www.stadtentwicklung.berlin.de/aktuell/pressebox (14/11/05)

D Final Conclusions[160]

The objects of the evaluation described in this report are the ten transport measures carried out in the frame of the TELLUS project in Berlin from February 2002 until January 2006. These demonstration measures, which differed widely regarding contents, types and underlying rationales, aimed at bringing positive effects for the city by shaping its urban transport more sustainable. In this regard, the TELLUS demonstration measures in Berlin were not an isolated attempt, but they were integrated into the city's integrated local transport policy.

TELLUS Berlin as all the participating cities within the TELLUS project set itself ambitious transport-related, environmental and social objectives. Moreover the project formulated target quantifications not only for the project life cycle but also for 2010. This emphasised the process character of the project not ending with its financial assistance but bringing effects for the city beyond this phase. Likewise, an analysis of the demonstration measures and their potential impacts carried out already in the initial phase of the project showed that solely through the implementation of the TELLUS project the target values of the objectives were not be reached on a city level, particularly not within the limited time frame of four years. Therefore it was decided for the evaluation to rather focus on the measure level and the analysis of the implementation process. The developed key indicator monitoring system, since in line with the direction of the local transport strategy, was interpreted as an instrument to monitor the development of the Berlin transport and related environmental conditions as a whole beyond the TELLUS project. So with help of the monitoring system areas for future action can be identified.

The complex integrated project was carried out by numerous partners from different backgrounds. While the majority of the demonstration measures dealt with the implementation of technical innovations, emphasis was also put on measures that focussed on the development and implementation of social and organisational innovations.

The measures themselves were of a great variety and addressed different sectors of transport (commercial and public transport as well as individual mobility). Moreover, they were often operating on a rather small, sometimes even local and generally geographically dispersed scale. As a consequence, there was only a limited possibility to create and make use of synergies between the measures. This is with the exception of those measures aiming at the introduction and wider use of CNG-vehicles, where the respective efforts of the demonstrators created a greater awareness of and acceptance for the technology. Furthermore, due to the measures characteristics, the (assessable) impacts on city level were only minor and difficult to distinguish from general development trends and impacts of

[160] Please note that the following does not contain an executive summary of the evaluation results, but rather presents an overview of the lessons learnt from the point of view of the evaluation. Further details on the measure results can be found in the resume sections of the respective chapters in Part B of this report.

other, not TELLUS related measures that worked towards the same objectives, for example with regard to air pollution. Regarding the evaluation, this posed a challenge for the development and proof of cause-effect relationships.

Likewise, an estimation of the future potentials of the measures, which was carried out by means of scenario building and took into account the identified barriers and drivers, incorporating them into the framework conditions and measure modifications, showed that also in the future no major effects can be expected from the individual measures. Or rather the effects that are to be expected are not within the sphere of those indicators measured and monitored within TELLUS. Instead, local and small scale effects, such as the improvement of transport connections in peripheral areas, a better access to car sharing, stronger consideration of 'soft' impacts like public awareness and information, mark a shift in transport policy in general. This shift had already been indicated in the Integrated Transport Plan of Berlin, and the TELLUS measures deliver evidence for the seriousness of its pursuit.

So by and large, the TELLUS measures in Berlin showed that there is a potential for innovative transport activities. Albeit, the creation of the appropriate conditions for their implementation as well as the creation of acceptance and moreover utilisation of these potentials are central aspects, that need to be considered and addressed with more emphasis. The demonstration measures contributed to this perception and, moreover, they delivered first allusions as to what changes are needed and how these could be brought along. The effects analysed and findings gained by the evaluation are therefore relevant for further development of the measures and future policy decisions.

In this regard, main findings and achievements are to be seen within the identification of drivers and barriers for the implementation of innovative (pilot) projects as well as the initiation of communication processes and the stimulation of co-operation on different levels. The latter proved to be of particular importance also within the TELLUS life cycle in cases, where combined efforts of the parties involved led to the achievement of the conditions necessary for the realisation of a measure. Noteworthy in this regard is the achievement of a change in the legislative framework that made the implementation of the Mobile Parking system possible. Another example of the possible outcome of processes stimulated in the project is the utilisation of the Car Modal technology for transportation services for disabled people, which shows that in analogy to framework conditions also sometimes measures, schemes and plans have to change in order to be realisable.

These and other findings can be condensed into valuable lessons learnt. While those have already been outlined in detail in previous chapters of this report, the following paragraph will name again some important conclusions that hold relevance not only for the measures but also for the project design as such.

What was shown in the project was that experiences made with transport innovations in other cities and / or different contexts should be taken into account before the plan for a demonstration or pilot project is being drawn up. Since this was not always the case in

TELLUS Berlin, some measures were subject to considerable delays that could otherwise possibly have been avoided. At the same time, changes in framework conditions, which can not be influenced directly, should be considered and if possible backed up by appropriate alternative plans. That way, implementation setbacks and even the termination of a measure could be avoided. The Risk Register applied in TELLUS was not in all cases sufficient to fulfil the intended purpose, also because it was introduced when the project had already been running for quite some time.

Regarding framework conditions, EU, national and local legislation and administration play an important role in the transport sector. Depending on the actual circumstances these can positively contribute to transport innovations (e.g. the Air Quality Directive supported the wider introduction of CNG-vehicles), but they can also hinder implementation (like in the case of Car Modal). Sometimes, these obstacles can be overcome; however this requires intensive co-operation and a mutual understanding of the aims. In TELLUS it was in particular the work of the Senate Department for Urban Development that supported some of the measures and thus enabled their realisation, like for example in the case of Mobile Parking.

The crucial point about co-operation was that the different backgrounds of the partners in each individual measure and within the entire project provided for differences in organisational structures, communication routines, planning approaches, schools of thought, etc. Again, a common understanding of the aims and objectives of the project is a prerequisite if these differences are to be prevailed over. A contribution to that can also be made by personal and institutional commitment, which in general is a factor that can be decisive for the outcome of a measure and the project.

Apart from this, co-operational difficulties also increase if some of the partners have to act on the verge of economic viability. What is meant by this is that especially small companies, that often obtain an enormous innovative potential, are sometimes overloaded with the financial, administrative and reporting requirements of EU projects. Additionally, the collection of data and information needed for the evaluation were not budgeted, so that co-operation with the evaluation posed an additional workload for some demonstrators, the advantage of which was not always immediately perceived.

Furthermore, future budgets should give more finances to ‘soft activities’, such as marketing and awareness rising, since without the content of the envisaged users, no measure can run successfully. A user-orientated perspective thus needs to be applied for organisational approaches but also and especially for technological applications.

Not only the measures probed to be of the innovative kind, but also the evaluation had to test new ways to deal with this complex integrated project. So for example the fact that the objects of the evaluation were innovative pilot projects had several consequences in this regard.

First, as described above, the analysis of the implementation process played an important role in the TELLUS evaluation. Drivers that promoted successful implementations and barriers that hindered the demonstration measures in reaching their potentials were analysed.

Second, the innovative pilot projects were not readily shaped at the beginning of the project. Their design was adapted step by step to the specific situations. Accordingly the evaluation concept developed in the beginning could not be followed through without likewise being adapted to the changed conditions. Therefore the evaluation had to react in a highly flexible way.

Third, often difficult implementation processes led to delays and consequently to the situation that effects of the measures during the project time were not visible and measurable. But this does not mean that there would be no impacts at all. The measures that tried to influence long established mobility routines of people or measures that require a change of legal framework in order to be implemented could only be the start of a longer process.

Therefore, no final assessment regarding their benefits in terms of the environmental, social and economical sphere of the city could be made in this context and potential impacts were estimated with the means of scenario building.

In order to give consideration to the special characteristics of the TELLUS project the evaluation took over a strong process role. In co-operation with the demonstrators the evaluation team established an integrating framework for the single measures by relating the measure level objectives with the objectives on city and project level. Moreover, it had to integrate the various demands and expectations of the different levels and to find a balance between the interest of the European Commission on hard facts and knowledge transfer and the limited resources of the demonstration measures to collect and provide data.

This approach needed a close contact, which was valuable in terms of getting a lot of inside information and understanding the process. But it was also very resource intensive for the evaluation team. Therefore in future projects it would be advisable to either allocate more resources to a horizontal evaluation work package or to require a sound evaluation concept as an integrated component of the measure design already in the very start of the project. In either case a lead time to set up a common implementation and evaluation framework for the project would be a valuable means to increase the efficiency and effectiveness of the implementation process.

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Final Evaluation Report

Berlin

ANNEXES

Issued in November 2005

Content

ANNEX 1:

Details on Achievement of Objectives

Demonstration Measure 6.4 – Tele Parking System / Mobile Parking

IMMEDIATE OBJECTIVES

Recruitment of 300 test persons

Mobile Parking started the service in the beginning of February 2005. In April 2005 already 5,750 phones were registered with 600 parking transactions per day. In October there were about 5,600 accounts with about 7,200 registered phones. The numbers have since continued to rise. (⇨ B.2 Chapter 3 *Delayed and altered implementatio*n and Chapter 4.2 *Customer Acceptance*)

Implementation of the Tele Parking system in the demonstration area

The Mobile Parking system was introduced in February 2005 in two Berlin areas under the name of "Handy Parken", Districts in "City West" and Berlin Mitte District. (⇨ B.2 Chapter 3 *The service*)

Making parking management more flexible

Mobile Parking succeeded in implementing a service, which enables by-the-minute billing. A further flexibility like varying prices according to demand is depending on political or administrative decisions and is not yet realisable due to legal constrictions (⇨ B.2 Chapter 3 *The service*, Chapter 5 *Achievement of Objectives*).

Achieve extensive political and public awareness for TELLUS

The launch of the Mobile Parking service in the beginning of 2005 caused considerable media attention (⇨ B.2 Chapter 4 *Public awareness*)

Improve public-private co-operation

Extensive and persistent co-operation between the technology provider, the local partner FAV and several public institutions was vital for the implementation. The final success proved the established public-private co-operation (⇨ B.2 Chapter 4.2 *Public-private co-operation*, Chapter 5 *Cooperation and Local Partner*).

INTERMEDIATE OBJECTIVES

Change in legal framework

The most hindering legal restrictions were changed in November 2003 (⇨ B.2 Chapter 3 *Legal situation*). There are other terms, which lead to the requirement of an ongoing provision of the traditional parking management infrastructure. This reduces any possible efficiency advantages of the new service.

Full scale implementation in Berlin

The service was first implemented in two Berlin districts (Berlin Mitte, Berlin West) and later expanded to four additional districts (⇨ B.2 Chapter 3 *The service*). "Handy Parken" is now available in all areas with parking management. The test phase was prolonged until March 2006. The upholding of the service depends on empirical results about possible changes of parking charge revenue and cost efficiency. If the service (or any similar service) should be continued after the test phase it has probably to be tendered by the public authorities with a naturally open outcome. (⇨ B.2 Chapter 3 *Outlook*, Chapter 5.3 *Achievement of objectives*).

Making parking management more cost efficient/convenient

Cost effects can not yet be estimated due to missing data.

Enhance acceptability of parking management

Changes of the acceptability of parking management can not be stated due to missing data.

Demonstration Measure 6.5 – Road Pricing

IMMEDIATE OBJECTIVES

Design of a multi functional road pricing scheme for Berlin

The demonstrator developed a road-pricing system by modelling the traffic effects of HDV road pricing in Berlin. The objective is only partly achieved because the emission standards of the HDVs were not included in the conceptual design. (⇨B.2 Chapter 3)

INTERMEDIATE OBJECTIVES AND ULTIMATE OBJECTIVES

Since the conclusion of the measure has the direction not to implement a road pricing for heavy duty vehicles in Berlin due to marginal welfare benefits, in all probability the intermediate and ultimate objectives will not be achieved based on the concept study designed in measure 6.5. (⇨B.2 Chapter 3)

Demonstration Measure 7.5 – Future Management of Urban Public Transport

IMMEDIATE OBJECTIVES

Part 1)

Carrying out a "Management Business Game"

The Management Business Game was carried out in four workshop sessions and completed successfully (⇨ B.4 Chapter 3 *Part 1*).

Identifying the options of the actors of the "Management Business Game" for improving public mobility services and efficiency

The two scenarios developed out of the results of the Management Business Game identified options for actors in the field of transportation planning and provision under different framework conditions (⇨ B.4 Chapter 3 *Part 1*).

Improve intra-organisational co-operation at the city level

Co-operation was improved for participants of the Management Business Game (⇨ B.4 Chapter 4.2).

Achieve extensive political and public awareness for TELLUS

The results of the Management Business Game and the scenarios were presented to political decision makers in Berlin. Further dissemination took place through publishing of a compendium on the workshop results of Part 1; the results of Part 2 and 3 are supposed to be published in the end of 2005 and further disseminated by means of technical articles and expert seminars (⇨ B.4 Chapter 3 *Part 1, Part 3*, Chapter 4.1 *Evaluation methods*, Chapter 4.2 *Impacts*)

Part 2)

Defining realistic and innovative quality standards for functional/area related tendering

Quality standards for functional tendering were prepared by means of research and debate, which also included the innovative element of the definition of equivalences (⇨ B.4 Chapter 3 *Part 2*).

Part 3)

Establishing a benchmarking tool for local public transport plans

Because of the varying quality of local public transport plans and the difficulties arising from the lack of consensus of plan development, contents, structure and its position within the transport plan hierarchy, it appeared to be unreasonable to develop a benchmarking tool for auditing and evaluation. Instead, the developed criteria serve as a guideline for further plan improvement, which is supported by the initiated debate and the continuation of the co-operation between the project team and relevant actors (⇨ B.4 Chapter 3 *Part 3*).

INTERMEDIATE OBJECTIVES

The intermediate objectives

- Improve quality of public transport,
- Increase costumer satisfaction,
- Increase costumer loyalty,
- Gain new costumers

have all been rated not applicable, since the results of the measure were not implemented, which would have been a prerequisite for the accomplishment of the above stated objectives.

Demonstration Measure 8.4 – Metropolitan Fleet Car

IMMEDIATE OBJECTIVES

Carry out market research

Although no structured market research was carried out, the market situation in Berlin was analysed by approaching numerous companies and institutions and interviewing their responsible persons. (⇨ B.5 Chapter 3)

Develop a business plan

A business plan for MFC was developed in time. (⇨ B.5 Chapter 3)

Develop a concept for the demonstration of Metropolitan Fleet Car (MFC)

A concept for the demonstration was developed and adapted to the market conditions. (⇨ B.5 Chapter 3)

Demonstration of the Metropolitan Fleet Car concept under day-to-day conditions

The concept has been/is planned to be implemented in several companies but the results available yet are only sufficient to show trends not to come to a final assessment (⇨ B.5 Chapter 3)

Substantial use of the fleet capacities

Due to lack of data this objective can not be assessed. Nevertheless trends of first data available show that this objective is likely to be reached with a wider implementation of the service (⇨ B.5 Chapter 4.2)

Reduce costs for fleet owner and car sharing users

Due to lack of data this objective can not be assessed. But since the service was implemented by the companies due to reasons of rationalisation at least the fleet owners seem to benefit financially from it. (⇨ B.5 Chapter 3)

INTERMEDIATE OBJECTIVES

Make the operation of passenger car fleets more efficient

Due to lack of data the achievement of this objective can not be assessed

Wider introduction of Metropolitan Fleet Car

Also the implementation of Metropolitan Fleet Car in Berlin on a wider level started in the very end of the demonstration phase and a final assessment on this basis is difficult to make, the increasing number of institutions involved as well as of the new car sharing stations opened show the trend towards the achievement of the objective in the future.

Reduce private cars in the city

Due to lack of data the achievement of this objective can not be assessed

Demonstration Measure 8.5 – Car Modal

IMMEDIATE OBJECTIVES

Develop a concept for CharterCab in the southern peripheral region of Berlin

The concept for CharterCab was developed by the consortium in co-operation with the customer and user participation. (⇨ B.6 Chapter 3)

Simulation of the implementation

In November 2003 a simulated pre-run of the service was carried out organised by the customer and user participation. (⇨ B.6 Chapter 3 *User Participation*)

Find taxi drivers to join the Mobil Club

Although the acceptance of the concept was not as high as expected taxi drivers could be found to take part at the demonstration of CharterCab. (⇨ B.6 Chapter 5.2)

Find potential users to join the Mobil Club

Originally it was envisaged to find a minimum of 500 members to join the customer organisation "Mobil Club". This objective was not achieved. Through contact with key persons in the area, flyers, the internet and marketing and press activities of the customer and user participation linked with the simulation run of the service 50 members could be attracted of which 15 actually used the service. (⇨B.6 Chapter 3 *User Participation,* Chapter 4.2)

Find solution for legal implementation barrier

A legal basis for the service could not be found, which was one of the reasons why the CharterCab service was discontinued. (⇨B.6 Chapter 3 *Legal situation*)

Implementation of CharterCab in the southern peripheral region of Berlin

The service was implemented in November 2003 and was operated on small scale (12 users/day) until January 2004. CharterCab was discontinued after the end of the demonstration phase as it was not possible to integrate it into the service of the local public transport provider. (⇨B.6 Chapter 3)

Implementation of "Fellow Passengership" in the southern peripheral region of Berlin

The CarModal part "Fellow Passengership" (and also "Telematic Cashcar") was not implemented. In March 2003 the demonstrator decided to cancel the implementation of the other parts of Car Modal, because the financial and time resources required were a lot higher than it had been assumed in the initial phase of the measure. (⇨B.6 Chapter 3 *Reduced implementation*).

INTERMEDIATE OBJECTIVES

CharterCab stopped operating after its demonstration phase, thus the objectives “Enhance the public transport connection of peripheral regions with Berlin” and “Increase occupancy rate of taxis and private cars”, which are ultimately linked to a wider implementation, could not be reached.

Demonstration Measure 9.3 – Inner City Logistic Centre

Part 3) Container tracking system

IMMEDIATE OBJECTIVES

Design a new telematics-based container tracking system

Within the framework of the pilot project, a GPS-based container tracking system was developed, which wholly fulfilled the demands of the Zapf removal company (⇨B.7 Chapter 3, Chapter 4.2).

Demonstration of container tracking system by the Zapf removals company

In February 2003, test operations were conducted with prototypes in five containers. It was demonstrated that the system is fully functional and easily operable by responsible personnel. System accessibility during test operations was confirmed. The prototypes are still in operation (⇨B.7 Chapter 3, Chapter 4.2).

Enhance the economic efficiency of inter-modal freight transport

Since the pilot project was not extended to a larger scale level, the objective is not applicable (⇨B.7 Chapter 3).

INTERMEDIATE OBJECTIVES

Since the pilot project was not extended to a larger scale level, the evaluation of the intermediate objectives could not be undertaken.

Demonstration Measure 9.4 – Financing Contracts for CNG Vehicles

Due to the change in demonstration design the objectives were not applicable anymore and could therefore not be evaluated. (⇨B.8 Chapter 3)

Demonstration Measure – 10.4 Customer and User Participation

Identify target group of the respective demonstration measure in question

The object was met differently with each demonstration measure. For further detail see the respective evaluation report.

Establish a direct contact between customers and companies

The object was met differently with each demonstration measure. For further detail see the respective evaluation report.

Improve customer relationship

The object was met differently with each demonstration measure. For further detail see the respective evaluation report.

Get valuable feedback

The object was met differently with each demonstration measure. For further detail see the respective evaluation report.

Improve knowledge about customer needs

The object was met differently with each demonstration measure. For further detail see the respective evaluation report.

Improve the demonstration measures

The object was met differently with each demonstration measure. For further detail see the respective evaluation report.

Demonstration Measure 11.6 – Dynamic Real-Time Passenger Information for Trams

IMMEDIATE OBJECTIVES

Prototyping of an interface between the public transport operation control centre and the dynamic passenger information system (Daisy)

The interface was prototyped. All necessary adjustments to enable a reliable function of Daisy took place (⇨ B.10 Chapter 3 *The Approach*).

Acceleration of the pilot realisation of Daisy for trams and buses

The targeted acceleration met some obstacles. In the beginning, necessary outcomes of another project had to be awaited (⇨ B.10 Chapter 5.2 *Barriers*). Later, technical problems had to be overcome (⇨ B.10 Chapter 3 *The Approach*, Chapter 5.2 *Barriers*).

INTERMEDIATE OBJECTIVES

Full scale implementation of Daisy for all trams and buses

Further interfaces will be installed, but not every tram or bus station will be equipped. Installation and maintenance of the necessary infrastructure is costly, so mainly busy lines or stops shall be furnished to keep costs and benefits in balance (⇨ B.10 Chapter 3 *Outlook* and Chapter 5.3 *Achievement of Objectives*). But, an alternative real-time information service for mobile phones using the same data source as Daisy is already now available at each stop (⇨ B.10 Chapter 5.3 *Achievement of Objectives*).

Increase quality of information of PT customers

The survey shows a perception of increased quality of information (⇨ B.10 Chapter 4.2, *Customer Acceptance*).

Increase quality of service

The survey shows a perception of increased quality of service (⇨ B.10 Chapter 4.2 *Customer Acceptance*).

Increase customer satisfaction

The survey shows an increased customer satisfaction (⇨ B.10 Chapter 4.2 *Customer Acceptance*).

Increase customer loyalty

Due to lack of data this objective can not be assessed.

Demonstration Measure 12.6 – Introduction of CNG-powered Vehicles

IMMEDIATE OBJECTIVES

Enhance Information about CNG-vehicles

The demonstrator undertook a good number of activities to make CNG-vehicles known to the public. Presentations of CNG-lorries were given on conferences, and workshops about CNG-vehicles were organised. In the numerous press articles the environmental advantages and also the financial incentives were communicated. (⇨B.11 Chapter 4.2)

Reduce investment cost of CNG-vehicles

Through funding of CNG-vehicle purchase, the difference in purchase costs of CNG-vehicles as compared to conventional Diesel driven vehicles has been reduced. (⇨B.11 Chapter 3)

Gain new customers

In October 2005 the number of lorries supported in the context of the demonstration measure 12.6 reached 91. (⇨B.11 Chapter 4.2)

INTERMEDIATE OBJECTIVES

Increase sale figures

Since the demand for CNG-lorries increased significantly in 2005 this intermediate objective could be noted as achieved. (⇨B.11 Chapter 4.2)

Improve acceptance of CNG technology

As shown in B. 11 chapter 4.2 the acceptance of CNG-engines was slightly improved.

ULTIMATE OBJECTIVES

It is assumed that the ultimate objectives will also be achieved when the demonstration measure is finished.

ANNEX 2:

Indicator Fact Sheets

Indicator Fact Sheets

List of indicators

TELLUS objective	Indicator	Unit of the indicator
Reduction of road casualties and injured persons	fatalities, road accident-related injuries	total number
Reduce congestion	mean journey times between given locations	minutes per journey
	average speed between given locations	km/h (derived)
Reduce car kilometres	car kilometres	total number
Increase of public transport use	passenger kilometres	
	passengers	
Increase the modal share in favour of public transport	average modal split	percentage of trips (or vehicle kilometres or passenger kilo-metres)
Reduce air pollution	level of PM_{10}	µg/m³
	level of NO_2	
	level of benzene	
	level of CO	mg/m³
Reduce traffic related CO_2 emissions	CO_2 emissions	tons p.a.
Reduce NO_X emissions	NO_X emissions	tons p.a.
Reduce noise	noise level	dB(A) road length
Reduce traffic related energy use	primary energy use	TeraJ/a
	final energy use	TeraJ/a
	type-specific final energy use	TeraJ/a
Improvement of intra-organisational co-operation at the city level	quality of intra-organisational co-operation	qualitative terms
Improvement of public-private co-operation	quality of public-private co-operation	qualitative terms
Achievement of political and public awareness	media exposure	qualitative and quantitative terms
	events organised	
	presentations given	

TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Reduction of road casualties and injured persons"

TELLUS Key Indicator: fatalities,

TELLUS Key Indicator: road accident-related injuries

Context, impacts

Road accidents are responsible for a large number of injuries and fatalities. In the EU road accidents claimed a total of 41,000 lives in 1998, but numbers have fallen by 28 % since 1980. Road accidents are the main cause of death for persons under 40.[1]

During recent decades, considerable efforts have been made to reduce the number and severity of transport accidents, including educational programmes, limitation of permitted blood alcohol level in drivers, speed limits, technical measures such as safety belts and air bags, as well as traffic control measures.

Transport safety is a part of the social dimension of sustainability. The risk to get involved in a traffic accident has a direct impact on quality of life. Due to this high risk many people, especially the elderly and children, feel insecure and are constricted in their mobility.

Accident rates are known to vary with the quality of road infrastructure, the technology of vehicles, the behaviour of drivers, traffic regulations, vehicle density etc. While policies must address each and every such aspect, this indicator provides an aggregated measure of the overall policy performance with regard to safety.[2]

Unit of the indicator

Total number of fatalities and
Total number of road accident-related injuries

Indicator-related objectives

Reduction of road casualties and injured persons by 10% until 2006
Reduction of road casualties and injured persons by 20% until 2010

Methods of measurement

Data from ongoing statistics.

Source of data and analysis

Berlin Statistical Office: Statistical yearbook. The IVP collects and analyses the data.

[1] EEA (2001: 21)
[2] See METEOR (2002), Annexes

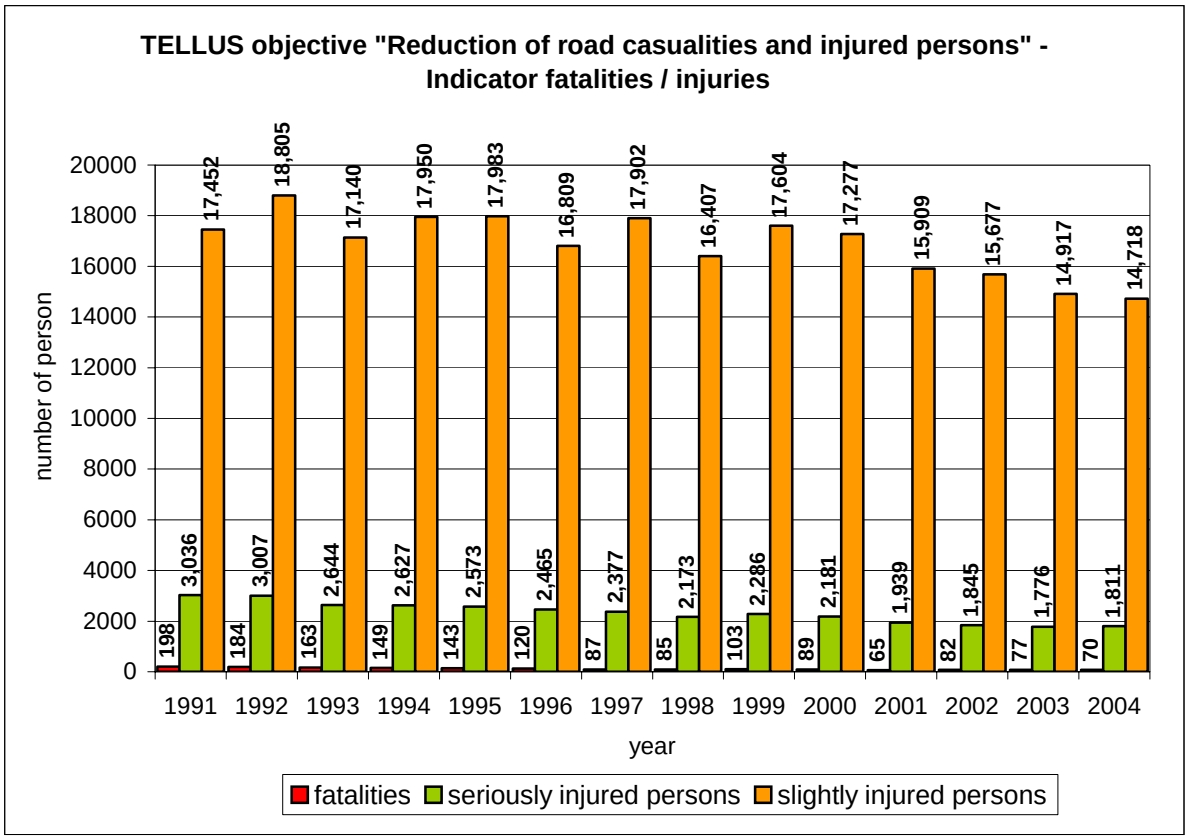
Legal basis

Time table to collect and analyse the data

Retrospective view: From 1991 until the end of the TELLUS Project, the data has been collected and analysed yearly.

Development of the indicator value

During the last decade the number of fatalities decreased significantly (from 198 to 70 fatalities). With regard to the seriously injured person the number fell from 3,036 persons in 1991 to 1,811 persons in 2004.



Source: Statistisches Landesamt Berlin (ed.) (2005)

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	Transport safety (number of fatalities and number of injuries caused by traffic accidents)
NFP (Switzerland)	Road casualties (fatalities and injured persons)
BPI/PRR (UBA Germany)	-
TERM (EU: European Environment Agency)	Number of traffic accidents, fatalities and injuries
EST (OECD)	-
CSD (Germany)	Number of fatalities and injures persons caused by road traffic

References

EEA (2000): Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen.

EEA (2001): TERM 2001. Indicators tracking transport and environment integration in the European Union. Copenhagen.

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METEOR (2002): WP4 Project Impact Evaluation. Task 4.1. Evaluation Guidelines.

Statistisches Landesamt Berlin (ed.) (2005): Statistisches Jahrbuch 2004. Berlin.

Spillmann, W. et al. (1998): Nachhaltigkeit: Kriterien im Verkehr. Berichte des NFP 41 “Verkehr und Umwelt”, Bericht C5. Bern.

TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Reduce congestion"

TELLUS Key Indicator: average speed (derived)

Context, Description of the indicator

The indicator „average speed" is derived from the measured indicator 'mean journey time between given locations'. The indicator is related to flow conditions in the network. Hence the phenomenon congestion is described as a result of the network quality performance. The longer the mean journey time between given locations, the lower the average speed. The level of congestion is measured by the average speed.
Unit of observation is the trip performance of taxis operating in Berlin. Congestion is a situation in which the average speed decreases below a pre-defined limit (e.g. 80% of permitted speed).

Unit of the indicators

Minutes per journey
Km/hr (derived)

Indicator-related objectives

Reduce congestion by 5% until 2006
Reduce congestion by 10% until 2010

Critical aspects of the objectives
The road congestion problem is an example of a self-reinforcing process with feedback loops stimulating car use. Policies aimed at reducing road traffic congestion and improving speeds lead to a further proliferation of the system. Therefore any congestion policy should contain travel speeds within economically tolerable limits.
Less congestion expressed by lower journey times and increasing average speeds causes travelling by car to be more attractive. More car use leads to more negative effects regarding to energy/fuel consumption, air quality and economic benefits. Hence the achievement of the TELLUS objectives becomes more difficult.

Methods of measurement

Application of Floating Car Data (FCD) from the German Aerospace Center Berlin (DLR), Institute of Transport Research (IVF)
The FCD traffic information system is using the Global Positioning System (GPS). Several hundred taxis in Berlin are equipped with a GPS receiver and send their current position to the taxi headquarters. The data are processed by the DLR for a traffic situation analysis (analysing the positions, velocity, travel time, routes of the taxis).
The indicator "mean journey times" is a direct indicator. Mean journey times (in minutes per journey) generated by the FCD System have been used to calculate the average speed. Based on the respective findings, speed histograms were produced.

Source of data and analysis

The data was generated and provided by IVF/ DLR, the analysis was carried out by IVP.

Time table to collect and analyse the data

Retrospective view: From 2002 until the end of the TELLUS Project, the data has been collected and analysed yearly.

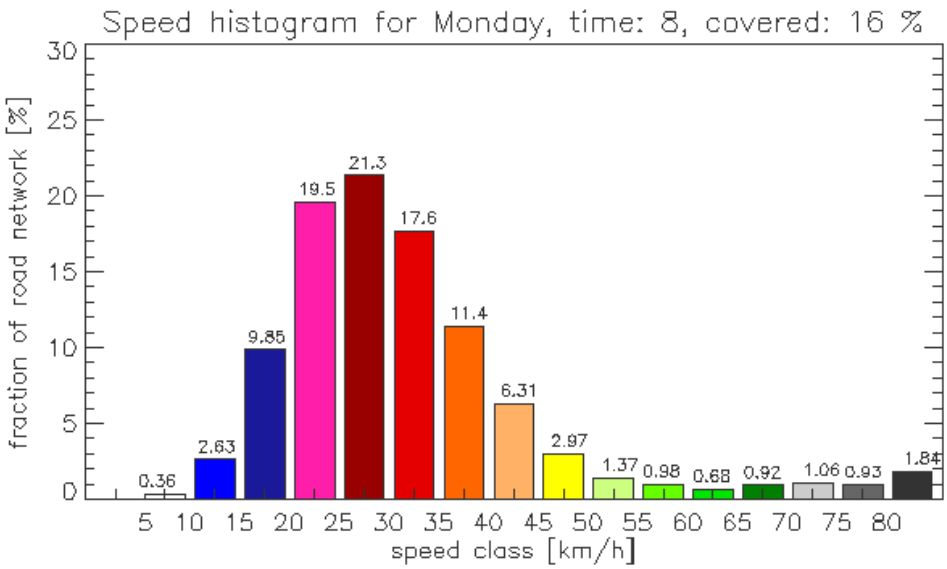
Development of indicator value

Speed histograms – data explanation

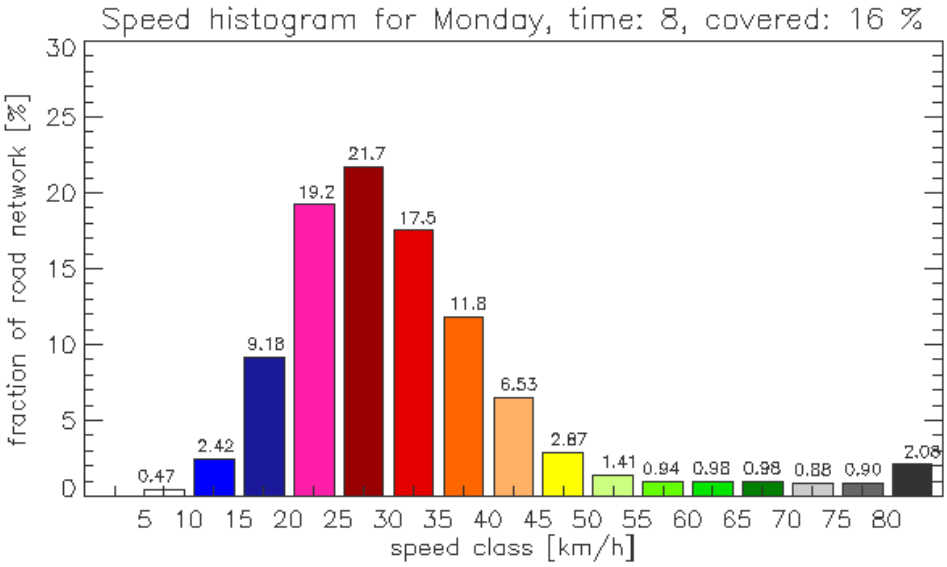
The histograms below are based on Floating Car Data (FCD) collected from taxis operating in Berlin. The FCD are generated from main roads in Berlin. The FCD penetration on these roads is adequate. Velocities base on Navtech road segments. Only road segments with more than eight hits are considered. Data for 2002 and 2003, as well as data for working days and weekdays are illustrated separately. The mean velocities are computed for covered roads only. They are length-weighted.

Speed histograms for Working Days

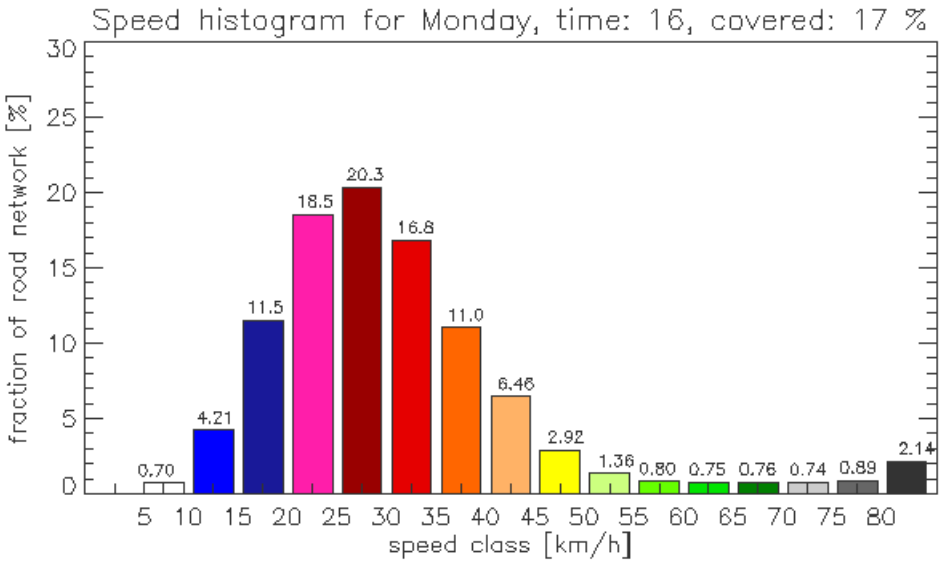
Speed histogram for 2002 - morning rush hour (mean 31.8 km/h)



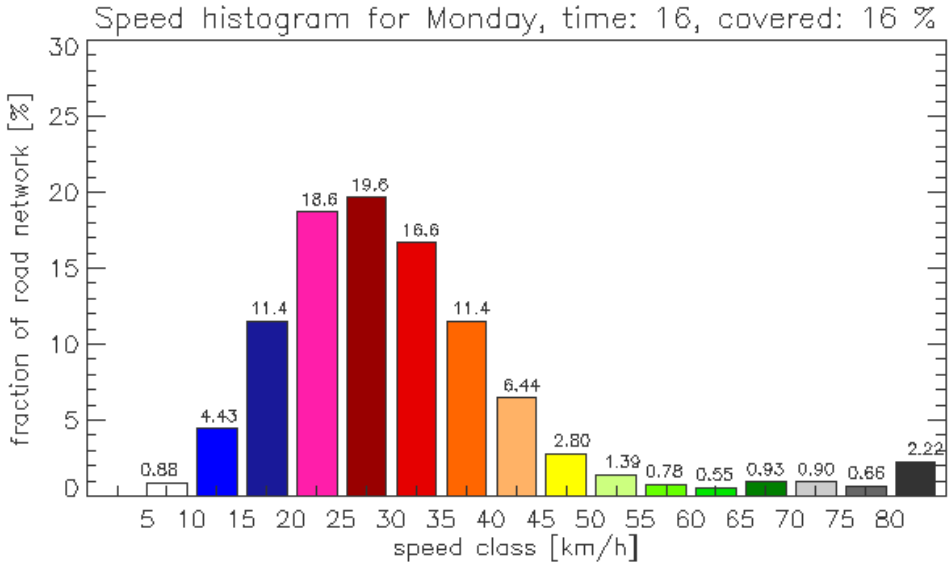
Speed histogram for 2003 - morning rush hour (mean 32.1 km/h)



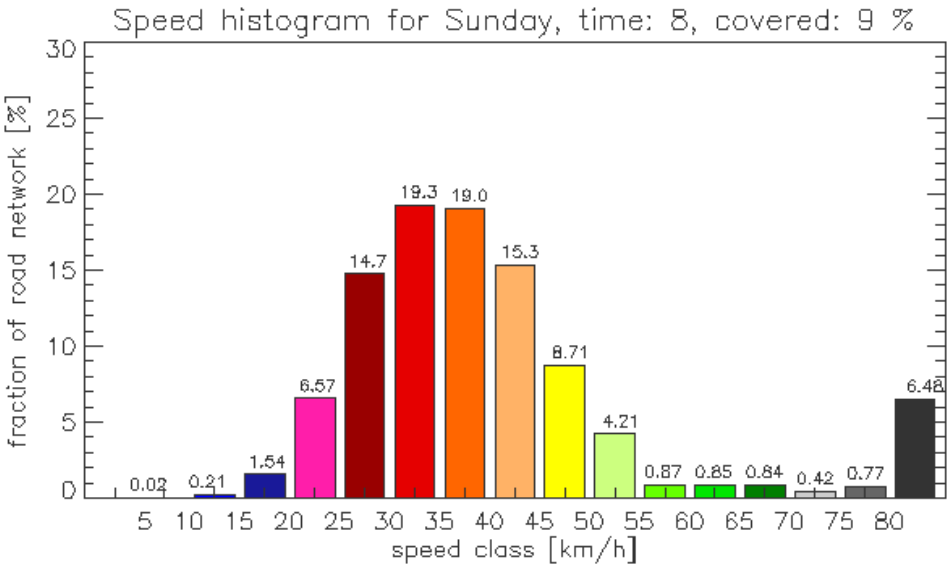
Speed histogram for 2002 - evening rush hour (mean 31.3 km/h)



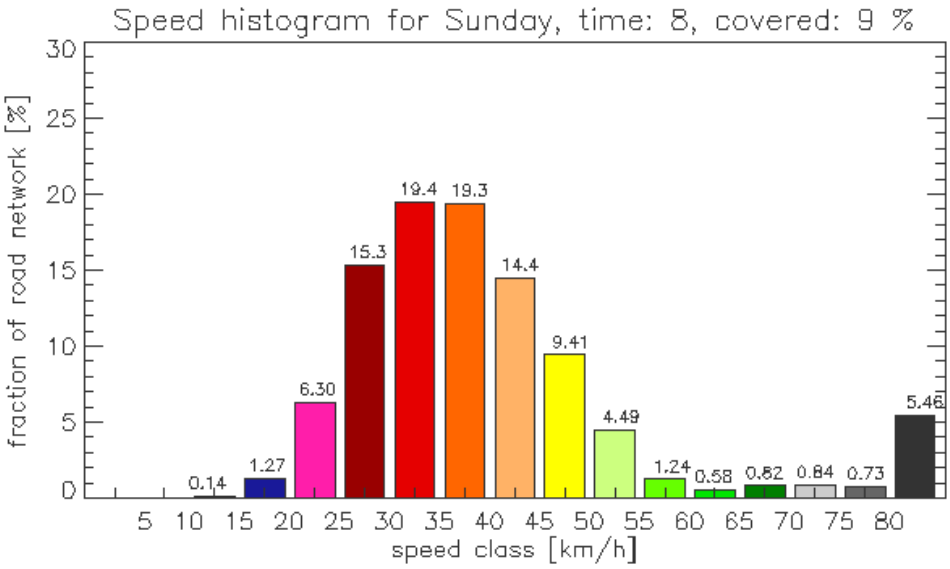
Speed histogram for 2003- evening rush hour (mean 31.2 km/h)



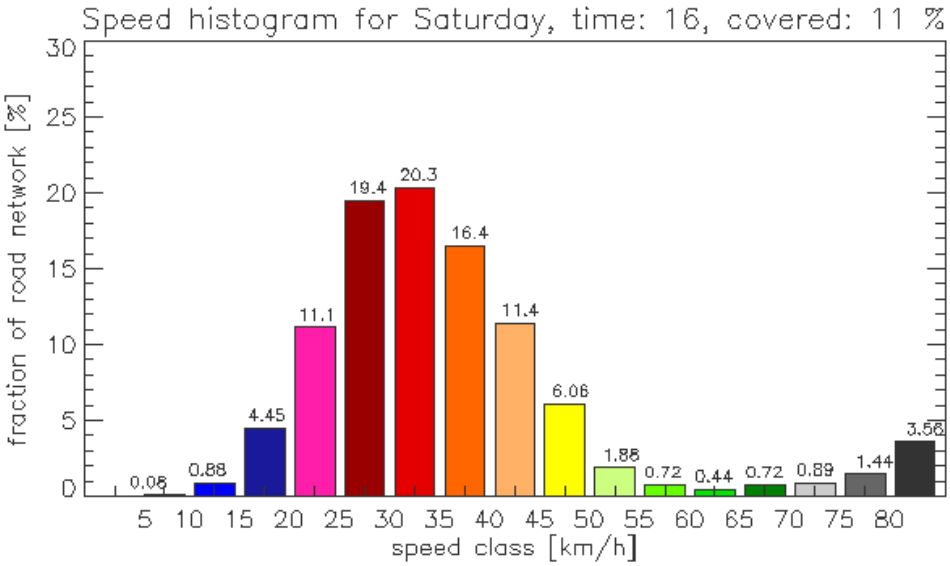
Speed histogram for 2002 - Sundays at 8 am (mean 40.0 km/h)



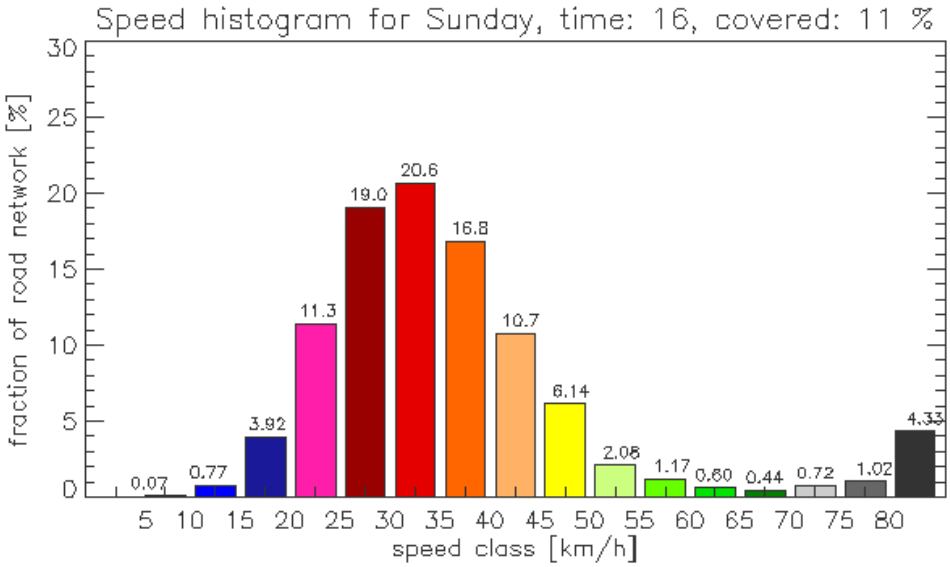
Speed histogram for 2003 - Sundays at 8 am (mean 39.8 km/h)



Speed histogram for 2002 - Saturdays 4 pm (mean 36.2 km/h)



Speed histogram for 2003 - Saturdays 4 pm (mean 36.5 km/h)



Source: German Aerospace Center Berlin (unpublished)

According to information communicated by DLR in March and October 2005, no significant speed changes appeared in 2004 in comparison with 2002 and 2003

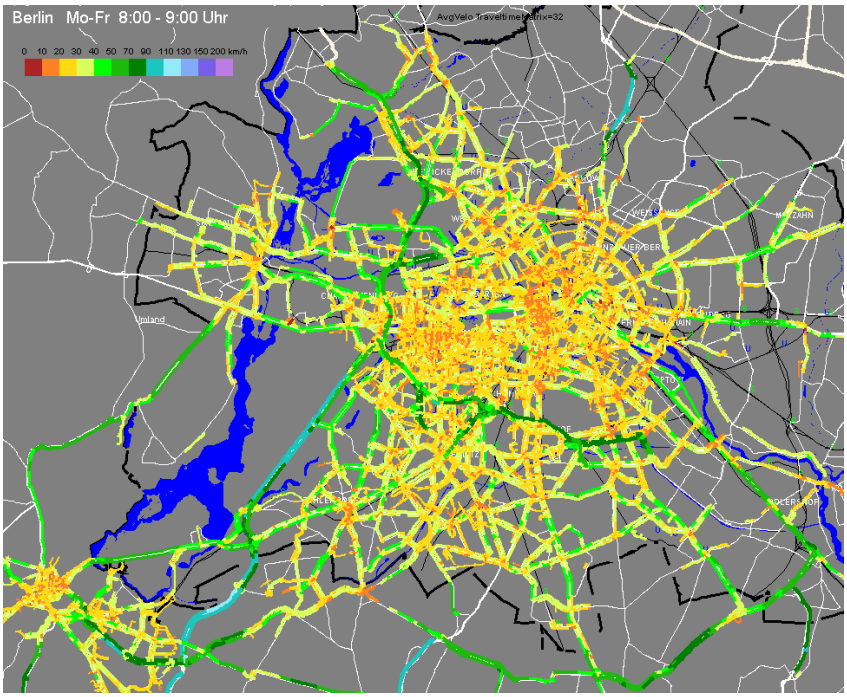
Morning rush hour for 2004: mean 32.0 km/h
Evening rush hour for 2004: mean 31.2 km/h

Results
On working days streets are more congested at the evening rush hour. At weekends a considerable shift to higher velocity classes can be observed. There is no significant year-to-year trend. Both daily and weekly course are very similar. Trend investigations of Berlin road infrastructure require long term observations.

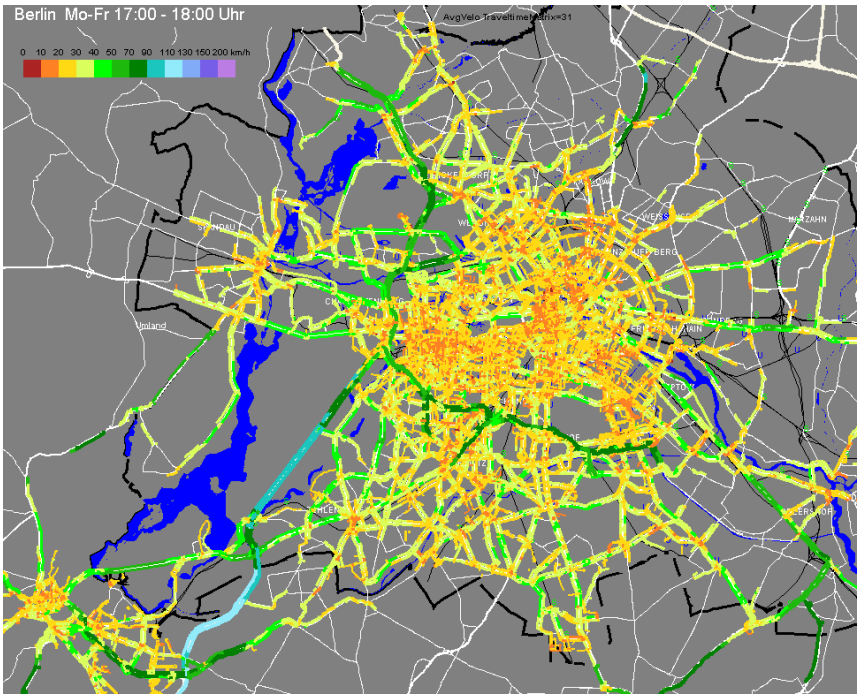
Presentation of congestion data

One way to present congestion situation on city level is the production of road maps indicating different qualities of traffic flow. Below is one example to highlight relevant congestion problem road sections in Berlin. The figure shows the derived velocities for a one-hour period in Berlin. The velocities calculated are based on data from 132 registered taxis in Berlin.

Speed distribution – morning hours (8 – 9 am) derived from FCD in Berlin



Speed distribution – evening hours (5– 6 pm) derived from FCD in Berlin



Source: German Aerospace Center Berlin (unpublished)

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	- Daily trip length (peak and off peak) - Average vehicle speed (peak and off peak)
TERM	Average journey length and time per person, by mode and purpose (work/education, business, shopping, leisure, holidays).
EST	-
CSD	-
NFP (Switzerland)	-
BPI/PRR	-

References

EEA (2000): Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen.

METEOR (2002): WP4 Project Impact Evaluation. Task 4.1. Evaluation Guidelines.

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STERN, E.; SALOMON, I. PIET, H.L. (2002): Travel Behaviour. Spatial Patterns, Congestion and Modelling. Cheltenham, UK; Northampton, MA, USA.

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TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Reduce congestion"

TELLUS Key Indicator: average speed at fixed measure points

Indicator: traffic volume at fixed measuring points

Description of the indicators (network-related congestion measures), relevance

The unit of analysis correspondents to the flow conditions on the network at fixed measure points. The average speed at these measure points and the traffic volume are network-related congestion measures. Low speeds and high traffic volumes are typical for congestion.

Unit of the indicator

Km/h (peak and off peak)
Vehicles/day

Indicator-related objectives

Reduce congestion by 5% until 2006
Reduce congestion by 10% until 2010

Critical aspects of the objectives see Indicator Fact Sheet for "mean journey times"
A disadvantage of these measures is, that network congestion figures provide a picture which is too negative, because they are based on a number of small, behaviourally irrelevant queuing times.
The additional time spent in congestions may be compensated by high speeds in other segments of the trip. These network-related congestion measures do not measure the impact of congestion on users, who avoid the congestion by adapting their behaviour (e.g. by taking a detour route or an earlier departure time with a longer trip time but without congestion).
Another critical issue is to determine a speed which indicates congestion. METEOR says that congestion is the situation, in which the average speed decreases below the pre-defined limit of 80% of the permitted speed. In any case it is helpful just to describe the development of the speed over the time to show the tendency of this indicator.

Methods of obtaining data

Speed measurements by using traffic sensor network which is run by the VMZ. (Verkehrsmanagementzentrale :Traffic management centre)

Source of data and analysis

The data were collected and provided by the VMZ, the analysis was done by IVP.

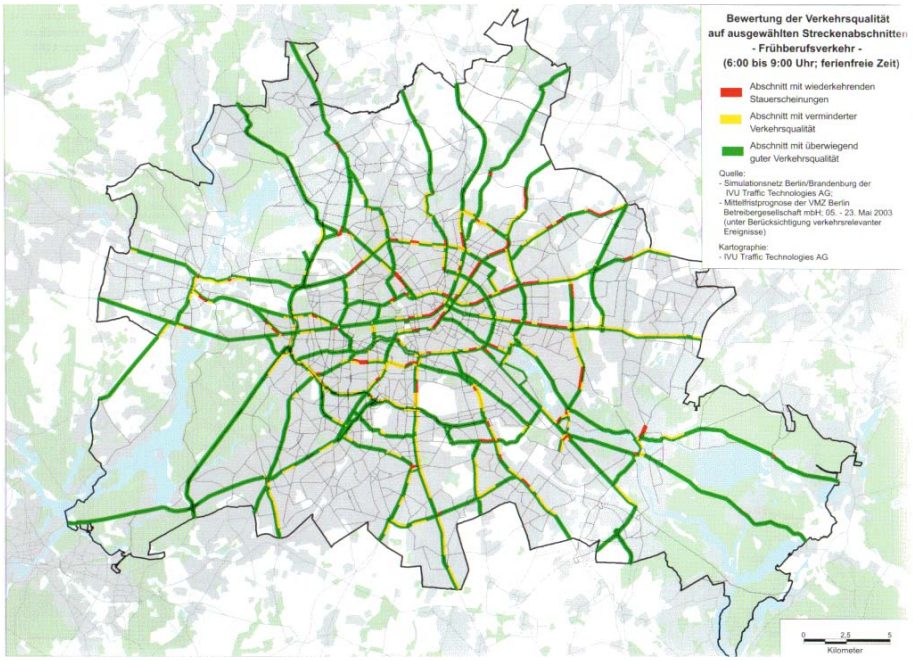
Time table to obtain and analyse the data

Retrospective view: since 2002 until end of the TELLUS Project, the data has been obtained yearly.

Presentation of congestion data

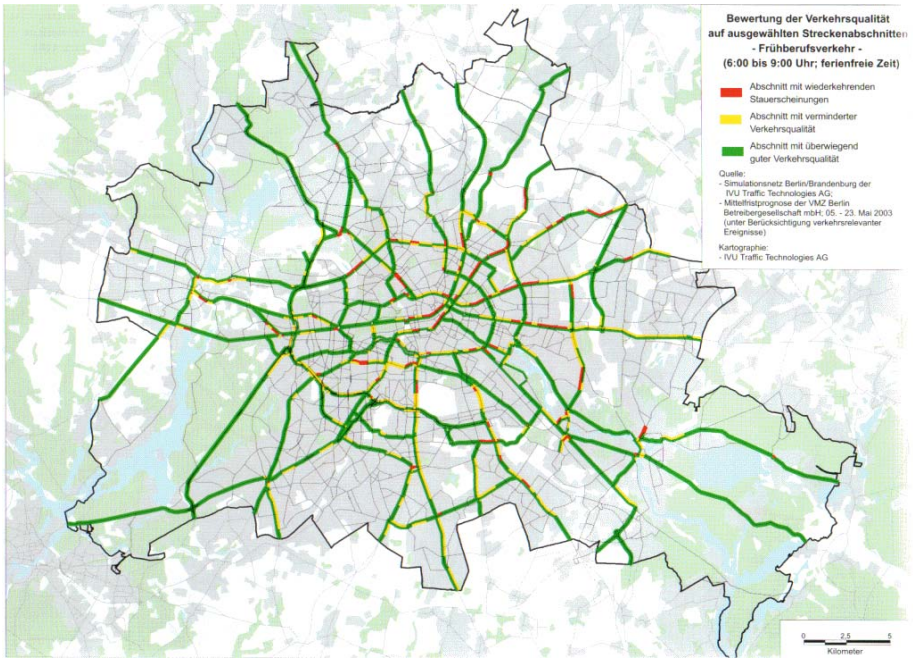
One way to present congestion situation on city level is the production of road maps indicating different qualities of traffic flow. Below is one example to highlight relevant road sections with congestion problems in Berlin. The quality categories used are as follows: red – road section with recurrent congestion pattern; yellow – road section with reduced traffic flow quality; green – no traffic flow reduction.

Network traffic quality in selected road section in Berlin 2003: morning hours (6 – 9 am)



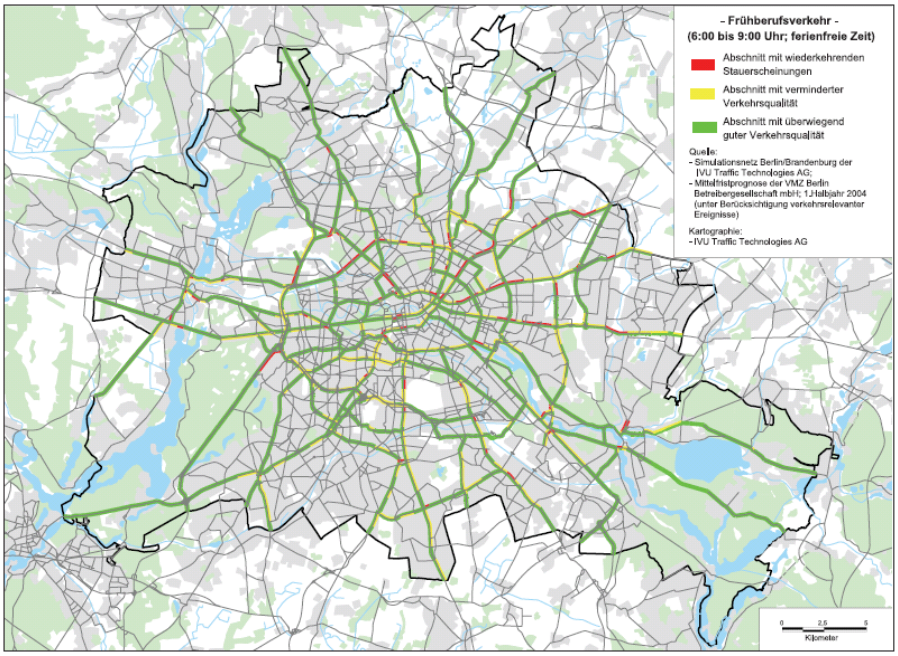
Source: Senatsverwaltung für Stadtentwicklung (ed.) (2003: 20)

Network traffic quality in selected road section in Berlin 2003: afternoon hours (3 – 6 pm)



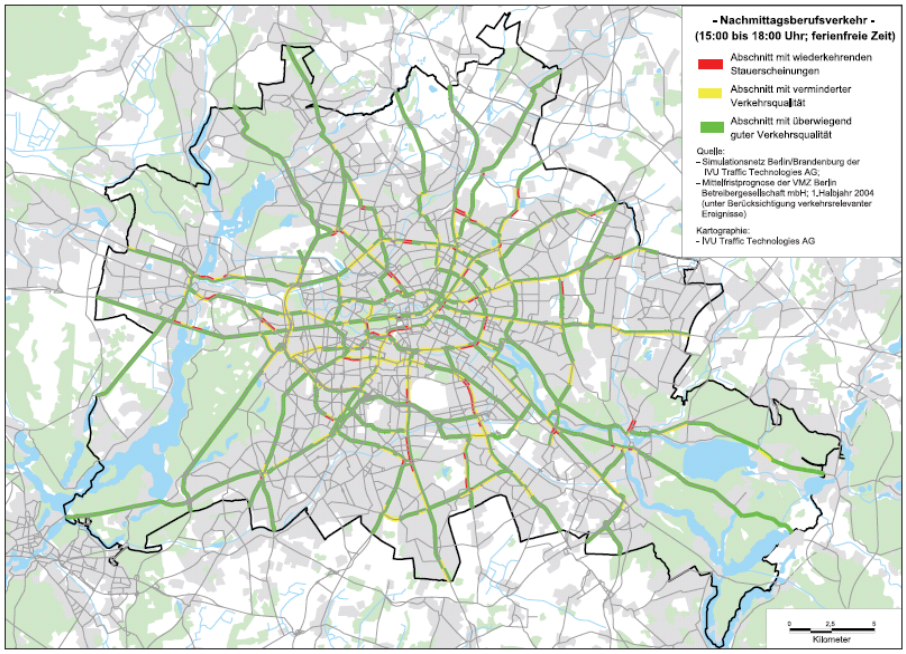
Source: Senatsverwaltung für Stadtentwicklung (ed.) (2003: 21)

Network traffic quality in selected road section in Berlin 2004: morning hours (6 – 9 am)



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2005: 28)

Network traffic quality in selected road section in Berlin 2004: afternoon hours (3 –6 pm)



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2005: 29)

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	-
TERM (EU: European Environment Agency)	-
EST (OECD)	-
CSD (Germany)	-
NFP (Switzerland)	-
BPI/PRR	-

References

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (ed.) (1998): Nachhaltige Entwicklung in Deutschland. Entwurf eines umweltpolitischen Schwerpunktprogramms. Bonn.

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TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Reduce car kilometres"

TELLUS Key Indicator: Car kilometres

Context, impacts

Passenger transport demand especially by car has increased much more rapidly than population over the past 25 years, reflecting a rise in mobility: the average daily distance travelled by EU citizens was 16.5 km in 1970 and 36 km in 1996. The spatial spread of economic activities, urban sprawl, the evolving service sector, higher disposable incomes and car ownership, and increased leisure time all influence size of mobility.[3]

Car kilometres are an important input variable for ecological and social adverse effects in the transport sector. The more vehicle kilometres, the higher emissions, noise levels, consumption of resources and the annoyance of the inhabitants.

Unit of the indicator

Car kilometres (total car km per year)

Indicator-related objectives

Reduce car kilometres by 3% until 2006
Reduce car kilometres by 5% until 2010

Methods measurement

Estimations on the basis of traffic censuses.

Source of data and analysis

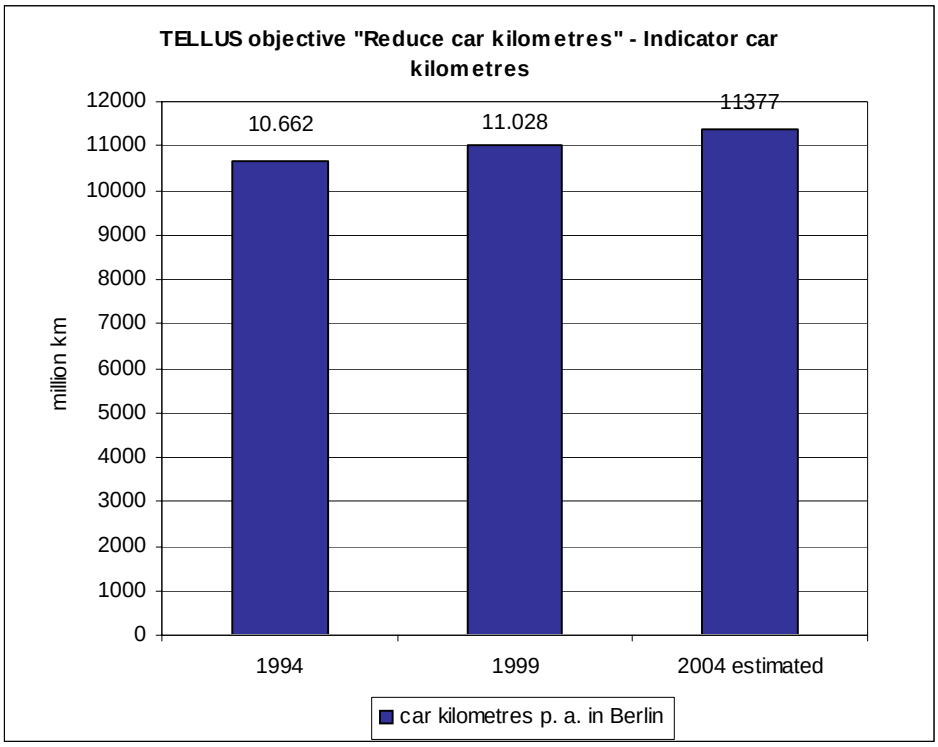
Senate Department of Urban Development

Time table to obtain and analyse the data

Retrospective view: since 1994 until end of the TELLUS Project, the data has been obtained yearly.

[3] EEA (2000: 45 et seq.)

Development of the indicator value



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2001), Senatsverwaltung für Stadtentwicklung (ed.) (1998: 40), own estimate

In order to estimate the 'car kilometres' for the year 2004 the development of the 'total average daily car mileage' has been examined. Between 1998 and 2004 the 'average daily car mileage' increased from 32,960,796 to 34,003,740, which can be expressed by the rate of increase.

Total average daily car mileage in Berlin (in km)

1998	2004	*Rate of increase between 1998 -2004*
32,960,796	34,003,740	*1.0316*

Senatsverwaltung für Stadtentwicklung (ed.) (2005: 19)

A simplified estimate of the annual car kilometres in 2004 is based on the following assumption: annual car kilometres in 1999 multiplied by the rate of increase for average daily car mileage.

Estimated annual car kilometres for 2004: 11,028 * 1.0316 = 11,377 million car kilometres

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS)	Average modal split (vehicle and passenger)
NFP (Switzerland)	-
BPI/PRR (UBA Germany)	Percentage of non motorised transport; percentage of cars with more than one passenger
TERM (EU: European Environment Agency)	-
EST (OECD)	-
CSD (Germany)	**-**

References

EEA (2000): Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen.

EEA (2001): TERM 2001. Indicators tracking transport and environment integration in the European Union. Copenhagen.

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TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Increase of public transport use"

TELLUS Key Indicator: Passenger kilometres

TELLUS Key Indicator: Passengers

Description of the indicators, relevance

Growing attractiveness of public transport should be related in increasing numbers of passenger kilometres and passengers.
Unfortunately prices for public transport are increasing while those for car use remain about constant. Alternatives to the car are often lacking or they appear less attractive or illadapted to new urban patterns. Initiatives like improved services are meant to break this trend but these have as yet had little impact.[4]

Unit of the indicator

Passenger kilometres,
Passengers (total number)

Indicator-related objectives

Increase of public transport use by 5% until 2006
Increase of public transport use by 10% until 2010

Critical aspects
Increasing numbers of passenger kilometres and passengers are not necessarily combined with decreasing numbers in car kilometres and are consequently not suitable to show a trend towards more sustainability.

Methods of measurement

Assessments by the local public transport company.

Source of data and analysis

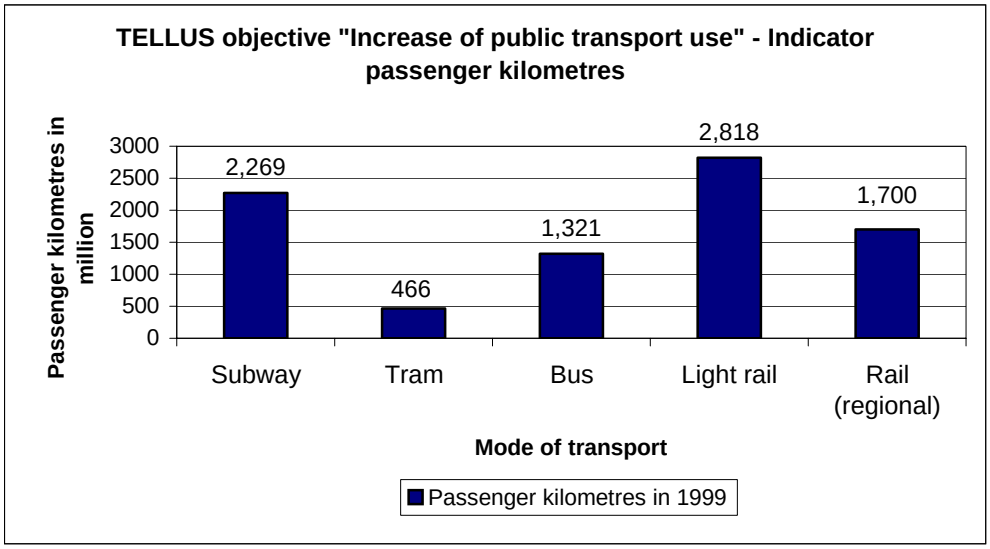
BVG, S-Bahn

Time table to obtain and analyse the data

Retrospective view: since 1999 until end of the TELLUS Project, the data has been obtained yearly.

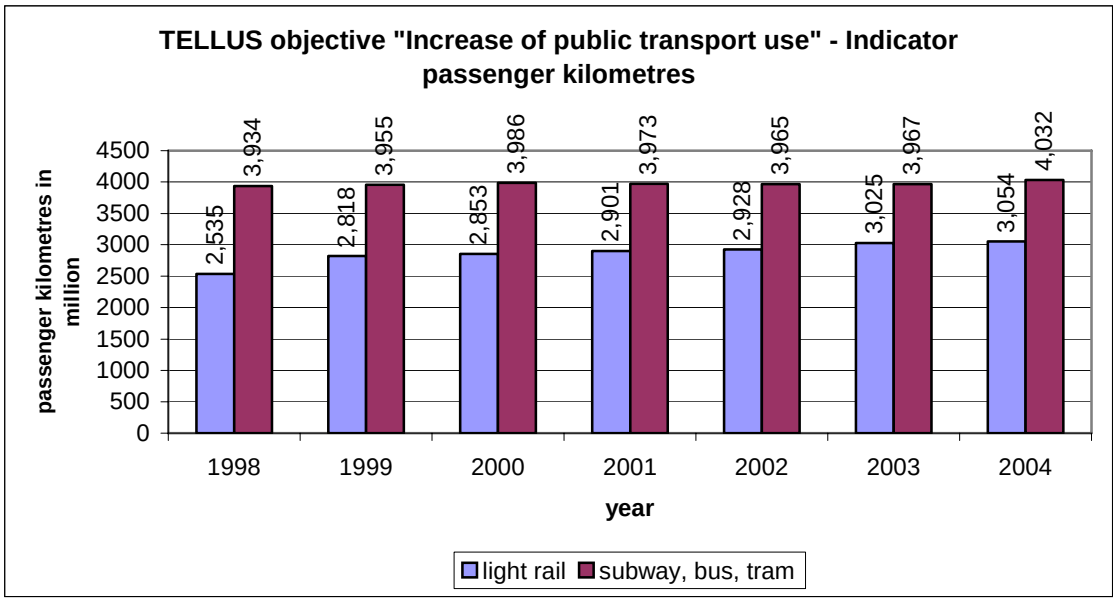
[4] EEA (2001: 23)

Development of the indicator value

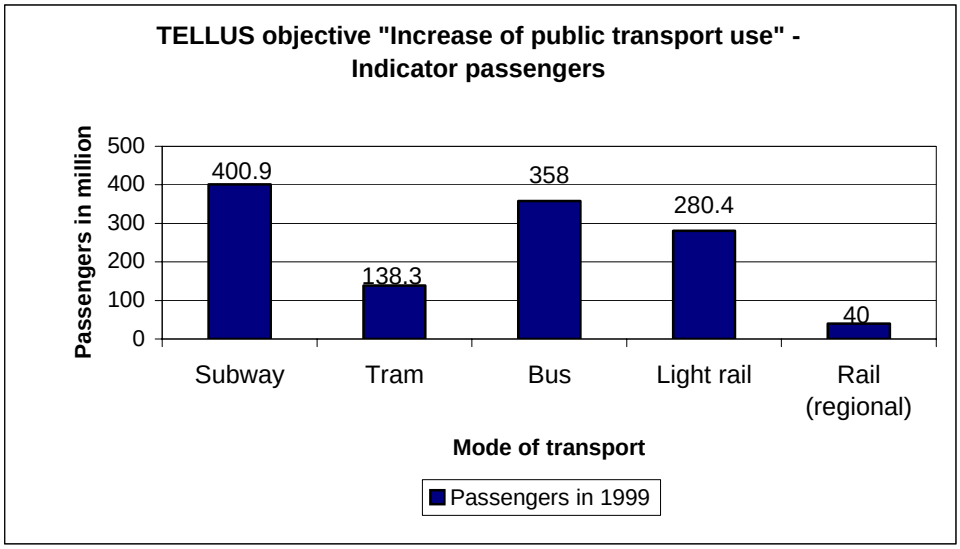


Source: Senatsverwaltung für Stadtentwicklung (ed.) (2000: II-15)

The following graph considers the two public transport companies in Berlin. Light rail is operated by DB/ S-Bahn and subway, bus and tram by BVG.

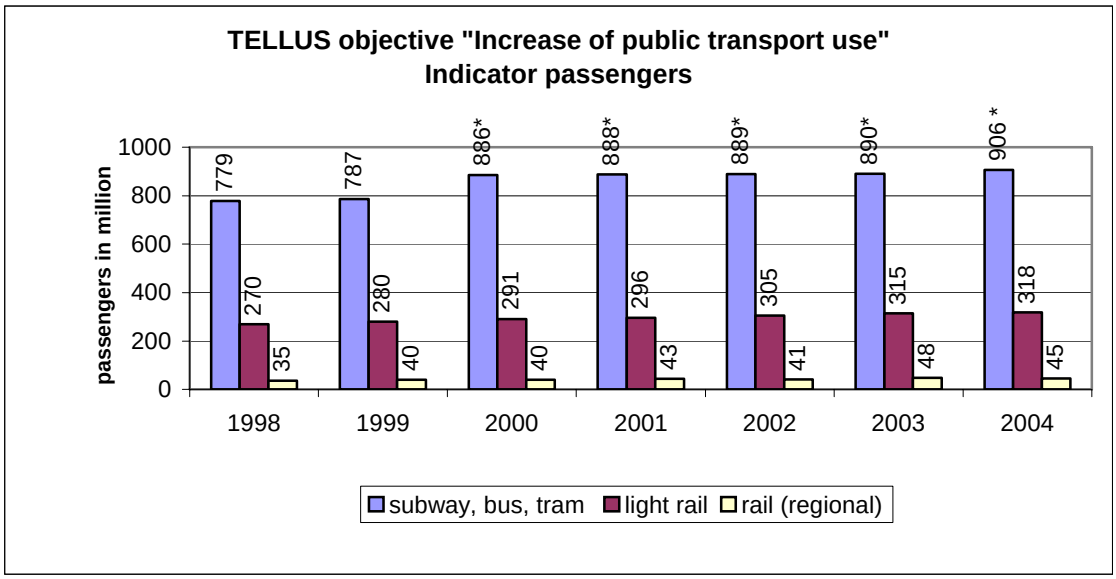


Source: Berliner Verkehrsbetriebe (BVG) (2005), S-Bahn Berlin GmbH (2003)



Senatsverwaltung für Stadtentwicklung (ed.) (2001: II-15)

The following graph considers the two public transport companies in Berlin. Light rail is operated by DB/ S-Bahn and subway, bus and tram by BVG.



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2005: 37), Berliner Verkehrsbetriebe (BVG) (2005), S-Bahn Berlin GmbH (2003)

* Different calculation methods were applied from 2000 onwards.

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS)	-
NFP (Switzerland)	-
BPI/PRR (UBA Germany)	-
TERM (EU: European Environment Agency)	Passenger-km travelled by mode of transport
EST (OECD)	-
CSD (Germany)	- kilometres travelled by public transport (absolute) - kilometres travelled by public transport (relating to inhabitants)

References

EEA: TERM (2001). Indicators tracking transport and environment integration in the European Union. Copenhagen.

Hesse, M. et al. (1997): Konzeptionelle Entwicklung von Nachhaltigkeitsindikatoren für den Bereich Verkehr. UFOPLAN 1997, Forschungsvorhaben 201 03 211. Schlussbericht. Berlin.

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S-Bahn Berlin GmbH (2003): Umweltbericht der S-Bahn Berlin GmbH 1998-2003. Berlin.

TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Increase the modal share in favour of public transport"

TELLUS Key Indicator: Average modal split

Context, impacts

Total passenger kilometres travelled in the EU more than doubled over the period 1970-1997. The average growth rate of 2.8% per year is even higher than the average growth in GDP over the same period (2.5 % per year).[5]

Passenger car transport is the primary carrier in the EU: over the period from 1980 to 1997 its share rose from 66 to 77%.

The share of rail is decreasing, as the train is often not considered to be an attractive option, partly because of inefficient rail services.

The modal shares of walking and cycling have declined. However half of all car trips are less than 6 km. Moreover 10% are less than 1 km, which is an ideal distance for walking.[6]

Motorised vehicles are a burden on the environment in terms of emissions, noise, congestion. Furthermore the amount of space in the cities for alternative usage decreases. The performance of measures should be monitored through the dynamics of modal split. The modal split of non-motorised modes should increase in the context of successful demonstration measures.

Unit of the indicator

Percentage of trips or vehicle kilometres or passenger kilometres.

Indicator-related objectives

Increase the modal share in favour of public transport by about 3% until 2006
Increase the modal share in favour of public transport by about 5% until 2010

Critical aspects

The modal split is a controversial indicator since it is derived as the percentage of a varying main unit. Consequently the percentage of car trips can decrease (recognised as a positive trend) while the absolute number of trips by car increases continuously because the main unit increases too.

Methods of measurement

Model calculations by the Senate Department of Urban Development.

Source of data and analysis

Senate Department of Urban Development.
The IVP collected and analysed the data.

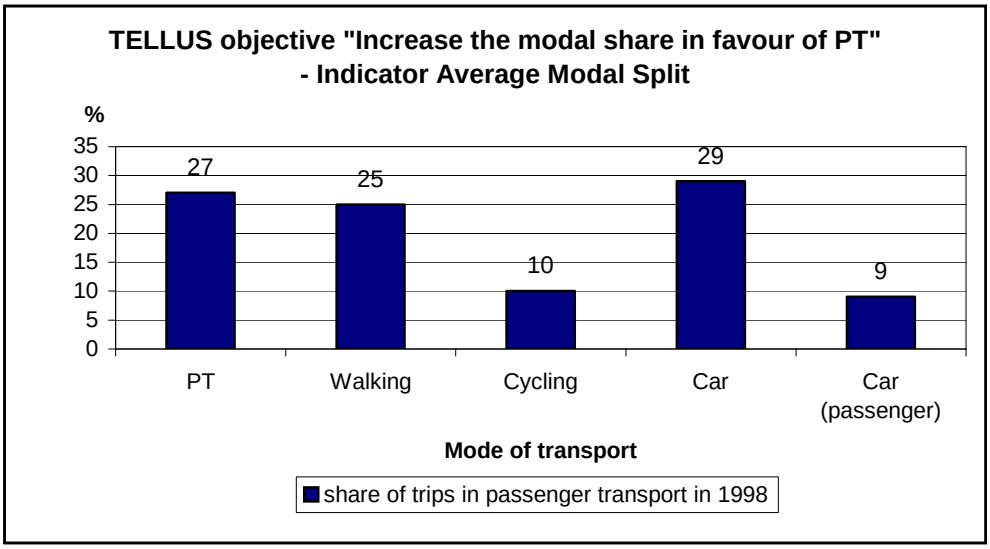
[5] EEA (2000: 48)
[6] EEA (2001: 23)

Time table to collect and analyse the data

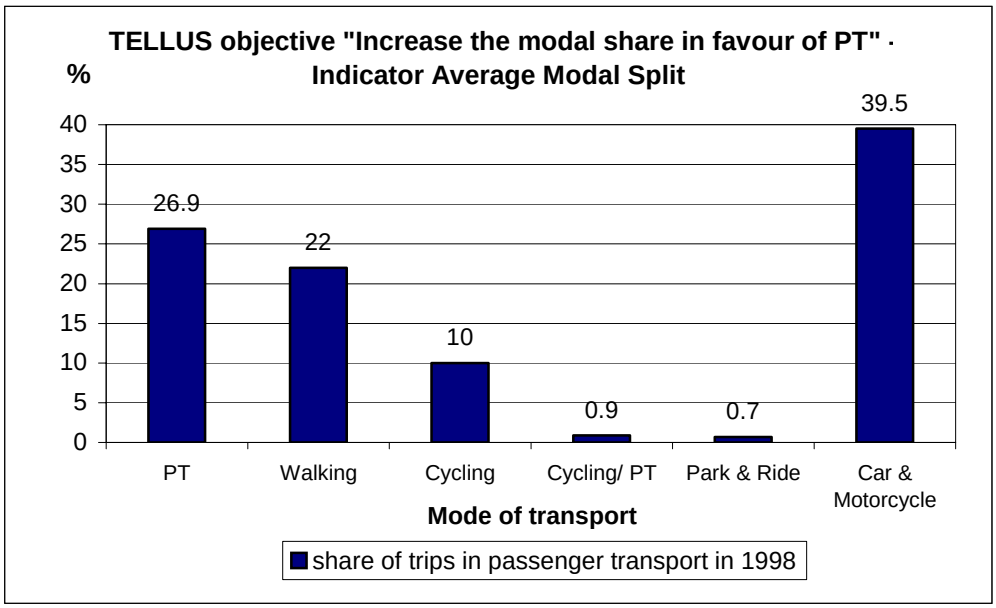
Retrospective view: From 1998 until the end of the TELLUS Project. The data has been collected as often as results had been available.

There is a weakness in monitoring due to non-availability of data for the last years. Modal-split figures are based on the household survey carried out in 1998. Scenarios for the local transport plan consider a planning period up to 2015 and estimate modal-split figures on the basis of the 1998-household-survey. It is intended to carry out a new household survey but due to high survey costs the time is not yet fixed.[7]

Development of the indicator value



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2003: VIII)



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2000: II-6)

[7] see Senatsverwaltung für Stadtentwicklung (ed.) (2005)

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS)	Average modal split (vehicle and passenger)
NFP (Switzerland)	-
BPI/PRR (UBA Germany)	Percentage of non motorised transport; percentage of cars with more than one passenger
TERM (EU: European Environment Agency)	Passenger-km travelled by mode of transport
EST (OECD)	-
CSD (Germany)	**-**

References

EEA (2000): Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen.

EEA (2001): TERM 2001. Indicators tracking transport and environment integration in the European Union. Copenhagen.

METEOR (2002): WP4 Project Impact Evaluation. Task 4.1. Evaluation Guidelines.

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Senatsverwaltung für Stadtentwicklung (ed.) (2005): Mobilität der Stadt. Berliner Verkehr in Zahlen. Berlin.

Surburg, U. et al. (BPI/PRR) (2001): Kommunale Agenda 21 – Modellvorhaben: Dauerhaft umweltverträgliche Mobilität in Stadt und Region. Teilvorhaben 1: Erstellung eines Katalogs technischer und planerischer Qualitätsziele. Endbericht Teil 2. Ziel- und Indikatorensysteme einer nachhaltigen Mobilität. Berlin.

TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Reduce air pollution"

TELLUS Key Indicator: level of PM_{10}

Context, impacts

"The transport sector is a major source of air pollution, and the dominant source in urban areas. Exposure to air pollution can cause adverse health effects, most acute in children, asthmatics, and the elderly, and can damage vegetation and materials (notably, the cultural heritage). Within the transport sector, road traffic is the most important contributor to urban air pollution. While national and EU regulations aimed at automobile emission reductions have resulted in considerably lower emissions per vehicle, the continuous expansion of the vehicle fleet is partly offsetting these improvements." [8]
Particulate matter is primarily emitted by diesel engines. Because of the adverse health effects particulate matter is the most severe air pollution problem affecting large cities. Particulate matter irritates the membranes of the respiratory system, causing increased respiratory symptoms and diseases like cancer.
Current trends show that gasoline is more and more substituted by diesel because of the higher energy efficiency.

Unit of the indicator

µg/m³

Indicator-related objectives

Reduce air pollution to levels below national and EC directives until 2006.

Critical aspects
EC directives are not sufficient to prevent serious health risks.

Methods of measurement

Use of the data of the air quality monitoring network in Berlin.

Source of data and analysis

Senate Department of Urban Development: data of air quality, annual reports. IVP collected and analysed the data.

[8] EEA (2000: 27)

Legal basis, standard values, political objectives

EU directive:

Council Directive 1999/30/EC

	Averaging period	Limit value	Margin of tolerance	Date by which limit value is to be met
Stage 1				
24-hour limit value for the protection of human health	24 hours	50 µg/m^3 PM_{10}, not to be exceeded more than 35 times a calendar year	50% on the entry into force of this Directive, reducing on 1 January 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2005	1 January 2005
Annual limit value for the protection of human health	Calendar year	40 µg/m^3 PM_{10}	20% on the entry into force of this Directive, reducing on 1 January 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2005	1 January 2005
Stage 2(1)				
24-hour limit value for the protection of human health	24 hours	50 µg/m^3 PM_{10}, not to be exceeded more than 7 times a calendar year	To be derived from data and to be equivalent on the Stage 1 limit value	1 January 2010
Annual limit value for the protection of human health	Calendar year	20 µg/m^3 PM_{10}	50% on 1 January 2005 reducing every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2010	1 January 2010

(1) Indicative limit values to be reviewed in the light of further information on health and environmental effects, technical feasibility and experience in the application of Stage 1 limit values in the Member States.

Schedule for meeting limit values regarding margin of tolerance

year	24-hour limit value			Annual limit value		
	limit value	tolerance value	limit value + margin of tolerance	limit value	tolerance value	limit value + margin of tolerance
Stage 1						
since to be in force of Directive	50 µg/m^3	25 µg/m^3	75 µg/m^3	40 µg/m^3	8 µg/m^3	48 µg/m^3
1 January 2001	50 µg/m^3	20 µg/m^3	70 µg/m^3	40 µg/m^3	6,4 µg/m^3	46,4 µg/m^3
1 January 2002	50 µg/m^3	15 µg/m^3	65 µg/m^3	40 µg/m^3	4,8 µg/m^3	44,8 µg/m^3
1 January 2003	50 µg/m^3	10 µg/m^3	60 µg/m^3	40 µg/m^3	3,2 µg/m^3	43,2 µg/m^3
1 January 2004	50 µg/m^3	5 µg/m^3	55 µg/m^3	40 µg/m^3	1,6 µg/m^3	41,6 µg/m^3
1 January 2005	50 mg/m^3	0 µg/m^3	50 µg/m^3	40 µg/m^3	0 µg/m^3	40 µg/m^3
Stage 2						
1 January 2005	50 µg/m^3	To be derived from data and to be equivalent on the Stage 1 limit value		20 µg/m^3	10 µg/m^3	30 µg/m^3
1 January 2006	50 µg/m^3			20 µg/m^3	8 µg/m^3	28 µg/m^3
1 January 2007	50 µg/m^3			20 µg/m^3	6 µg/m^3	26 µg/m^3
1 January 2008	50 µg/m^3			20 µg/m^3	4 µg/m^3	24 µg/m^3
1 January 2009	50 µg/m^3			20 µg/m^3	2 µg/m^3	22 µg/m^3
1 January 2010	50 µg/m^3			20 µg/m^3	0 µg/m^3	20 µg/m^3

National directives:

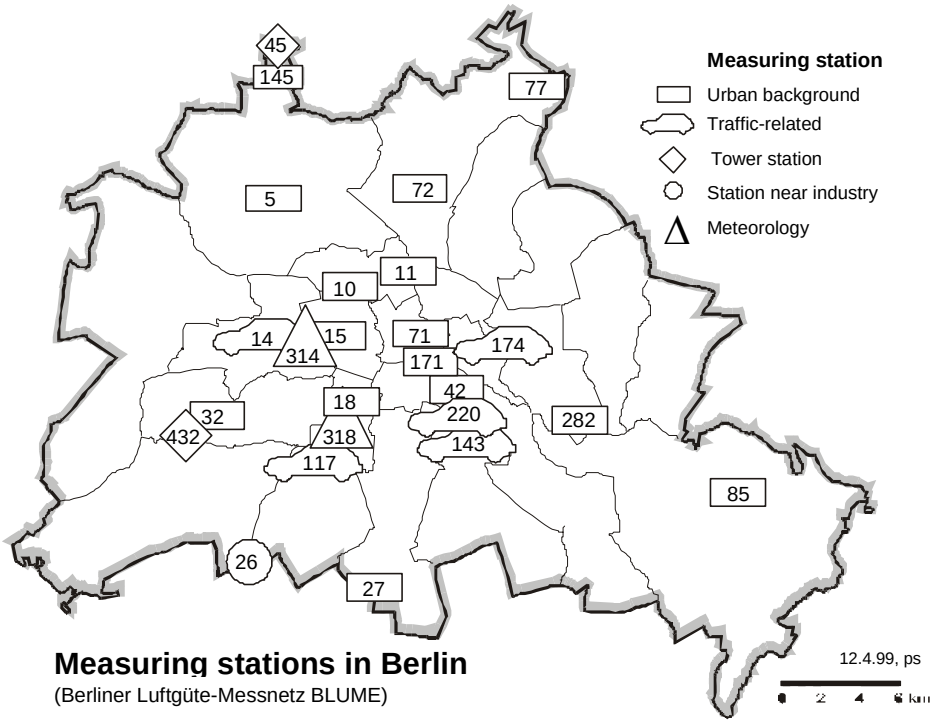
The Directive 1999/30/EC of the European Parliament and of the Council was transferred into national legislation in 2002. Relevant on national level is the 22. BImSchV, that has been in force since 12 September 2002.

Time table to collect and analyse the data

Retrospective view: From 2000 until end of the TELLUS Project. The data has been generated yearly; the analysis was done by the IVP.

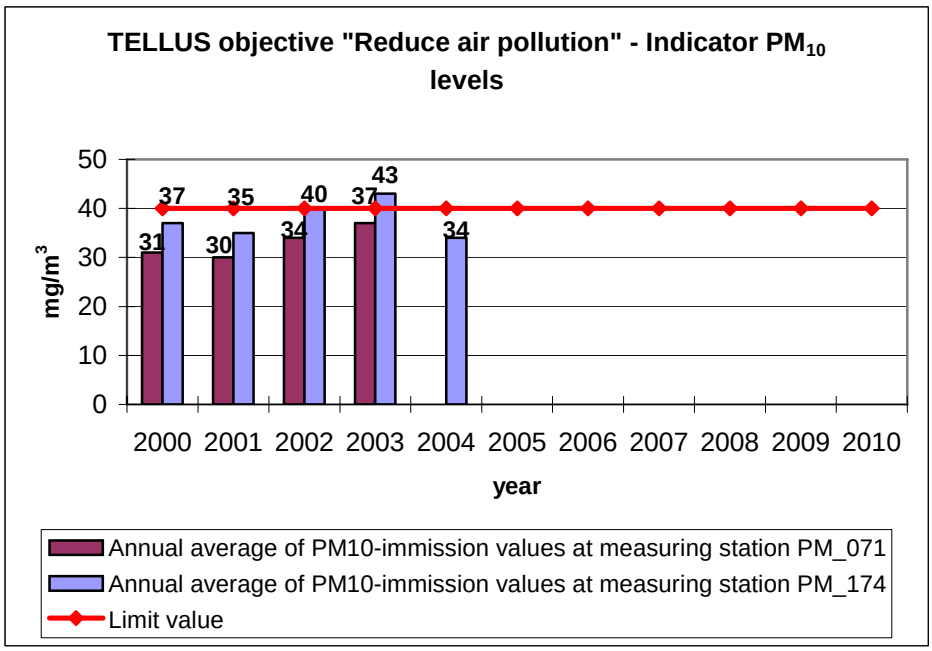
Development of the indicator value

The figure gives an overview of Berlin measuring stations with their identification number.



PM_{10} was measured in 2000 at measuring stations 42, 71, 77, 14, 117, 174. In 2001 and 2002 the measurement network for PM_{10} was extended and PM_{10} is now measured at 13 measuring stations.

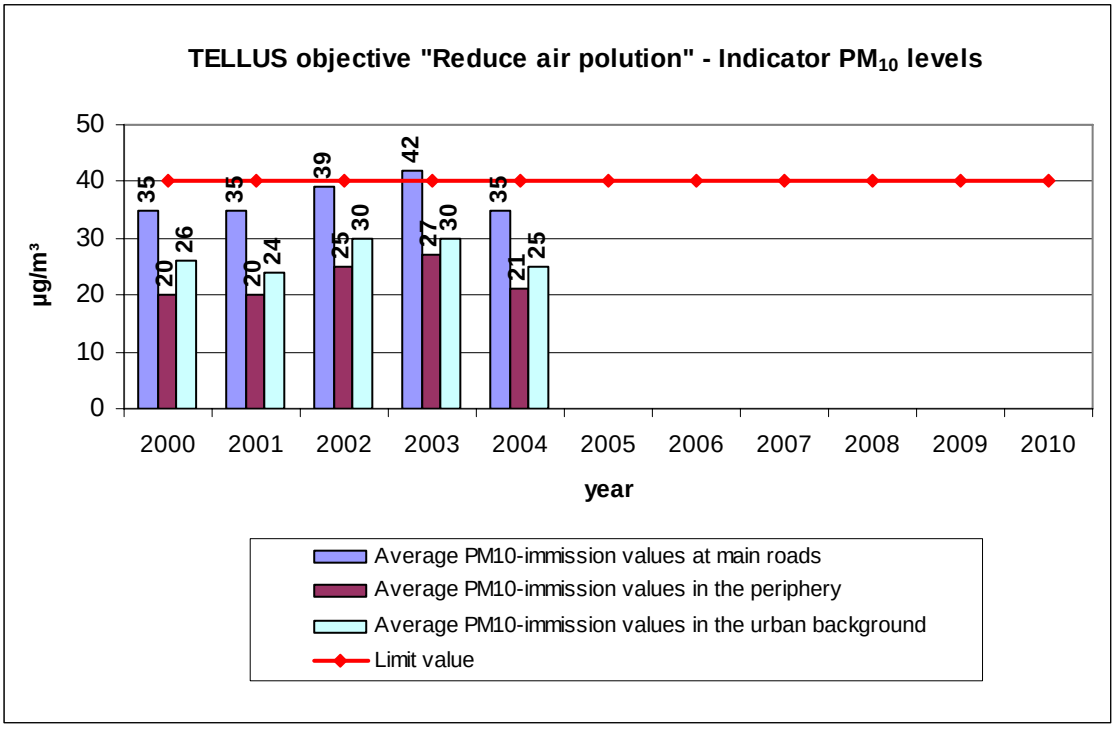
Annual limit value for the protection of human health (annual average)



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2001, 2002, 2003, 2004, unpublished)

The graph shows the annual average of PM_{10} at measuring station PM_071 and PM_174. Measuring station PM_071 is located in the urban background. PM_174 is a measuring station situated near a main road. It was the measuring station with the highest PM_{10} values in the city in 2000, 2001 and 2002. In 2003 and 2004 the measuring station with the highest annual average values was PM_014. Measuring station PM_071 was put out of operation in 2004.

Annual limit value for the protection of human health (annual average)



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2005)

The annual limit value of 40µg/m^3 (valid until 01.01.2005) was not exceeded at any measuring station in the city in 2000, 2001, 2002 and 2004. In 2003 the limit value was exceeded at all measuring stations at main roads (PM_014, PM_117, PM_174). The limit value plus margin of tolerance for the year 2003 of 43 mg/m^3 was exceeded at measuring station PM_014.

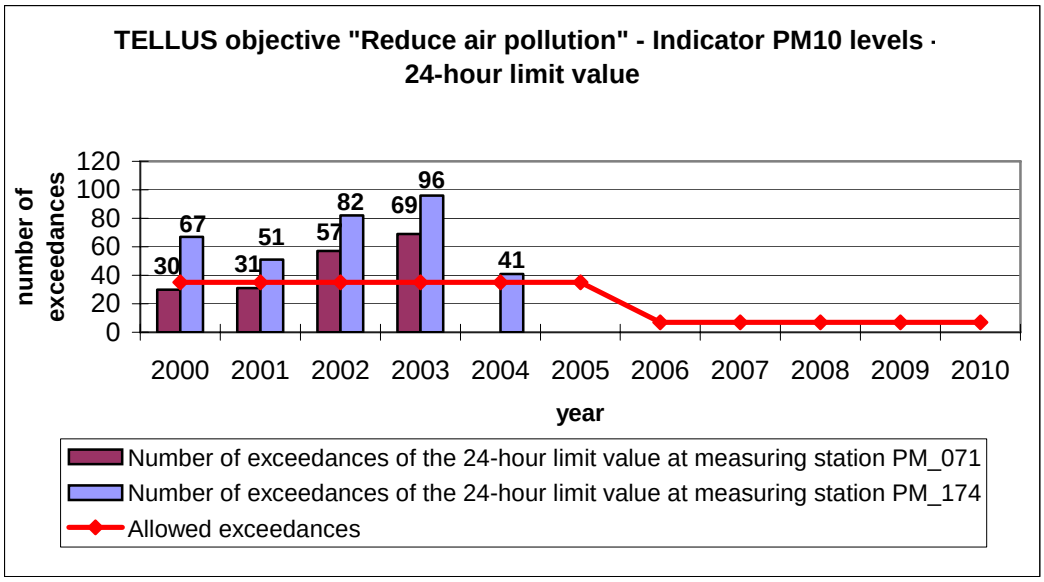
24-hour limit value for the protection of human health (24-hour average)

year	24h limit value	
	limit value	measuring stations with more than 35 exceedences
2000	50 µg/m^3	at 3 stations of 6
2001	50 µg/m^3	at 4 stations of 12
2002	50 µg/m^3	at 9 stations of 13
2003	50 µg/m^3	at 10 stations of 14
2004	50 µg/m^3	at 3 stations of 12
2005	50 µg/m^3	
2006	50 µg/m^3	

Source: Senatsverwaltung für Stadtentwicklung (ed.) (2001, 2002, 2003, 2004, unpublished)

The table shows the number of exceedances of the 24 hour limit value for the protection of human health of 50µg/m³ and the number of measuring stations, where this limit value was exceeded. According to Directive 1999/30/EC no more than 35 exceedances are allowed per annum.

24-hour limit value for the protection of human health (24-hour average)



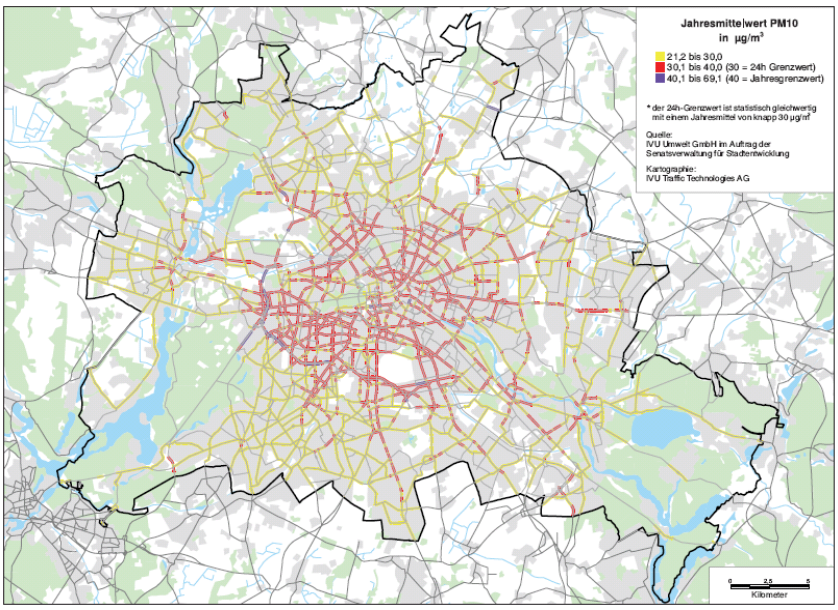
Source: Senatsverwaltung für Stadtentwicklung (ed.) (2001, 2002, 2003, 2004, unpublished)

The graph shows the number of exceedances of the 24-hour limit value of 50 µg/m³ at measuring stations PM_071 and PM_174. Measuring station PM_071 was put out of operation in 2004.
In 2002 and 2003 the allowed number of exceedances (35 times a year till 2005) was exceeded at several measuring stations in the city and in 2004 at all measuring stations at main roads.

Presentation of PM_{10} data

One way to present the immission load situation on city level is the production of road maps indicating spatial dispersion of PM_{10}. Below is one example to highlight relevant PM_{10} problem road sections in Berlin. The quality categories used are as follows: yellow – road section with 21.2 to 30.0 µg/m³ annual value; red – road section with 30.1 to 40.0 µg/m³ annual value; purple – 40.1 to 69.1 µg/m³ annual value (40 = limit value).

Immission load of PM_{10} in 2002 (annual mean)



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2005: 72)

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	Particulate levels (PM_{10} concentration on an annual basis, in ppm or g/m³)
TERM	Emission of PM - kilo tonnes: The emission reduction during the last decade are mainly due to abatement measures; light and heavy good vehicles are the largest emitters in road transport.
EST	-
CSD	-
NFP (Switzerland)	PM_{10} level at the places of residence (% excessively burdened people)
BPI/PRR	-

References

EEA (2000): Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen.

METEOR (2002): WP4 Project Impact Evaluation. Task 4.1. Evaluation Guidelines.

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Spillmann, W. et al. (1998): Nachhaltigkeit: Kriterien im Verkehr. Berichte des NFP 41 “Verkehr und Umwelt”, Bericht C5. Bern.

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TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Reduce air pollution"

TELLUS Key Indicator: level of NO_2

Context, impacts

"The transport sector is a major source of air pollution, and the dominant source in urban areas, having overtaken the combustion of high-sulphur coal, oil and industrial combustion processes. Exposure to air pollution is associated with adverse health effects, most acute in children, asthmatics, and the elderly, and can damage vegetation and materials (notably, the cultural heritage). Within the transport sector, road traffic is the most important contributor to urban air pollution. While national and EU regulations aimed at automobile emission reductions (such as the introduction of catalytic converters or unleaded petrol) have resulted in considerably lower emissions per vehicle, the continuous expansion of the vehicle fleet is partly offsetting these improvements."[9]

Nitrogen oxides are produced whenever air is involved in high-temperature combustion processes. Exposure to NO_2 is associated with adverse health effects. Ambient nitrogen dioxide causes respiratory problems in humans and damage to plants.

Unit of the indicator

µg/m³

Indicator-related objectives

Reduce air pollution to levels below national and EC directives until 2006.

Methods of measurement

Air quality is one of the major elements of environmental analysis in urban transport. Berlin keeps an air quality monitoring network (BLUME and RUBIS network). Changes in the concentration of NO_2 over the lifetime of the TELLUS Project were observed and comparisons to the time before the implementation of TELLUS had been made. Nevertheless, the interpretation of the indicator has to take into consideration that the local air quality is influenced by a variety of non-transport and non-project related factors.

Berlin uses also air pollution models to calculate concentrations of air pollutants on all main roads (model: IMMIS-Luft).

For the analysis of the air quality the average value of the relevant measuring stations is sufficient.

Source of data and analysis

Senate Department of Urban Development: data of air quality, annual reports. IVP collects and analyses the data.

[9] EEA (2000: 27)

Legal basis, standard values, political objectives

EU directive:

Council Directive 1999/30/EC

	Averaging period	Limit value	Margin of tolerance	Date by which limit value is to be met
Hourly limit value for the protection of human health	1 hour	200 µg/m^3 NO_2, not to be exceeded more than 18 times a calendar year	50% on the entry into force of this Directive, reducing on 1 January 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2010	1 January 2010
Annual limit value for the protection of human health	Calendar year	40 µg/m^3 NO_2	50% on the entry into force of this Directive, reducing on 1 January 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2010	1 January 2010

Schedule for meeting limit values regarding margin of tolerance

year	**Hourly limit value**			**Annual limit value**		
	limit value	**tolerance value**	**limit value + margin of tolerance**	**limit value**	**tolerance value**	**limit value + margin of tolerance**
since to be in force of Directive	200 mg/m^3	100 mg/m^3	300 mg/m^3	40 mg/m^3	20 mg/m^3	60 mg/m^3
1 January 2001	200 mg/m^3	90 mg/m^3	290 mg/m^3	40 mg/m^3	18 mg/m^3	58 mg/m^3
1 January 2002	200 mg/m^3	80 mg/m^3	280 mg/m^3	40 mg/m^3	16 mg/m^3	56 mg/m^3
1 January 2003	200 mg/m^3	70 mg/m^3	270 mg/m^3	40 mg/m^3	14 mg/m^3	54 mg/m^3
1 January 2004	200 mg/m^3	60 mg/m^3	260 mg/m^3	40 mg/m^3	12 mg/m^3	52 mg/m^3
1 January 2005	200 mg/m^3	50 mg/m^3	250 mg/m^3	40 mg/m^3	10 mg/m^3	50 mg/m^3
1 January 2006	200 mg/m^3	40 mg/m^3	240 mg/m^3	40 mg/m^3	8 mg/m^3	48 mg/m^3
1 January 2007	200 mg/m^3	30 mg/m^3	230 mg/m^3	40 mg/m^3	6 mg/m^3	46 mg/m^3
1 January 2008	200 mg/m^3	20 mg/m^3	220 mg/m^3	40 mg/m^3	4 mg/m^3	44 mg/m^3
1 January 2009	200 mg/m^3	10 mg/m^3	210 mg/m^3	40 mg/m^3	2 mg/m^3	42 mg/m^3
1 January 2010	200 mg/m^3	00 mg/m^3	200 mg/m^3	40 mg/m^3	0 mg/m^3	40 mg/m^3

National directives:

The Directive 1999/30/EC of the European Parliament and of the Council was transferred into national legislation in 2002. Relevant on national level is the 22. BImSchV, that has been in force since 12 September 2002.

The following national regulations provide more limit values for NO_2 levels.

National legal basis	Averaging period	limit value
Immission values according TA-Luft	Calendar year	80 µg/m^3
	98%-value (0.5 h)[1]	200 µg/m^3
MIK values according VDI 2310	0.5 hours	200 µg/m^3
	24 hours	100 µg/m^3
Concentration values according 23.BImSchV	98%-value (0.5h)[1]	160 µg/m^3

MIK = maximum immissions concentration
MIK values according VDI 2310 are not mandatory.
TA-Luft (Technische Anleitung zur Reinhaltung der Luft) = technical direction for air pollution prevention
VDI (Verein Deutscher Ingenieure) = the Association of Engineers in Germany
[1] = 98% value of all average 0.5 hour values of a year

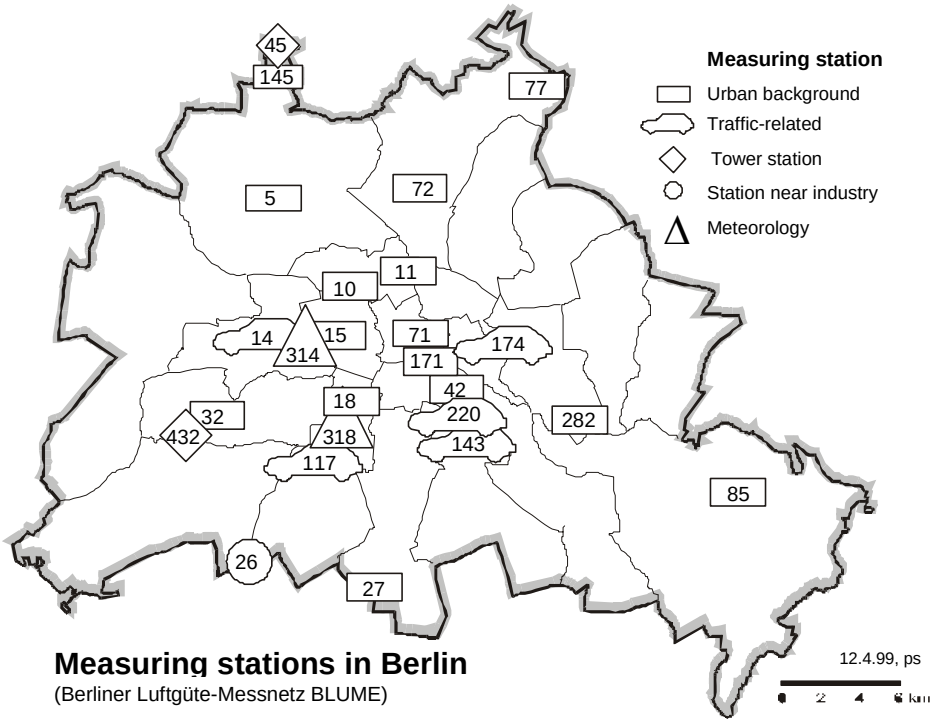
Furthermore in the 22.BImSchV an alarm threshold of 400µg/m^3 for an average period of an hour measured three hours in a row is defined.

Time table to collect and analyse the data

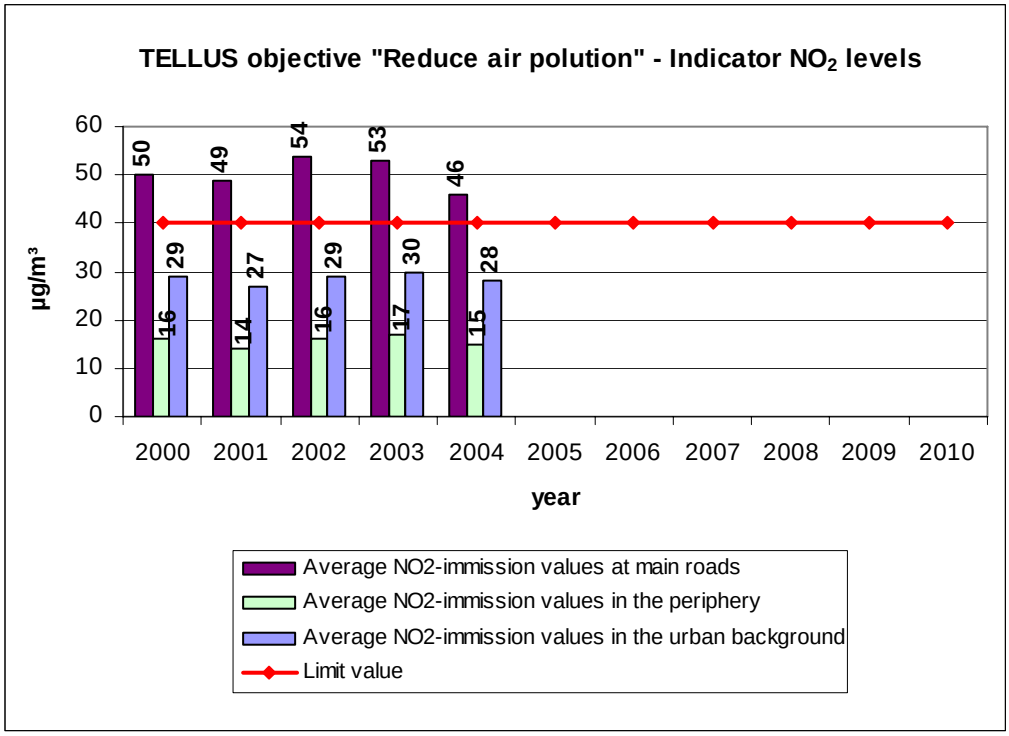
Retrospective view: From 2000 until end of the TELLUS Project, the data will be collected and analysed yearly.

Development of the indicator value

The figure gives an overview of Berlin measuring stations with their identification number.



Annual limit value for the protection of human health (annual average)



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2001, 2002, 2003, 2004, unpublished)

The graph shows the annual average of NO_2-immissions (annual limit value for the protection of human health is 40 µg/m^3) on the five measuring stations near heavily stressed main roads compared to the average of NO_2-immissions of seven measuring stations in the urban background and six measuring stations in the periphery.
The average values at measuring stations at main roads exceed the annual limit value for the protection of human health of 40 µg/m^3 that is to be met in 2010.

The table provides an overview of the number of measuring stations with exceedances of the annual limit value for the protection of human health of 40 µg/m^3 and of the annual limit value plus the margin of tolerance.

year	Annual limit value			
	limit value	exceedances	limit value + margin of tolerance	exceedances
2000	40 mg/m^3	at 4 measuring stations	60 mg/m^3	at 1 measuring station (143)
2001	40 mg/m^3	at 5 measuring stations	58 mg/m^3	at 1 measuring station (143)
2002	40 mg/m^3	at 5 measuring stations	56 mg/m^3	at 1 measuring station (143)
2003	40 mg/m^3	at 5 measuring stations	54 mg/m^3	at 2 measuring stations (143, 117)
2004	40 mg/m^3	at 6 measuring stations	52 mg/m^3	at 1 measuring station (117)
2005	40 mg/m^3		50 mg/m^3	
2006	40 mg/m^3		48 mg/m^3	

Hourly limit value for the protection of human health (hourly average)

The table shows the number of exceedances of the hourly limit value for the protection of human health of 200 µg/m³ and the number of measuring stations, where this limit value was exceeded. According to Directive 1999/30/EC not more than 18 exceedances in a calendar year are allowed.

year	Hourly limit value			
	limit value	number of exceedances	at number of measure stations	measure stations with more than 18 exceedances
2000	200 mg/m3	28	1	at 1 measuring station (143)
2001	200 mg/m3	3	2	
2002	200 mg/m3	1	1	
2003	200 mg/m3	62	5	at 2 measuring stations (143, 115)
2004	200 mg/m3	2	1	
2005	200 mg/m3			
2006	200 mg/m3			

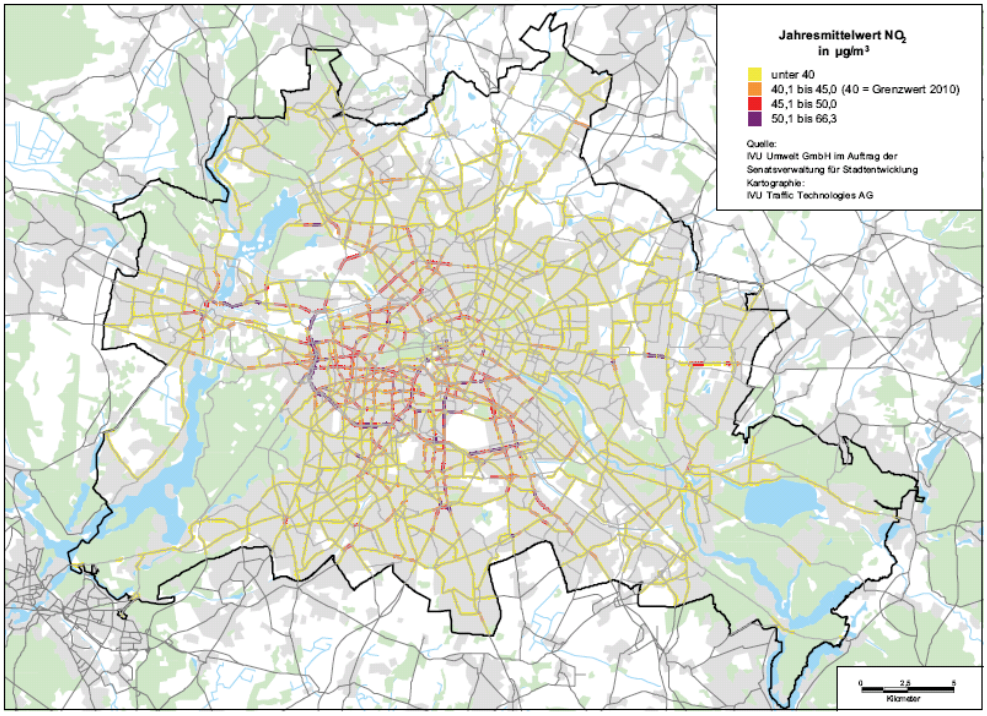
Source: Senatsverwaltung für Stadtentwicklung (ed.) (2001, 2002, 2003, 2004, unpublished)

Measuring station 115 operates since 1 August 2003. For that reason the values of the measurements cannot be considered for the calculations of the annual average of NO_2-immissions (annual limit value for the protection of human health of 40 µg/m^3).

Presentation of NO_2 data

One way to present the immission load situation on city level is the production of road maps indicating spatial dispersion of NO_2. Below is one example to highlight relevant NO_2 problem road sections in Berlin. The quality categories used are as follows: yellow – road section with values below 40 µg/m^3 ; orange – road section with 40.1 to 45.0 µg/m^3 annual value (40 = limit value in 2010); red – road section with 45.1 to 50.0 µg/m^3 annual value purple – above 50.0 µg/m^3 annual value.

Immission load of NO_2 in 2002 (annual mean)



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2005: 70)

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	NO_x levels (NO_x concentration on an annual basis, in ppm or g/m³)
TERM	NO_x emissions: kilo tonnes NO_x is the most important pollutant contributing to the formation of acidifying substances and tropospheric ozone; passenger cars are the largest NO_x emitters (59%); increase road travel has partly offset reductions achieved.
EST	-
CSD	-
NFP (Switzerland)	NO_x level at the places of residence (% excessively burdened people)
BPI/PRR (UBA Germany)	Percentage of inhabitants exposed to NO_x levels under 25 µg/m³, resp. percentage of road length

References

EEA (2000): Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen.

METEOR (2002): WP4 Project Impact Evaluation. Task 4.1. Evaluation Guidelines.

Senatsverwaltung für Stadtentwicklung (ed.) (2001): Luftgütemessdaten Jahresbericht 2000. Berlin.

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Senatsverwaltung für Stadtentwicklung (unpublished.): Luftgütemessdaten Jahresbericht 2004. Berlin.

Senatsverwaltung für Stadtentwicklung (ed.) (2005): Mobilität der Stadt. Berliner Verkehr in Zahlen. Berlin.

Spillmann, W. et al. (1998): Nachhaltigkeit: Kriterien im Verkehr. Berichte des NFP 41 “Verkehr und Umwelt”, Bericht C5. Bern.

Surburg, U. et al. (BPI/PRR) (2001): Kommunale Agenda 21 – Modellvorhaben: Dauerhaft umweltverträgliche Mobilität in Stadt und Region. Teilvorhaben 1: Erstellung eines Katalogs technischer und planerischer Qualitätsziele. Endbericht Teil 2. Ziel- und Indikatorensysteme einer nachhaltigen Mobilität. Berlin.

TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Reduce air pollution "

TELLUS Key Indicator: level of benzene

Context, impacts

"The transport sector is a major source of air pollution, and the dominant source in urban areas. Exposure to air pollution can cause adverse health effects, most acute in children, asthmatics, and the elderly, and can damage vegetation and materials (notably, the cultural heritage). Within the transport sector, road traffic is the most important contributor to urban air pollution. While national and EU regulations aimed at automobile emission reductions have resulted in considerably lower emissions per vehicle, the continuous expansion of the vehicle fleet is partly offsetting these improvements."[10]
Emissions of benzene occur when there is combustion of carbon compounds. Emissions are the result of incomplete combustion, spillage or evaporative emissions.
Benzene contributes to ozone formation, has direct toxic effects on humans and animals, including carcinogenesis and neurotoxicity, and it is harmful to plants.
Emissions of benzene decreased significantly during the last years.

Unit of the indicator

µg/m³

Indicator-related objectives

Reduce air pollution to levels below national and EC directives until 2006

Critical aspects
Due to its carcinogenic properties there is no safe level for this pollutant. For carcinogenic substances total elimination should be the goal.

Methods of measurement

Use of the air quality monitoring network in Berlin.

Source of data and analysis

Senate Department of Urban Development: data of air quality, annual reports. IVP collected and analysed the data.

Legal basis, standard values, political objectives

EU directive:

[10] EEA (2000: 27)

Directive 2000/69/EC of the European Parliament and of the Council

	Averaging period	Limit value	Margin of tolerance	Date by which limit value is to be met
Limit value for the protection of human health	Calendar year	5 µg/m^3	5 µg/m^3 (100%) on 13 December 2000, reducing on 1 January 2006 and every 12 months thereafter by 1 µg/m^3 to reach 0% by 1 January 2010	1 January 2010

Schedule for meeting limit values regarding margin of tolerance

year	**limit value**	**tolerance value**	**limit value + margin of tolerance**
13 December 2000	5 µg/m^3	5 µg/m^3	10 µg/m^3
1 January 2001	5 µg/m^3	5 µg/m^3	10 µg/m^3
1 January 2002	5 µg/m^3	5 µg/m^3	10 µg/m^3
1 January 2003	5 µg/m^3	5 µg/m^3	10 µg/m^3
1 January 2004	5 µg/m^3	5 µg/m^3	10 µg/m^3
1 January 2005	5 µg/m^3	5 µg/m^3	10 µg/m^3
1 January 2006	5 µg/m^3	4 µg/m^3	9 µg/m^3
1 January 2007	5 µg/m^3	3 µg/m^3	8 µg/m^3
1 January 2008	5 µg/m^3	2 µg/m^3	7 µg/m^3
1 January 2009	5 µg/m^3	1 µg/m^3	6 µg/m^3
1 January 2010	5 µg/m^3	0 µg/m^3	5 µg/m^3

National directives:

The Directive 2000/69/EC of the European Parliament and of the Council was transferred into national legislation in 2002. Relevant on national level is the 22. BImSchV, that has been in force since 12 September 2002.

The following national regulation provides one more limit value for CO levels.

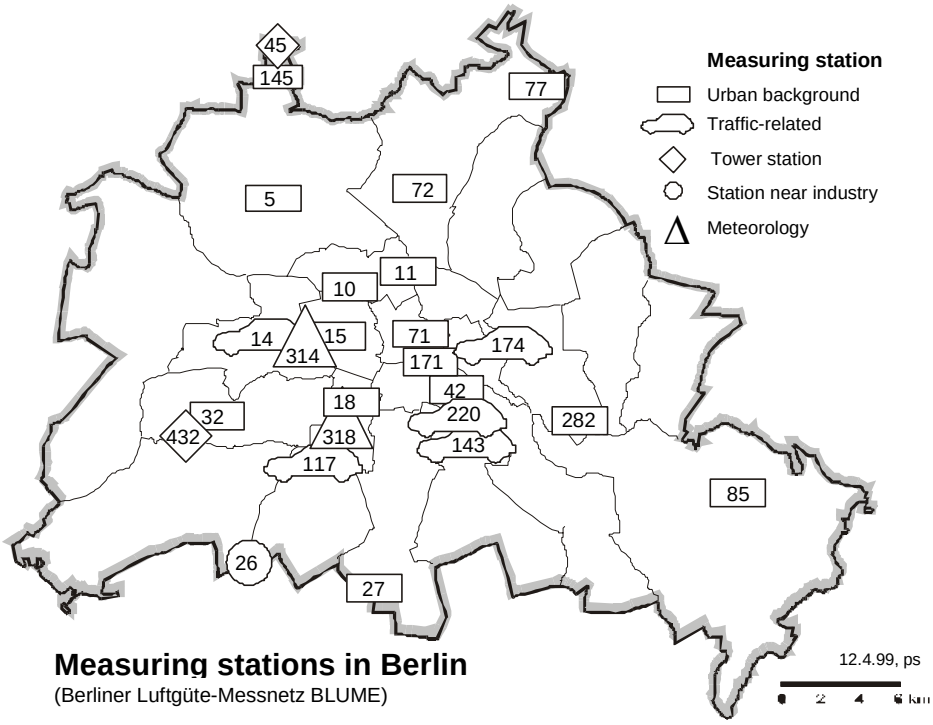
National legal basis	Averaging period	limit value
concentration values according 22.BImSchV	Calendar year	10 µg/m^3

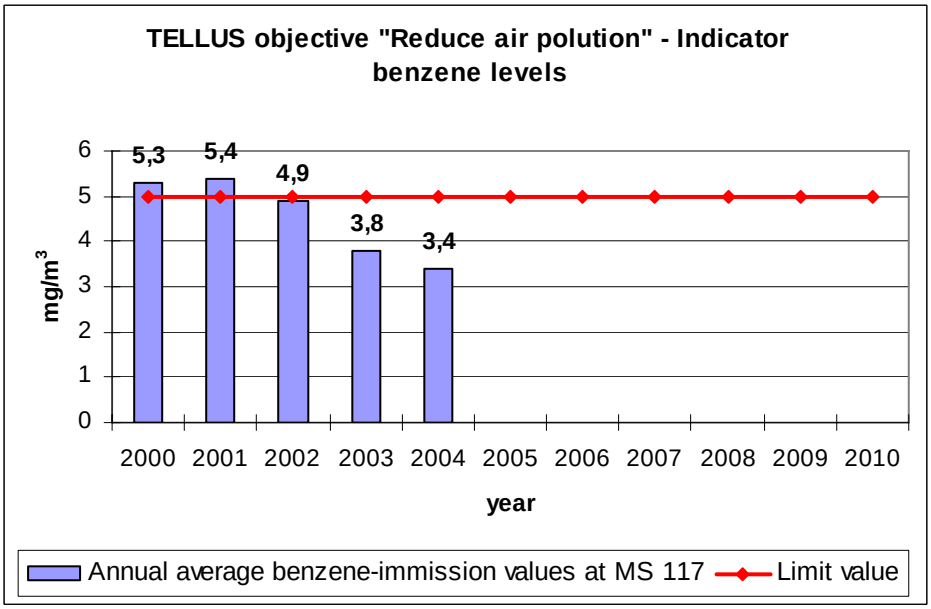
Time table to collect and analyse the data

Retrospective view: From 2000 until end of the TELLUS Project, the data has been collected and analysed yearly.

Development of the indicator value

The figure gives an overview of Berlin measuring stations with their identification number.





Source: Senatsverwaltung für Stadtentwicklung (ed.) (2001, 2002, 2003, 2004, unpublished)

The graph shows the annual average of benzene immission values at measuring station 117. This measuring station is situated close to a main road. It is the measuring station with the highest values of benzene in the city. In 2000 and 2001 the limit value for the protection of human health was only exceeded at measuring station 117. In 2002, 2003 and 2004 the given limit value (5 $\mu g/m^3$) was not exceeded neither at this nor at another measuring station.

Annual average of benzene (in mg/m³)

	MS 145 periphery	MS 42 periphery	MS 71 urban background	MS 14 urban background	MS 117 main road	MS 174 main road	annual average
2000	0.8	1.9	2.0	2.5	5.3	3.9	2.7
2001	1.5	2.0	2.0	3.2	5.4	4.2	3.1
2002	1.2	1.7	2.3	3.1	4.9	3.8	2.8
2003	1.2	1.7	2.1	2.4	3.8	3.1	2.4
2004	-	1.4	-	1.7	3.4	2.6	2.3

Source: Senatsverwaltung für Stadtentwicklung (ed.) (2001, 2002, 2003, 2004, unpublished)

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR	-
TERM	-
EST	-
CSD	-
NFP (Switzerland)	-
BPI/PRR	-

References

EEA (2000): Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen.

METEOR (2002): WP4 Project Impact Evaluation. Task 4.1. Evaluation Guidelines.

Senatsverwaltung für Stadtentwicklung (ed.) (2001): Luftgütemessdaten Jahresbericht 2000. Berlin.

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Senatsverwaltung für Stadtentwicklung (ed.) (2004): Luftgütemessdaten Jahresbericht 2003. Berlin.

Senatsverwaltung für Stadtentwicklung (unpublished): Luftgütemessdaten Jahresbericht 2004. Berlin.

TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Reduce air pollution"

TELLUS Key Indicator: level of CO

Context, impacts

"The transport sector is a major source of air pollution, and the dominant source in urban areas. Exposure to air pollution can cause adverse health effects, most acute in children, asthmatics, and the elderly, and can damage vegetation and materials (notably, the cultural heritage). Within the transport sector, road traffic is the most important contributor to urban air pollution. While national and EU regulations aimed at automobile emission reductions have resulted in considerably lower emissions per vehicle, the continuous expansion of the vehicle fleet is partly offsetting these improvements."[11]

CO is produced by the incomplete burning of carbon in fuels. High concentrations of CO occur along roadsides in heavy traffic, particularly at major intersections. The health effects of CO vary depending on the length and intensity of exposure and the health of the individual. Effects of CO include dizziness, headache, fatigue, visual impairment, reduced work capacity, reduced manual dexterity, and poor learning ability.[12]

Unit of the indicator

mg/m^3

Indicator-related objectives

Reduce air pollution to levels below national and EC directives until 2006

Critical aspects

Due to the anyway low concentration levels of CO this pollutant is no longer a crucial issue regarding air quality.

Methods of measurement

Concentration measurements at fixed street measurement points of the Berlin air quality monitoring network (BLUME).

Source of data and analysis

Senate Department of Urban Development: data of air quality, annual reports; Berlin Statistical Office: Statistical yearbook. IVP collects and analyses the data.

[11] EEA (2000: 27)
[12] See METEOR (2002: Annexes)

Legal basis, standard values, political objectives

EU directive:

Directive 2000/69/EC of the European Parliament and of the Council

	Averaging period	Limit value	Margin of tolerance	Date by which limit value is to be met
Limit value for the protection of human health	Maximum daily 8-hour mean	10 mg/m^3	6 mg/m^3 on 13 December, 2000, reducing on 1 January 2003 and every 12 months thereafter by 2 mg/m^3 to reach 0% by 1 January 2005	1 January 2005

Schedule for meeting limit value regarding margin of tolerance

year	limit value	tolerance value	limit value + margin of tolerance
13 December 2000	10 mg/m^3	6 mg/m^3	16 mg/m^3
1 January 2003	10 mg/m^3	4 mg/m^3	14 mg/m^3
1 January 2004	10 mg/m^3	2 mg/m^3	12 mg/m^3
1 January 2005	10 mg/m^3	0 mg/m^3	10 mg/m^3

National directives:
The Directive 2000/69/EC of the European Parliament and of the Council was transferred into national legislation in 2002. Relevant on national level is the 22. BImSchV that has been force since 12 September 2002.

The following national regulations provide more limit values for CO levels.

National legal basis	Averaging period	limit value
immission values according to TA-Luft	Calendar year	10 mg/m^3
	98%-value (0.5h)[1]	30 mg/m^3
MIK values according to VDI 2310	0.5 hours	50 mg/m^3
	24 hours	10 mg/m^3

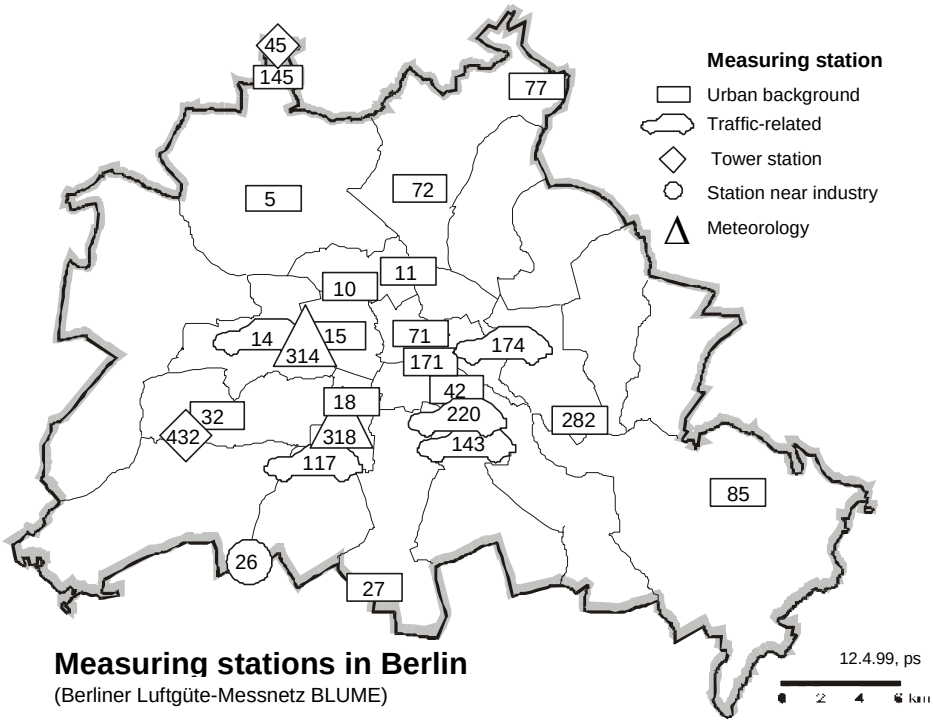
MIK = maxium immissions concentration
MIK values according VDI 2310 are not mandatory.
TA-Luft (Technische Anleitung zur Reinhaltung der Luft) = technical direction for air pollution prevention
VDI (Verein Deutscher Ingenieure) = Association of Engineers in Germany
[1] = 98% value of all average 0.5 hour values of a year

Time table to collect and analyse the data

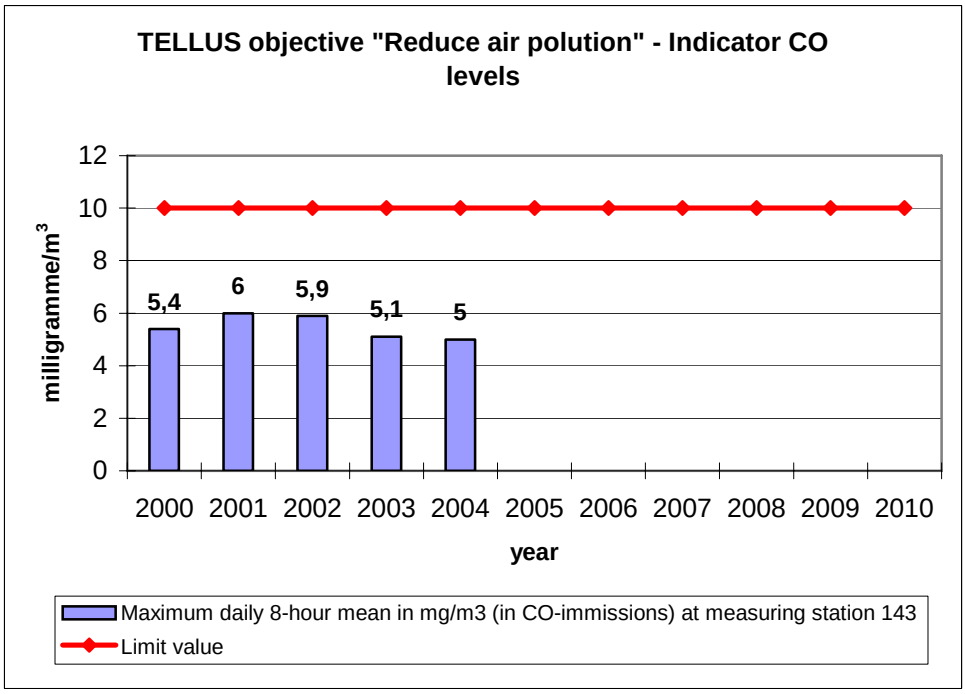
Retrospective view: From 2000 until end of the TELLUS Project, the data has been collected and analysed yearly.

Development of the indicator value

The figure gives an overview of Berlin measuring stations with their identification number.



Limit value for the protection of human health (Maximum daily 8-hour mean)



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2001, 2002, 2003, 2004, unpublished); Statistisches Landesamt Berlin (ed.) (2003: 530)

The graph shows the maximum daily 8-hour mean[13] of measuring station 143. The station is situated near the road. The highest values in the city were measured at this station.

Annual average of CO (in mg/m³)

	periphery	urban background	main roads	average
2000	0.2	0.4	1.1	0.6
2001	0.2	0.3	1.0	0.5
2002	0.3	0.4	1.0	0.6
2003	0.3	0.4	1.0	0.6
2004	0.2	0.4	0.8	0.5

Source: Senatsverwaltung für Stadtentwicklung (ed.) (2001, 2002, 2003, 2004, unpublished)

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	-
TERM	Emissions of CO : kilo tonnes emission reduction during the last decade is mainly a result of improved inspection of vehicles and increased penetration of diesel vehicles; passenger cars are the largest emitters (84%)
EST	-
CSD	-
NFP (Switzerland)	-
BPI/PRR (UBA Germany)	-

References

EEA: Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen 2000.
METEOR (2002): WP4 Project Impact Evaluation. Task 4.1. Evaluation Guidelines.
Senatsverwaltung für Stadtentwicklung (ed.) (2002): Luftgütemessdaten Jahresbericht 2001. Berlin.
Senatsverwaltung für Stadtentwicklung (ed.) (2003): Luftgütemessdaten Jahresbericht 2002. Berlin.
Senatsverwaltung für Stadtentwicklung (ed.) (2004): Luftgütemessdaten Jahresbericht 2003. Berlin.
Senatsverwaltung für Stadtentwicklung (unpublished.): Luftgütemessdaten Jahresbericht 2004. Berlin.
Statistisches Landesamt Berlin (ed.) (2003): Statistisches Jahrbuch 2002. Berlin.

[13] Maximum daily 8-hour mean (= highest value of a period (month or year), calculated from the moving mean over 8 hours (e.g. from 0 to 8, from 1 to 9, from 2 to 10 etc.). Statistisches Landesamt Berlin (ed.) (2002: 492)

TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Reduce traffic related CO_2 emissions"

TELLUS Key Indicator: CO_2 emissions

Context and impacts

Directly and indirectly, fossil fuels provide the energy for almost all transport activities. Transport is the fastest growing energy consumer in the EU. Carbon dioxide emissions (CO_2) are also a surrogate for the use of fossil fuels. CO_2 emissions from transport in the EU increased by 15% between 1990 and 1998. Road transport is the main cause of this increase and contributed 84% of CO_2 emissions in 1998[14].

The global impact of fossil fuel use is that the atmospheric concentrations of the greenhouse gases carbon dioxide, methane (CH_4) and nitrous oxide (N_2O) have grown significantly. Carbon dioxide is the generated pollutant of greatest concern in respect to global impacts on account of its likely involvement in climate change. In the EU CO_2 contributes to about 80% of the total EU greenhouse gas emissions. 24% of the carbon dioxide emissions result from the combustion of fossil fuels in the transport sector.[15]

Unit of the indicator

Tons p.a.

Indicator-related objectives

Reduce traffic related CO_2 emissions by 5% until 2006
Reduce traffic related CO_2 emissions by 10% until 2010

Methods of measurement

Calculations by the Senate Department for Economy. The CO_2 emissions are primary energy related emissions.

Source of data and analysis

Senate Department for Economy: Energy balance. IVP collected and analysed the data.

Political objectives

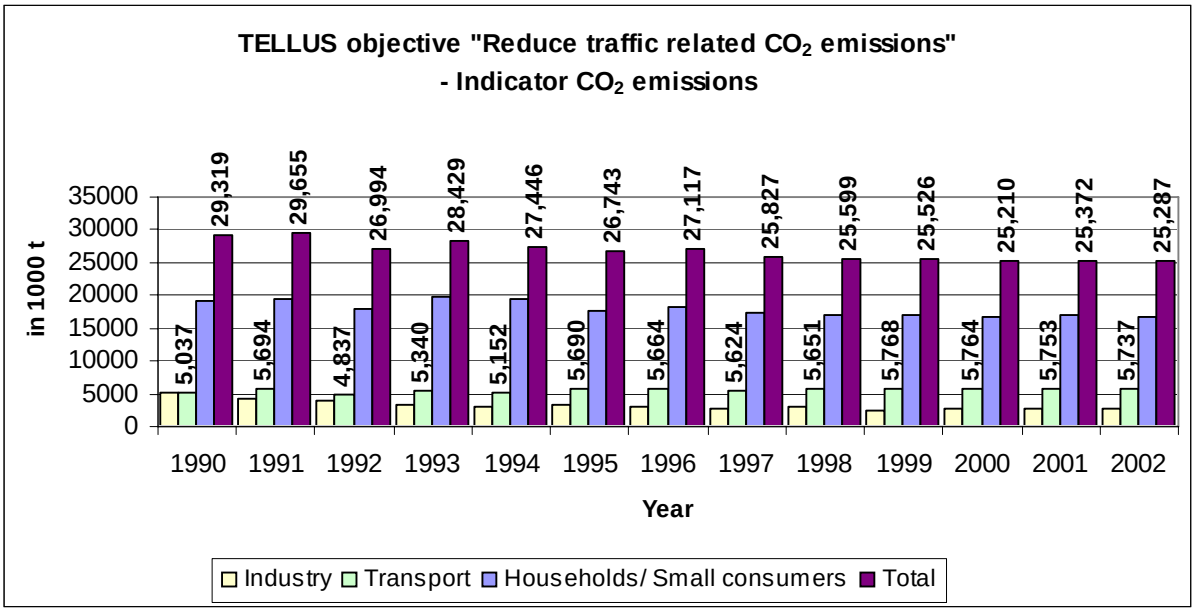
-

[14] EEA (2001: 14)
[15] METEOR (2002)

Time table to collect and analyse the data

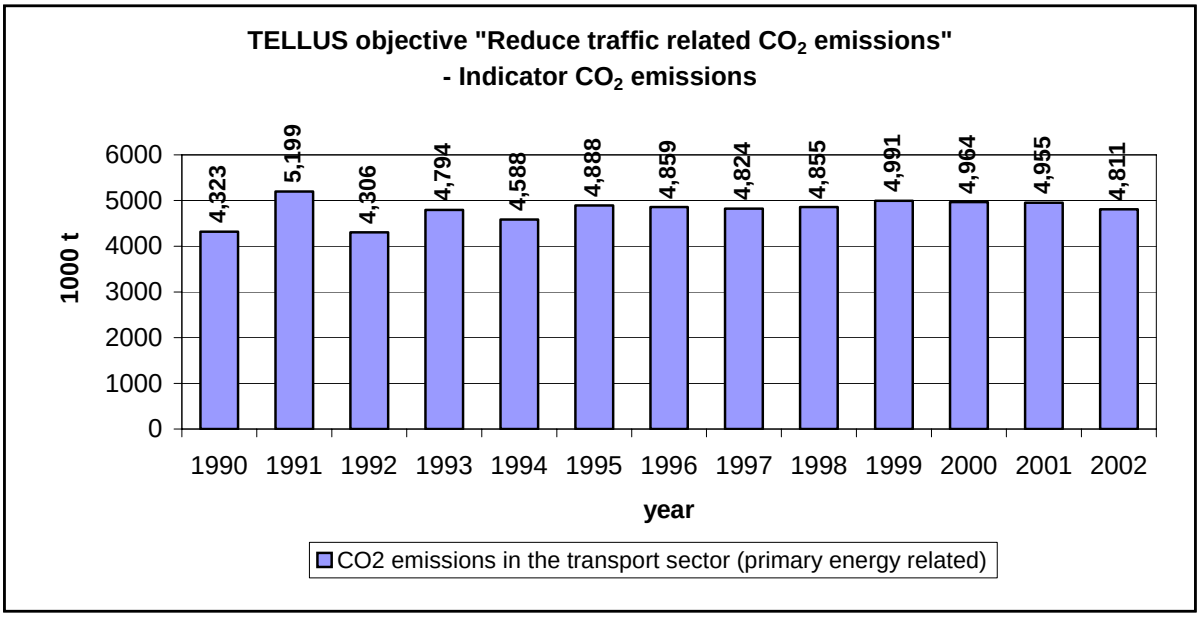
Retrospective view: From 1990 until the end of the TELLUS Project, the data has been calculated yearly.

Development of the indicator value



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2005: 65)

Annotation: The graph is based on *end energy related* data.



Source: Senatsverwaltung für Wirtschaft und Technologie (ed.) (n. d.)

According to information communicated by the Regional Statistic Office in July 2005 calculations for 2003 and later will be made available by the Regional Statistic Office at the end of 2005.

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	CO_2 emissions (CO_2 per vkm (g/km) derived)
TERM (EU: European Environment Agency)	CO_2 emissions (t/a)
EST (OECD)	CO_2 emissions
CSD (Germany)	CO_2 emissions (t/a)
NFP (Switzerland)	Emissions of greenhouse gases (in t CO_2 equivalent/a)
BPI/PRR	CO_2 emissions (t/inhabitant/a)

References

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Ed..) (1998): Nachhaltige Entwicklung in Deutschland. Entwurf eines umweltpolitischen Schwerpunktprogramms. Bonn.

EEA (2000): Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen.

EEA (2001): Indicators tracking transport and environment integration in the European Union. TERM 2001. Copenhagen.

Hesse, M. et al. (1997): Konzeptionelle Entwicklung von Nachhaltigkeitsindikatoren für den Bereich Verkehr. UFOPLAN 1997, Forschungsvorhaben 201 03 211. Schlussbericht. Berlin, Dezember.

METEOR (2002): WP4 Project Impact Evaluation. Task 4.1. Evaluation Guidelines.

OECD, Dist.: 24-Sep-1999: Environmentally Sustainable Transport. Final Report on Phase II of the OECD EST Project. Volume 1: Synthesis Report.

Senatsverwaltung für Wirtschaft und Technologie (ed.) (n. d.): Energiebilanzen für das Land Berlin 2001 und 2002.

Senatsverwaltung für Stadtentwicklung (ed.) (2005): Mobilität der Stadt. Berliner Verkehr in Zahlen. Berlin.

Spillmann, W. et al. (1998): Nachhaltigkeit: Kriterien im Verkehr. Berichte des NFP 41 “Verkehr und Umwelt”, Bericht C5. Bern.

Surburg, U. et al. (BPI/PRR) (2001): Kommunale Agenda 21 – Modellvorhaben: Dauerhaft umweltverträgliche Mobilität in Stadt und Region. Teilvorhaben 1: Erstellung eines Katalogs technischer und planerischer Qualitätsziele. Endbericht Teil 2. Ziel- und Indikatorensysteme einer nachhaltigen Mobilität. Berlin.

TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Reduce NO_x emissions"

TELLUS Key Indicator: NO_x emissions

Context, impacts

As a result of the introduction of catalytic converters NO_x emissions of the transport sector have fallen significantly during the last years. Nevertheless the transport sector is the main polluter of NO_x and its share on the total NO_x emissions increases continuously.
NO_x emissions are an important contributor to acid rain, acid deposition, and eutrophication, which can alter the ecosystems of water, forests and meadowlands. In addition to local and regional effects, NO_x emissions can have global effects in that nitrogen oxides can contribute to global warming directly and indirectly. In Europe transportation accounts for 60 per cent of NO_x emissions.[16]
In many parts of Europe, critical loads for acidification and eutrophication are exceeded by a factor of two to four, indicating that ecosystems are at risk of being damaged and their sustainability endangered.[17] The consideration of depositions of nitrogen compounds across Europe in relation to critical loads has indicated that for many areas even reduction of NO_x emissions from transportation to zero would not be sufficient to meet critical loads for deposition of nitrogen compounds in many areas. Critical levels for ozone would also be exceeded.[18]
Because of the TELLUS objective "reduce NO_x emissions from heavy traffic" the indicator "NO_x emissions" relates primarily to heavy traffic. For the sake of completeness and comparability NO_x emissions from the whole road traffic will be assessed.

Unit of the indicator

Tons p.a.

Indicator-related objectives

Reduce NO_x emissions from heavy traffic by 5% until 2006
Reduce NO_x emissions from heavy traffic by 10% until 2010

Methods of measurement

Model calculation (emission module of the model "IMMIS-Luft") carried out as a combination of traffic-specific (e.g. number of vehicles, driving mode) and vehicle-specific emission-factors.

Source of data and analysis

The Senate Department of Urban Development regularly worked out an emission inventory for the transport sector. IVP collected and analysed the data.

[16] OECD (1999: 13)
[17] A critical load has been defined as "the highest deposition of a compound that will not cause chemical changes leading to long-term harmful effects on ecosystem structure and function".
[18] OECD (1999: 21)

Remark: Data concerning NO_x emissions will only be calculated every four to five years. The next data will probably be calculated in 2007. Future annual data calculations depend on provision of data by the VMZ.

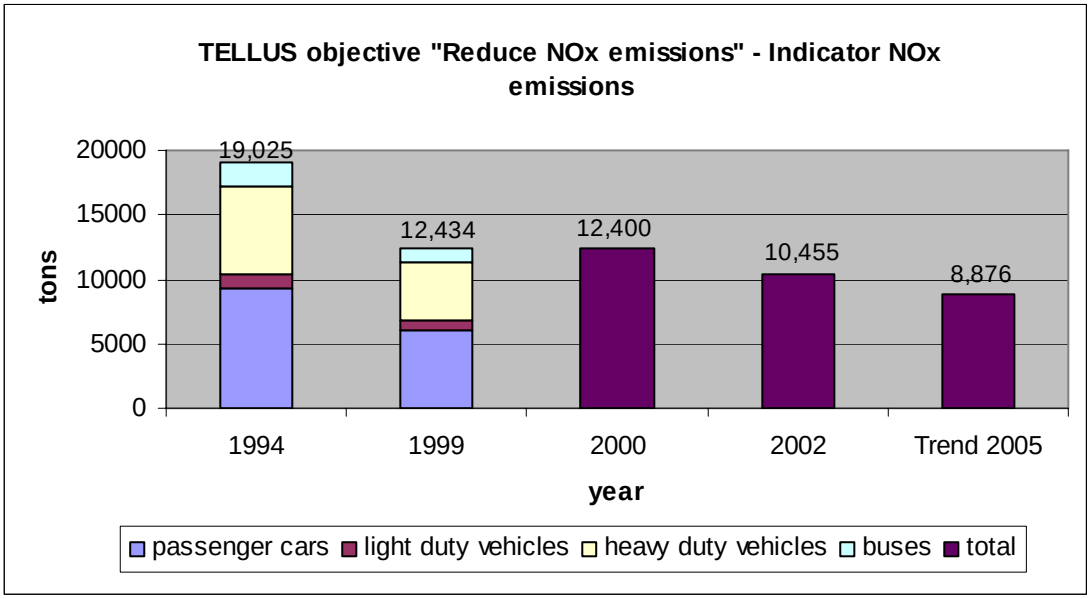
Legal basis, standard values, political objectives

National political objective (BMU 1998): Reduction of NO_x emissions from road transport by 70-80% until 2010 (base year is 1990). This objective is not mandatory.
BMU: Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit

Time table to collect and analyse the data

Retrospective view: 1994, 1999. The emission data of the following years was collected until the end of the TELLUS Project.

Development of the indicator value



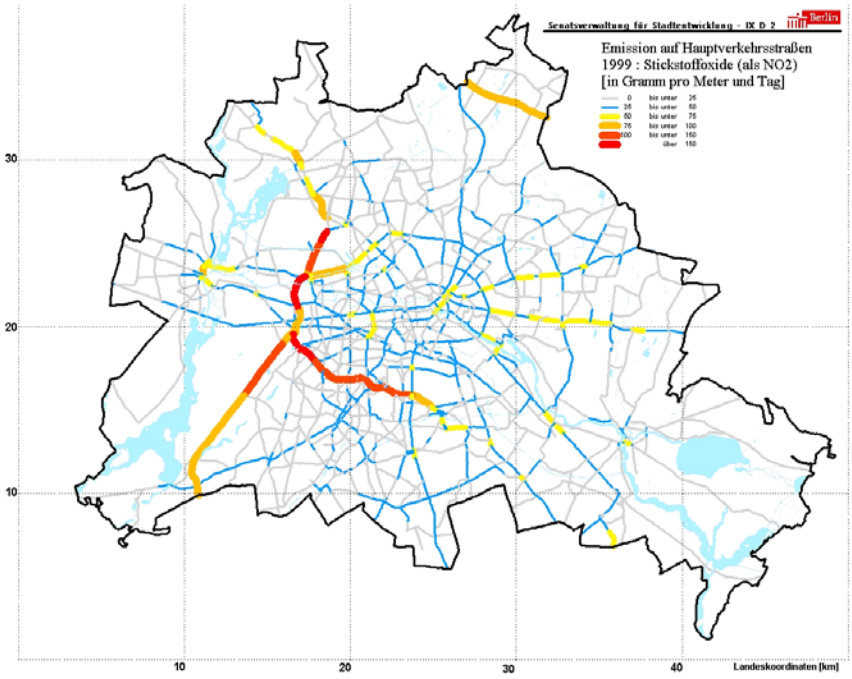
Source: Senatsverwaltung für Stadtentwicklung (ed.) (2001); Senatsverwaltung für Stadtentwicklung (ed.) (2005)

The figure shows the road traffic-related NO_x emissions in Berlin. For the years 1994 and 1999 these emissions are split for several vehicle classes, the remaining years show only the total ones. The model calculation for 2005 is based on already initiated measures for reduction of emissions.

Presentation of data

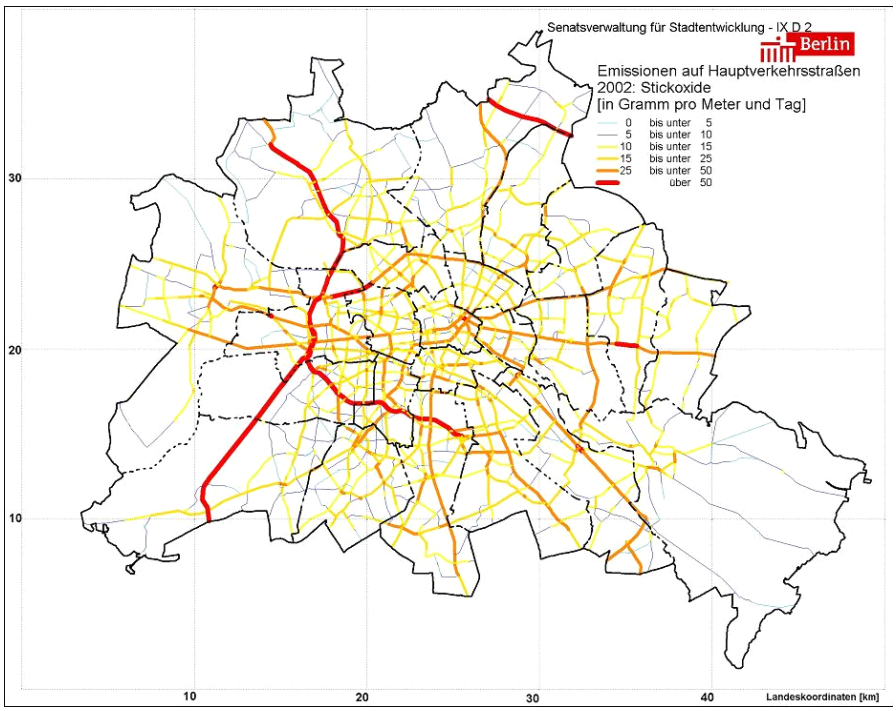
Emission data are prepared for urban road network to indicate street sections with high emissions. The maps show the traffic-related NO_x emissions for main roads in 1999 and 2002. The high emission sections are located along the urban motorway.

Spatial dispersion of traffic-related NO_x emissions 1999



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2001:12)

Spatial dispersion of traffic-related NO_x emissions 2002



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2005: A-29)

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	NO_x emissions (NO_x per vkm (g/km) derived)
TERM (EU: European Environment Agency)	NO_x emissions (t/a)
EST (OECD)	NO_x emissions
CSD (Germany)	NO_x emissions (t/a)
NFP (Switzerland)	NO_x emissions (t/a)
BPI/PRR	-

References

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (ed.) (1998): Nachhaltige Entwicklung in Deutschland. Entwurf eines umweltpolitischen Schwerpunktprogramms. Bonn.

EEA (2000): Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen.

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Spillmann, W. et al. (1998): Nachhaltigkeit: Kriterien im Verkehr. Berichte des NFP 41 “Verkehr und Umwelt”, Bericht C5. Bern.

TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Reduce noise"

TELLUS Key Indicator: Noise level

Context, impacts

Noise levels caused by transportation present a health concern or serious nuisance. Noise affects people physiologically and psychologically: noise levels above 40 dBA can influence well-being, with most people being moderately annoyed at 50 dBA and seriously annoyed at 55 dBA. Levels above 65 dBA are detrimental to health (WHO, 1999).[19]

Traffic noise is the most important source of environmental annoyance. According to the Environmental Expert Council of Germany, severe annoyance consistent over prolonged periods of time is to be regarded as causing distress. Even during sleep the noise from traffic may be subconsciously interpreted as warning signals and induce the release of stress hormones. In accordance with the noise-stress-hypothesis chronic stress hormone dysregulations and increases of established endogenous risk factors of ischaemic heart diseases have been observed for longterm environmental noise exposure. Therefore, an increased risk of myocardial infarction is to be expected. The results of individual studies on this subject in most cases do not reach statistical significance. However, according to the Environmental Expert Council, they show a consistent trend towards an increased cardiovascular risk if the daytime immission levels exceed 65 dBA.[20]

According to experts noise levels from transport should be universally below 65 dBA, in residential areas below 55 dBA during the day and below 45 dBA at night.[21]

Unit of the indicator

dB(A) road length

Indicator-related objectives

Reduce noise to levels below national and EC directives until 2006

Critical aspects

Methods of measurement

Model calculation by the Senate Department of Urban Development.

Source of data and analysis

The Senate Department of Urban Development works out regularly the noise levels at main roads. IVP collected and analysed the data.

[19] EEA (2000: 32)
[20] Ising, Kruppa (2001: 181)
[21] OECD (1999: 23)

Legal basis, standard values

Germany:
§ 41 BImSchG: Road construction or substantial modifications of public roads should not lead to harmful environmental impacts.
16. BImSchV (concretion of § 41 BImSchG): noise levels from transport should be in residential areas below 59 dBA during the day and in other areas below 64 dBA. During the night these values should be 10 dBA lower.
There is no regulation for existing roads.

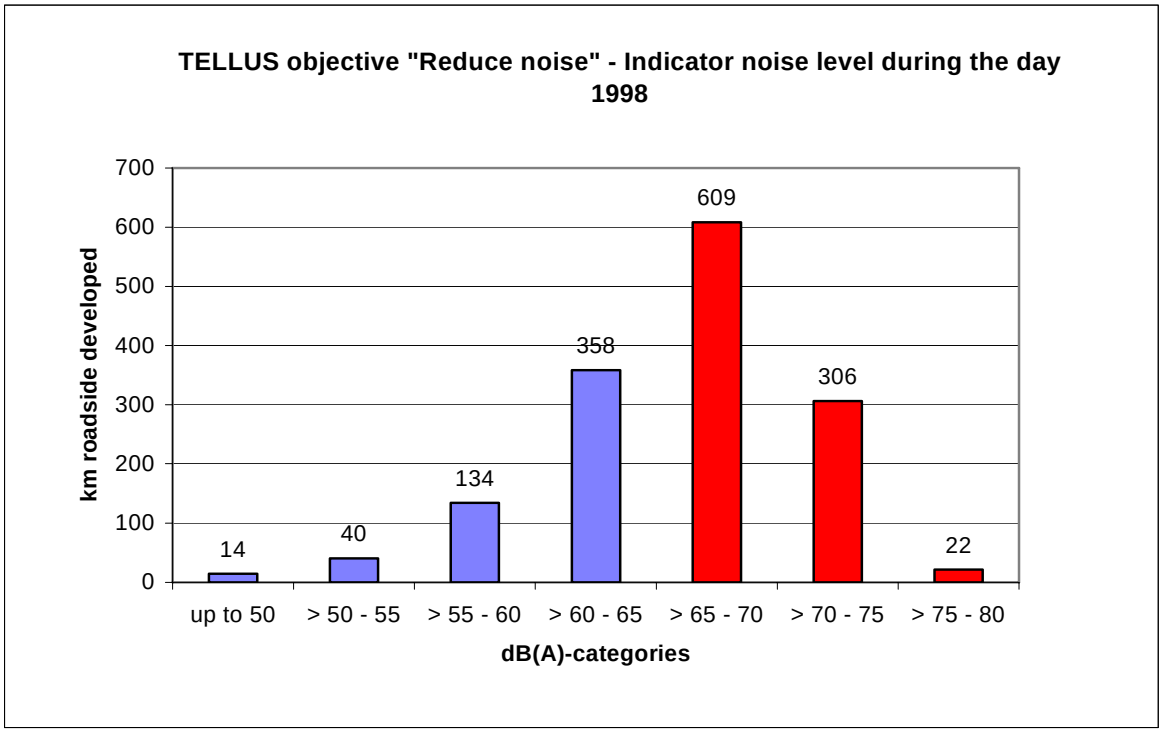
Standard values of the DIN 18005 ("Schallschutz im Städtebau") ("noise protection in urban development")
Residential areas: noise should not exceed 55 dBA during the day and 45 dBA during the night.
Other places: noise should not exceed 65 dBA during the day and 55 dBA during the night.

Time table to collect and analyse the data

Retrospective view: From 1998 until end of the TELLUS Project, the data will be collected as often as results are available. IVP collects and analyses the data.

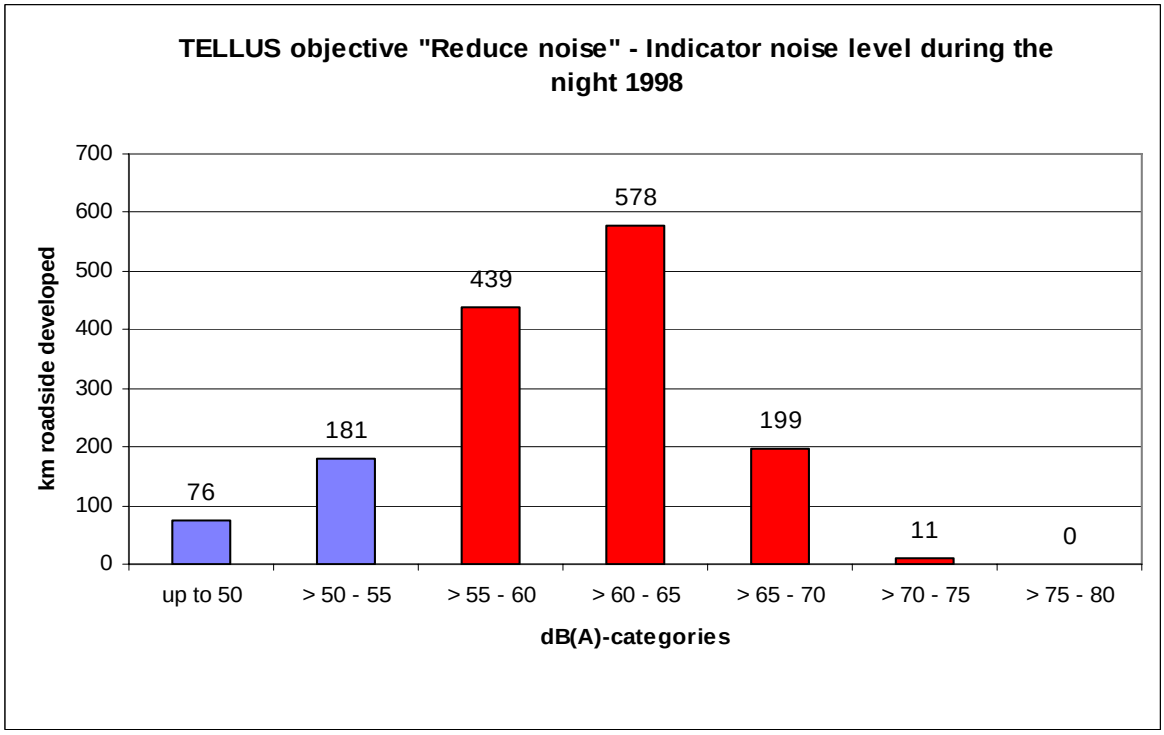
Development of the indicator value

The following figures show the road traffic noise at main roads in Berlin comparing the years 1998 and 2004.



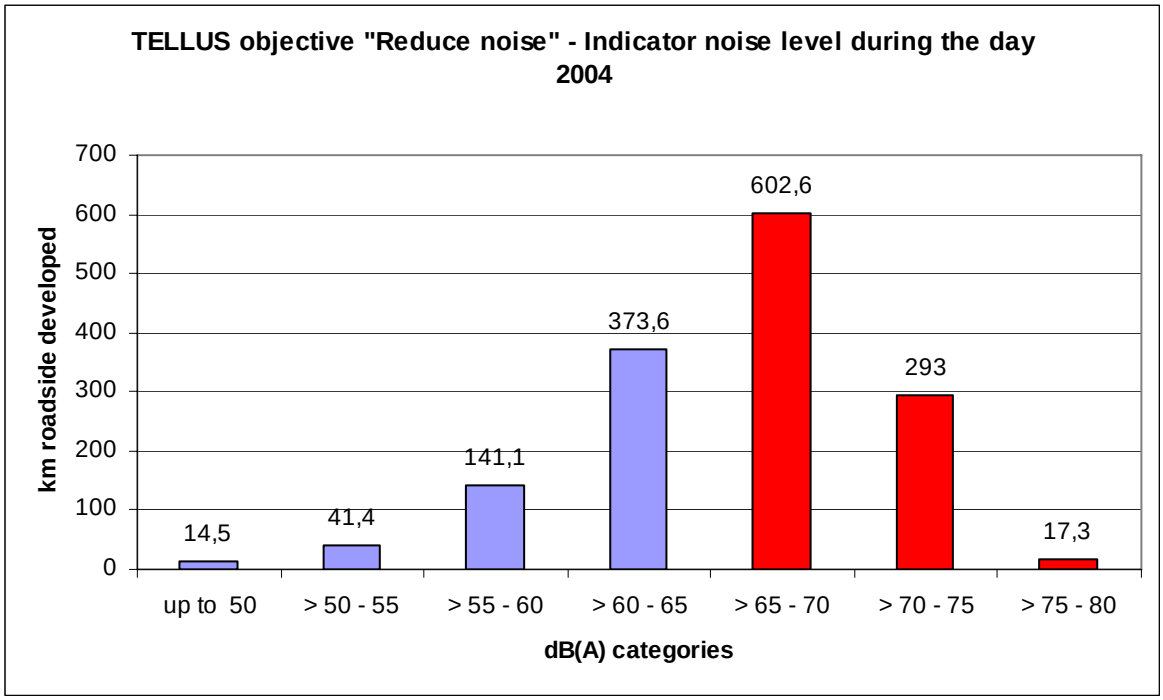
Source: Senatsverwaltung für Stadtentwicklung (2001)

Annotation: Number of people exposed to noise levels above 65 dBA during the day: 165,500 out of 351,905 inhabitants. This is equivalent to 70% of the inhabitants living near the main roads.



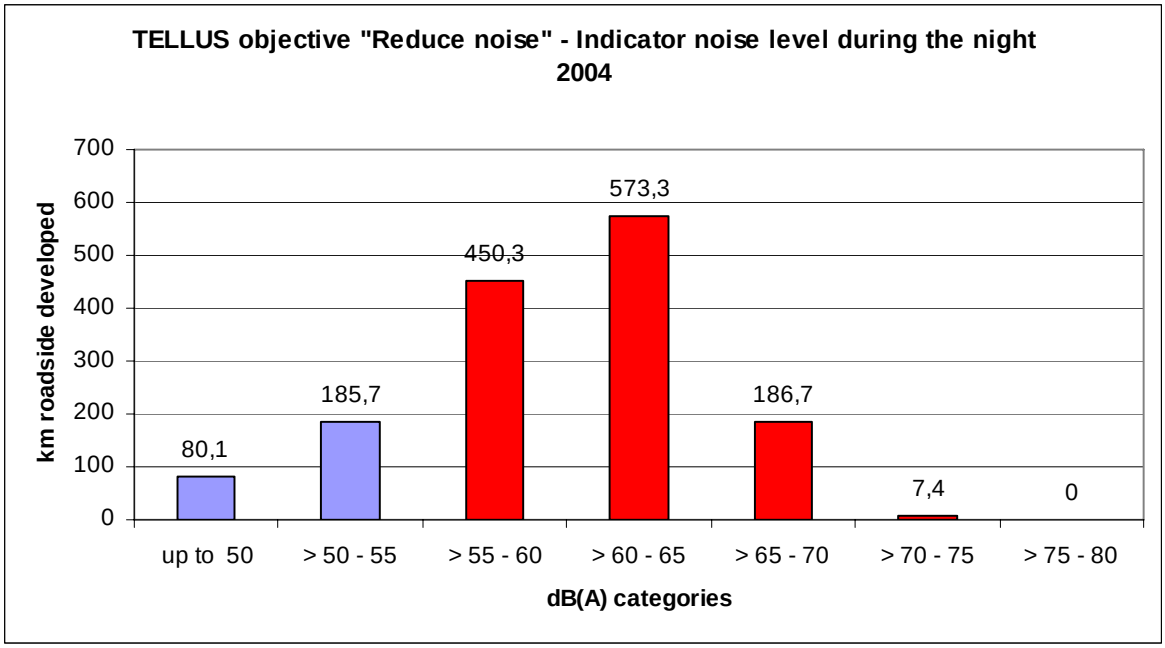
Source: Senatsverwaltung für Stadtentwicklung (2001)

Annotation: Number of people exposed to noise levels above 55 dBA during nights: 206,852 out of 351,905 inhabitants. This is equivalent to 88% of the inhabitants living near the main roads.



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2005: 77)

Annotation: Number of people exposed to noise levels above 65 dBA during the day: 218,081 out of 351,905 inhabitants. This is equivalent to 62% of the inhabitants living near the main roads.



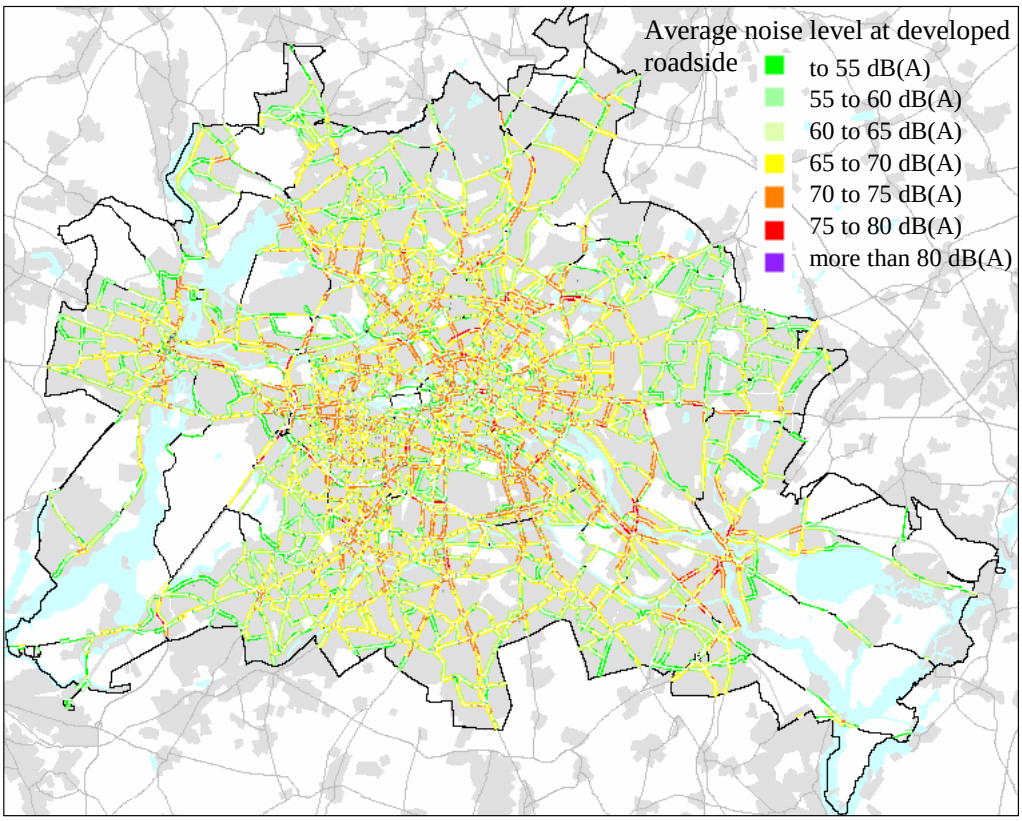
Source: Senatsverwaltung für Stadtentwicklung (ed.) (2005: 77)

Annotation: Number of people exposed to noise levels above 55 dBA during nights: 281,383 out of 351,905 inhabitants. This is equivalent to 80% of the inhabitants living near the main roads.

Presentation of noise data

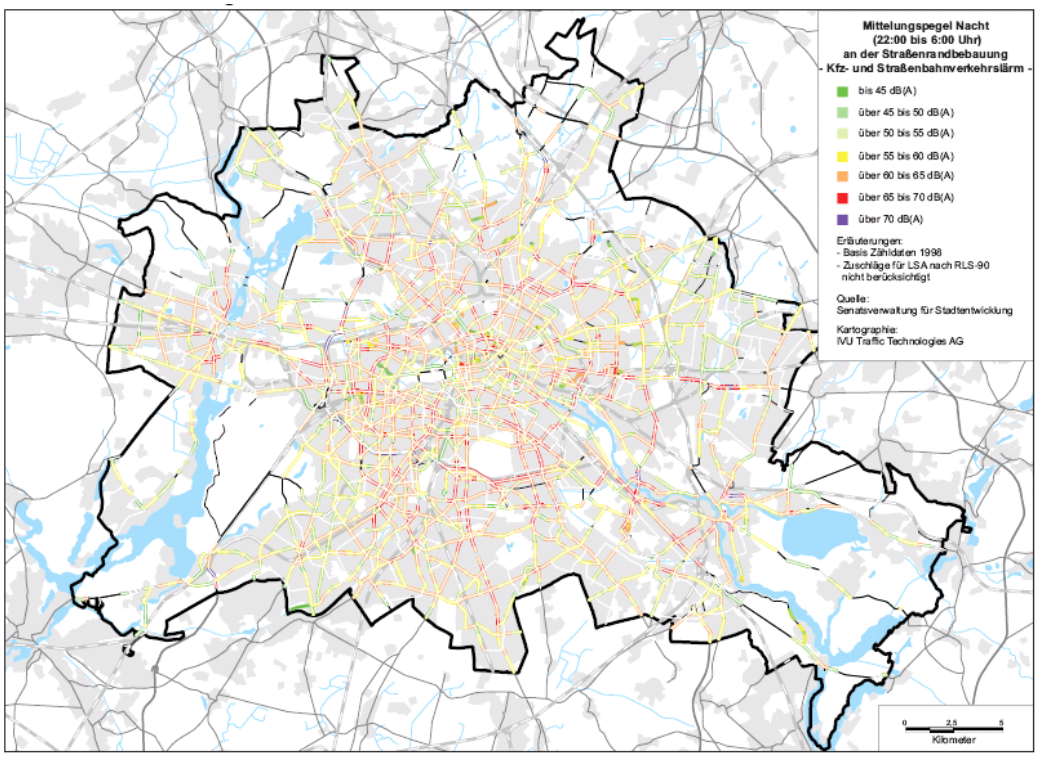
One way to present noise situation on city level is the production of road maps indicating different levels of noise. Below are two examples of a noise map of Berlin indicating the traffic related noise pattern during daytime.

Noise exposure in Berlin in 1998 during the day (6 am to 10 pm)



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2003: Annex map U01) (changed)

Noise exposure in Berlin in 2004 during the night (10 pm to 6 am)



Source: Senatsverwaltung für Stadtentwicklung (ed.) (2005: 76)

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	Noise perception (% of population exposed, broken down into 5 different perception bands of L_{day} and L_{night}, classification: absolutely dissatisfied, partly dissatisfied, absolutely satisfied, partly satisfied, neither satisfied nor dissatisfied)
NFP (Switzerland)	Noise level at the places of residence (% excessively burdened people)
BPI/PRR (UBA Germany)	Percentage of inhabitants exposed to noise levels under 65 dB(A) at days, percentage of inhabitants exposed to noise levels under 45 dB(A) at nights, resp. percentage of road length
TERM (EU: European Environment Agency)	% of population exposed to four transport noise exposure levels (in Ldn): 45<55 dB, 55-65 dB, 65-75 dB and >75 dB
EST (OECD)	Noise levels from transport
CSD (Germany)	Percentage of population troubled with traffic noise

References

EEA (2000): Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen.

Hesse, M. et al. (1997): Konzeptionelle Entwicklung von Nachhaltigkeitsindikatoren für den Bereich Verkehr. UFOPLAN 1997, Forschungsvorhaben 201 03 211. Schlussbericht. Berlin, Dezember.

Ising, H.; Kruppa, B. (2001): Zum gegenwärtigen Erkenntnisstand der Lärmwirkungsforschung: Notwendigkeit eines Paradigmenwechsels. In: Umweltmed Forsch Prax 6 (4).

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Surburg, U. et al. (BPI/PRR) (2001): Kommunale Agenda 21 – Modellvorhaben: Dauerhaft umweltverträgliche Mobilität in Stadt und Region. Teilvorhaben 1: Erstellung eines Katalogs technischer und planerischer Qualitätsziele. Endbericht Teil 2. Ziel- und Indikatorensysteme einer nachhaltigen Mobilität. Berlin.

TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Reduce traffic related energy use"

TELLUS Key Indicator: Primary energy use

TELLUS Key Indicator: Final energy use

TELLUS Key Indicator: Type-specific final energy use

Context, impacts

Transport is one of the main energy consuming sectors in the EU (over 30% of total final energy consumption in 1997). Its energy use is growing at a rate of about 3 % per annum. Road transport is responsible for 73% of transport energy consumption.
Transport is nearly fully dependent on fossil fuels (99%) and contributes significantly to emissions of greenhouse gases, acidifying substances, ozone precursors and other air pollutants.[22] Transport contributes 24% of the total CO_2 emissions in the EU.
Growth in road transport is the main cause of the increase in energy use: the increasing use of heavier more powerful cars and trucks along with low occupancy rates and load factors have offset improvements in fuel economy – mostly related to engine technology.[23]

Unit of the indicator

TeraJ/a

Indicator-related objectives

Reduce traffic related energy use by 5% until 2006
Reduce traffic related energy use by 10% until 2010

Critical aspects

-

Methods of measurement

A yearly analysis and compilation of statistics on these topics is made by the Senate Department of Economy (yearly energy balances).

Source of data and analysis

Senate Department of Economy. The indicator related analysis was done by IVP.

[22] EEA (2000: 18)
[23] EEA (2000: 19)

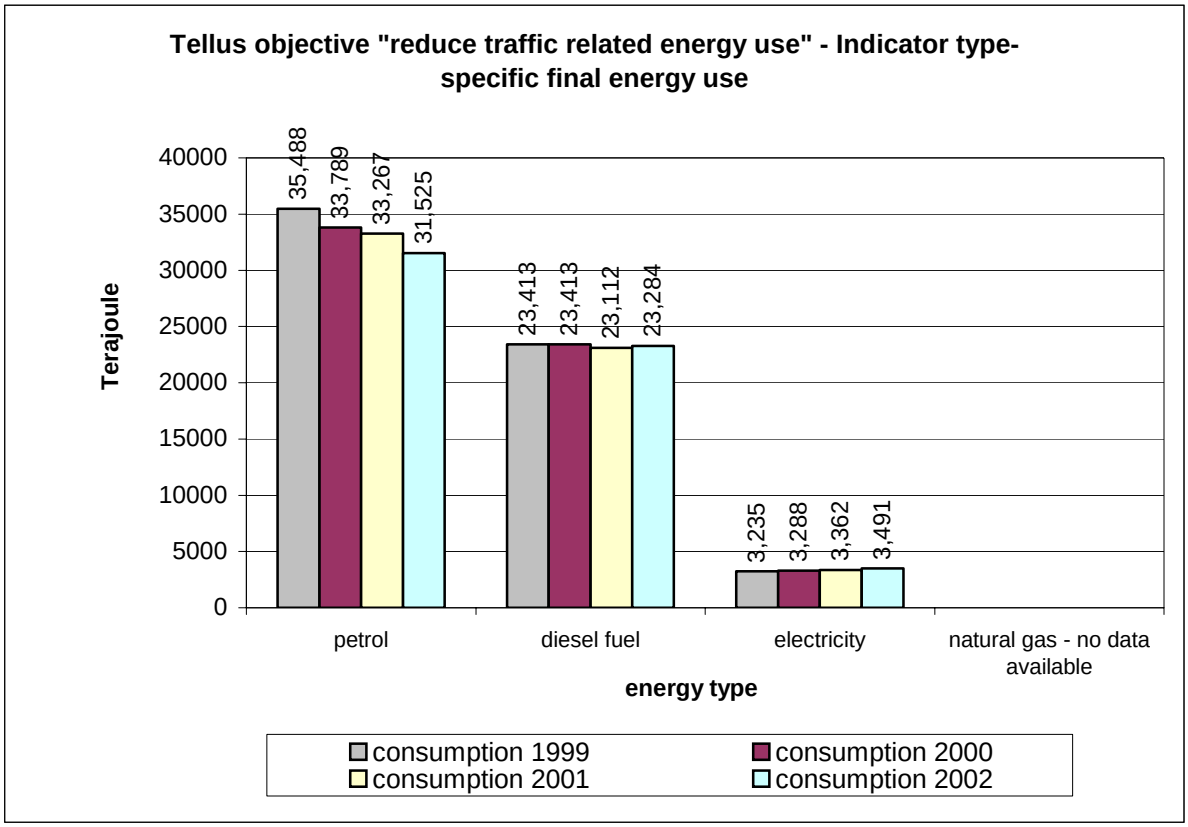
Legal basis

According to § 15 of a Berlin Law on Energy Saving (Berliner Energiespargesetz – BenSpG) the Senate of Berlin has to carry out a programme regularly (Landesenergieprogramm) which contains objectives and measures to save energy and to reduce the pollution of the environment.

Time table to obtain and analyse the data

Retrospective view: from 2002 until the end of the TELLUS Project, the data has been obtained yearly.

Development of the indicator value



Source: Senatsverwaltung für Wirtschaft und Technologie (ed.) (n.d.: Tab. 3)

There is a trend to reduce energy use in transport: 71,642 TJ transport related final energy (incl. kerosene) was used in Berlin in 1999; in 2000 the transport related final energy use declined to 71,283 TJ and in 2002 to 69,351 TJ.

In 2002 the amount of natural gas used for transportation purposes was 10 million kwh.

According to information communicated by the Regional Statistic Office in July 2005 calculations for 2003 and later will be made available by the Regional Statistic Office at the end of 2005.

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	Vehicle fuel efficiency (MJ per vkm)
NFP (Switzerland)	Fossil fuel consumption (J/a)
BPI/PRR (UBA Germany)	-
TERM (EU: European Environment Agency)	Final energy consumption by transport mode (road, aviation, marine, rail and inland waterways), expressed in million tonnes of crude oil equivalent (mtoe).
EST (OECD)	-
CSD (Germany)	- Transport related final energy consumption (Petajoule/a) - Transport related final energy consumption per inhabitant - Total fuel consumption (in mill./l) - Fuel consumption (l/100 vkm (cars and lorries))

References

EEA (2000): Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen.

Hesse, M. et al. (1997): Konzeptionelle Entwicklung von Nachhaltigkeitsindikatoren für den Bereich Verkehr. UFOPLAN 1997, Forschungsvorhaben 201 03 211. Schlussbericht. Berlin.

METEOR (2002): WP4 Project Impact Evaluation. Task 4.1. Evaluation Guidelines.

Senatsverwaltung für Wirtschaft und Technologie (ed.) (n.d.): Energiebilanz für das Land Berlin 2001 und 2002.

Spillmann, W. et al. (1998): Nachhaltigkeit: Kriterien im Verkehr. Berichte des NFP 41 “Verkehr und Umwelt”, Bericht C5. Bern.

TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Improve intra-organisational co-operation at the city level"

TELLUS Key Indicator: Quality of intra-organisational co-operation

Description of the indicators, relevance

The TELLUS objective "improvement of intra-organisational co-operation at the city level" refers to the quality of co-operation between the different departments of the Senate Department. TELLUS aimed at contributing to an improved communication and co-operation within the local administration of which not only the TELLUS Project was expected to benefit from but also future projects in the field of sustainable transport in Berlin.

Unit of the indicator

-

Indicator-related objectives

Improvement of intra-organisational co-operation at the city level

Methods of measurement

Surveys were carried out in June 2003 and September 2005. Each survey consisted of two steps:
First, with help of a telephone survey the structure of co-operation inside the administration was analysed. In a snowball system employees of the Senate Department were asked to state with whom they work together in the frame of TELLUS. In this way, a picture of the co-operation network could be developed and the departments involved could be identified.
Second, key persons of each department engaged in TELLUS related issues were asked to answer questions on the quality, quantity, durability and instruments of their co-operation with other members of the Senate Department.

Source of data and analysis

The surveys were carried out and analysed by the evaluation team.

Development of the indicator value

In 2003 the questionnaire was sent to 8 persons and returned by 7. In 2005 the questionnaire was sent to 7 persons and returned by 4.
In the survey 2003 in 9 cases persons named each other as co-operation partners, in 8 cases only one of both stated that there was a co-operation with the other person. In 2005 this proportion was 10 to 3 what can be interpreted as an improvement in the quality of co-operation even the quantity of co-operations was less.

Altogether the appraisal of the co-operation improved from 2.7 in 2003 to 2.0 in 2005[24]**.** In particular the information flow was perceived to be improving.
In three cases it was stated that new co-operations could be developed. The other persons perceived the co-operation not to be different to before.
Improved co-operations could be identified particularly between the environmental and the integrated transport department. These are expected to last after the termination of the project.

For further details see C.2 Chapter 3.5 of Final Evaluation Report

Time table to obtain and analyse the data

Surveys and analysis of the data: June 2003 and September 2005

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS)	-
NFP (Switzerland)	-
BPI/PRR (UBA Germany)	A yes/ no statement to the question “Does an integrated transportation development plan exist?” is used as indicator for intra-organisational co-operation
TERM (EU: European Environment Agency)	-
EST (OECD)	-
CSD (Germany)	- -

References

Surburg, U. et al. (BPI/PRR): Kommunale Agenda 21 – Modellvorhaben: Dauerhaft umweltverträgliche Mobilität in Stadt und Region. Teilvorhaben 1: Erstellung eines Katalogs technischer und planerischer Qualitätsziele. Endbericht Teil 2. Ziel- und Indikatorensysteme einer nachhaltigen Mobilität. Berlin 2001.

[24] Scale from 1 very good to 6 very bad

TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Improvement of public-private co-operation"

TELLUS Key Indicator: Quality of public-private co-operation

Description of the indicators, relevance

New transportation concepts like new forms of vehicle use, new ideas for the distribution of goods in the context of the project or initiatives on clean fleets require public-private co-operation. Public-private co-operation in this context refers to any kind of co-operation between the administration and the private demonstrators.

It was perceived that the risks that could have affected an effective implementation of the TELLUS demonstration measures, such as legal restrictions and obtaining of the permits necessary for the implementation, could be reduced by a good public-private co-operation. Hence good public-private co-operation was seen as a pre-requisite for a successful implementation of many TELLUS demonstration measures.

Unit of the indicator

Indicator-related objectives

Improvement of public-private co-operation

Methods of measurement

In order to assess the quality of public-private co-operation, face to face Interviews with identified key persons were carried out. Topics of the interviews were the kinds of co-operation, improvements of the co-operation, instruments of the co-operation, problems, estimation of the maintenance of the co-operation etc.

Source of data and analysis

The interviews were carried out and analysed by the evaluation team.

Legal basis

-

Time table to obtain and analyse the data

Survey and analysis of the data at the end of each demonstration measure.

Development of the indicator value

Out of the 10 TELLUS demonstration measures in Berlin, three were engaged in a public-private co-operation. In addition to that, two measures could be described as public-public co-operations. No coherent picture regarding the quality of public-private co-operation in TELLUS can be drawn:

- In general, co-operation with the Senate Department was described as good. Nevertheless, this view was not shared by all demonstrators, depending on the specific expectations and requirements of the measures.
- Co-operation between the demonstrator and Berlin's public transport company, BVG, was overall described as difficult. Main reasons appeared to be the hierarchical structure of the company, which led to a situation where decisions made on one level were not acted upon on a different level.
- Co-operation with public entities from the neighbouring federal state of Brandenburg was rated unsuccessful, which, however, might have been due to a number of factor.

In order to complete the picture, the side of the public entities and their view on the co-operation process and the factors that influenced it must also be considered. However, since only anecdotic information on the view of the public authorities, etc. exists; it is not possible to assess the role that the demonstrator himself played in the process of working together.
For further details see C.2 Chapter 3.5 of Final Evaluation Report.

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS)	-
NFP (Switzerland)	-
BPI/PRR (UBA Germany)	A yes/ no statement to the question "Does a co-operation between administration and citizens, initiatives exist?" is used as indicator for public-private co-operation
TERM (EU: European Environment Agency)	-
EST (OECD)	-
CSD (Germany)	- -

References

Surburg, U. et al. (BPI/PRR): Kommunale Agenda 21 – Modellvorhaben: Dauerhaft umweltverträgliche Mobilität in Stadt und Region. Teilvorhaben 1: Erstellung eines Katalogs technischer und planerischer Qualitätsziele. Endbericht Teil 2. Ziel- und Indikatorensysteme einer nachhaltigen Mobilität. Berlin 2001.

TELLUS objective monitoring and evaluation

Indicator Fact Sheet for TELLUS objective "Achievement of political and public awareness for TELLUS"

TELLUS Key Indicator: media exposure

TELLUS Key Indicator: events organised

TELLUS Key Indicator: presentations given

Description of the indicators, relevance

Acceptance of transport and environment policies correlates positively with availability of information and awareness of environmental problems. Public awareness and knowledge of environmental problems is therefore central to the development of appropriate transport policies.[25]

Political and public awareness for TELLUS had two dimensions: awareness for the several *demonstration measures* of the TELLUS Project and awareness for the *TELLUS objectives* on the city level which should have been reached by the implementation of the demonstration measures.

Awareness for demonstration measures: The rationale behind this was that the better people were informed about the new measures the more likely they were to take advantage of the measures and the better the measure performance would be.

Awareness for TELLUS objectives: Beside awareness for the demonstration measures TELLUS was also supposed to raise awareness for the necessity of a more environmentally friendly and a more efficient transportation system, which takes into account the variety of consequences of the transport sector. These issues were expressed in the TELLUS objectives. Also, awareness for these issues was deemed suitable to raise the acceptance for integrated policy strategies, too.

Unit of the indicator

-

Indicator-related objectives

Achievement of political awareness for TELLUS
Achievement of public awareness for TELLUS

Methods of measurements

Because of budget limitations and the amount of time and effort that would have been necessary for such an undertaking, a citizen survey regarding the awareness level of TELLUS could not be carried out. Thus, the assessment of this TELLUS objective was done based on an analysis of the media exposure and the dissemination activities of the demonstration measures. This was carried out mainly based on the information provided by the demonstrators themselves, which is compiled in various TELLUS reporting documents, such as the Progress and Management Reports.

[25] EEA (2000), p. 123.

The analysis was carried according to the following criteria:

- for media exposure: target groups, spatial coverage;
- for events organised: main focus (local, national, international); target groups (internal or public meeting).

Political awareness was assessed by means or collecting information on the number of and types of occasions that politicians on various levels were involved in the project and / or participated otherwise in TELLUS related activities.

Source of data and analysis

Data was collected by the Dissemination WP and documented in various TELLUS reporting documents such as Progress and Management Reports. The analysis was carried out by the evaluation team.

Legal basis

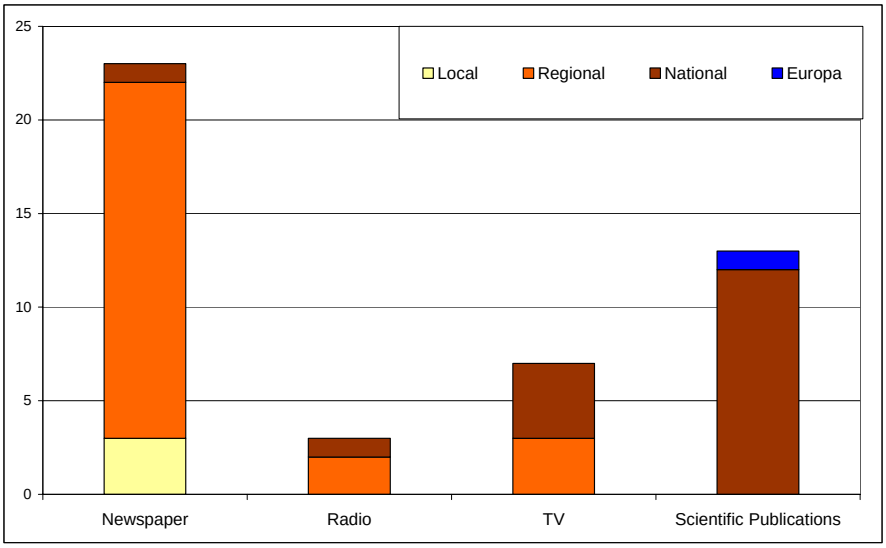
-

Time table to obtain and analyse the data

The relevant data was collected continuously.

Development of the indicator value

TELLUS media reporting and spatial coverage

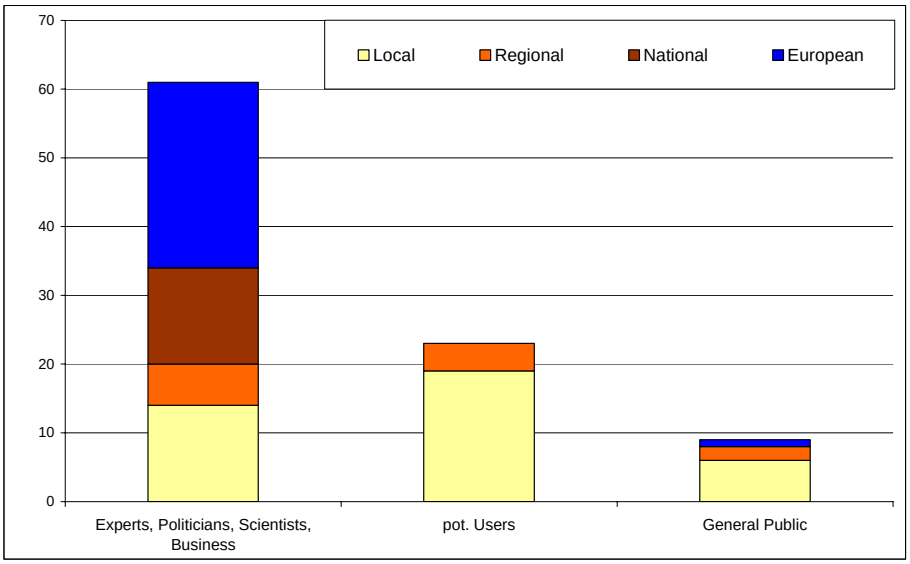


The overwhelming share of the media reporting was carried out in newspapers with predominantly regional focus. A number of strictly local newspapers as well as some national reporting could also be attained. Regarding radio and TV reporting, also the regional, generally Berlin based stations, broadcasted news on TELLUS. Scientific publications, however, contributed to the spreading of information on national and European level.

Regarding other activities and events, those directed at experts, potential partners, politicians and scientist made up the largest share of the events (see following figure). Also, they took place on all levels – from local to European. Because of its special character, the TELLUS youth competition is not

included in the figure above. The competition generated a lot of attention with the participating young, their schools and families as well as politicians and the media.

TELLUS public events and target groups



One difficulty associated with applied method of analysis is that neither the absolute number of persons reached nor their perception of the articles can really be analysed. Therefore, it can also not be assessed in how far the attention thus achieved translates into public awareness and eventually into public and individual behaviour can not be assessed here.

Regarding political awareness, a lot of activities took place that were also addressing the political sphere. In turn, TELLUS also received political attention, e.g. through the House of Representatives or the district politicians that were involved in the work of individual measures.

For further details see C.2 Chapter 3.5 of Final Evaluation Report.

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS)	Awareness level: knowledge of the new integrated measures on account of provided information. Data collection could be done by means of surveys (questionnaires or face to face interviews).
NFP (Switzerland)	-
BPI/PRR (UBA Germany)	-
TERM (EU: European Environment Agency)	Public awareness and attitude towards the environmental threats brought about by the transport sector.
EST (OECD)	-
CSD (Germany)	-

References

EEA (2000): Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen.

METEOR (2002): WP4 Project Impact Evaluation. Task 4.1. Evaluation Guidelines.

ANNEX 3:

Scenario for TELLUS measure 8.5 – Car Modal

Full Version

Table of Contents

1 Introduction

The aim of the TELLUS Car Modal measure in Berlin was to improve transport connections in peripheral areas of the city through the introduction of flexible, demand-oriented transport services. Throughout the lifecycle of the measure only the collective taxi service CharterCab was implemented, which is why the other two modules are not considered in this assessment.

From the present point of view flexible collective passenger services are a fairly new option in urban public transport, which is why a number of factors determining their operation, customer acceptance, interaction with the transport system and overall their success is as yet unclear. The CharterCab implementation in Berlin provided first information on some of these issues; however, a considerable number of assumptions had to be made in order to develop a 'story line' necessary for estimating potential outcomes. Generally, there is always a great number of possible developments regarding the areas of consideration outlined in the following. Since not all of these could possibly have been described and analysed, the Evaluation Team selected the potential line of development that seems most reasonable – and within the scope of the goals of TELLUS most desirable. Nevertheless, alternative developments will be indicated in brief, but they – and the related consecutive effects - will not be elaborated in more detail.

Furthermore, in order to plant the estimates firmer into a real-life context, some of the more practical calculations were carried out based on actual and projected conditions in a selected case study area.

2 Description of the measure characteristics in 2015

CC is a flexible, demand oriented service that is operated by large capacity taxis and taxi vans. The service operates along defined corridors in selected peripheral areas of the city. Passengers order the taxi by telephone and – after a short waiting time – they are transported from their door to the next public transport station that links the area to the inner city. Vice versa, upon request the CC collects them from the station and takes them to their door. However, the service is collective, meaning that generally more than one costumer should be transported at a time. This is to be achieved by intelligently bundling service times and frequencies.

CC is an integrated part of the public transport network. Thus, CC is part of the network itself, i.e. CC routes ultimately lead to public transport stations, connecting them to those areas that are farther away from the stations and/or are difficult to reach. Moreover, the service is integrated into the tariff system. The CC fare therefore is equal or only slightly above the fare for other modes of public transport.

The focus of the estimates presented her focus on the likely effects of replacing a conventional bus line that has low ridership with a CC route. However, there are other options to integrate flexible services with conventional public transport. For example in areas where

there are short but distinguished peak times with high passenger numbers while for most parts of the day and especially during genuine low-peak hours (mid-day, night time) transport demand is low, a combination of bus and CC service could be possible.

3 Framework conditions

The demonstration of the CC measure in TELLUS showed that in order to operate the service successfully a number of necessary preconditions have to be met. Thus it is assumed that by the year 2015 urban transport policy will have experienced some major changes and now provides the necessary conditions for flexible service: The main changes did take place regarding the following aspects:

Re-adjustment of legislative framework: The conventional and flexible public transport have the same legal statues and are subject to the same legal requirements and opportunities.

Equal access to tendering procedures: This in turn means that providers of flexible services can now also participate in bidding and tendering procedures, which according to European and German law will by then be put to use more frequently with the enforcement of the liberalisation of the transport market. The operational preconditions for tendering procedures that also include flexible services have partly been influenced by the findings generated in the TELLUS demonstration measure 7.5.

Strong role of local transport plans: The information basis for tendering procedures as well as the goals of transport, which must be fulfilled also by private providers, are largely provided by the transport plan, which has thus gained more importance. In this regard, the discussions carried out in and beyond TELLUS demonstration measure 7.5 were of considerable benefit.

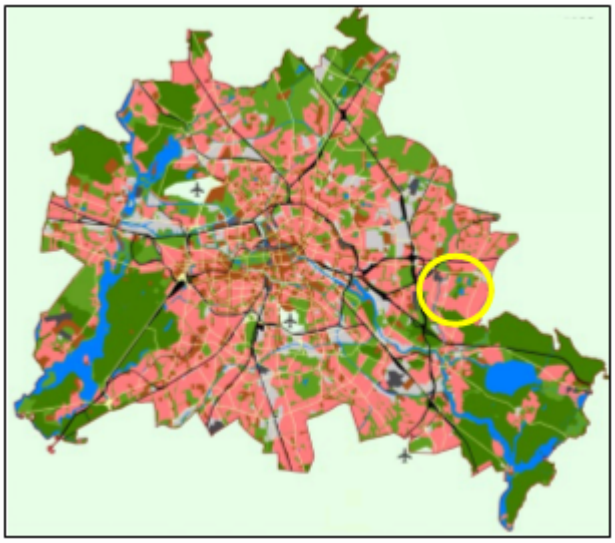
Comprehensive and coherent transport policy: The service is part of a bundle of measures of transport policies that supports an intelligent use of the existent transport infrastructure. These complementary measures work together with the flexible CC, for example by favouring access to the inner city with the public transport over car dominated accessibility. In such a way, parking space management, environmental zones, and congestion charging, only to name a few measures that could serve this purpose, keep people from using their cars to go into the inner city and support the utilisation of the new flexible collective service in the periphery. What is more, initiatives taken on national level (e.g. fuel taxation, national transport planning) support cities such as Berlin in adjusting their transport policy.

4 Description of case study area

The TELLUS demonstration area for the CharterCab service was located in the south-western periphery of Berlin. However, for the purpose of upscaling, a different case study area was chosen on the grounds of the better availability of the required data and information needed for the estimations.[1]

Alternatively, an area in the district of Berlin-Mahlsdorf was chosen for illustrating the service potentials. In the Local Public Transport Plan Mahlsdorf is mentioned as one of the peripheral areas in Berlin, for which the introduction of flexible services is envisaged. The district is located in the eastern periphery of the city (Figure 1). It is a predominantly residential area with mostly low-density detached and semi-detached housing. Mahlsdorf together with neighbouring two other former village settlements (Kaulsdorf and Biesdorf) make up the largest suburban detached housing estate of Berlin.

Figure 1: Location of case study area

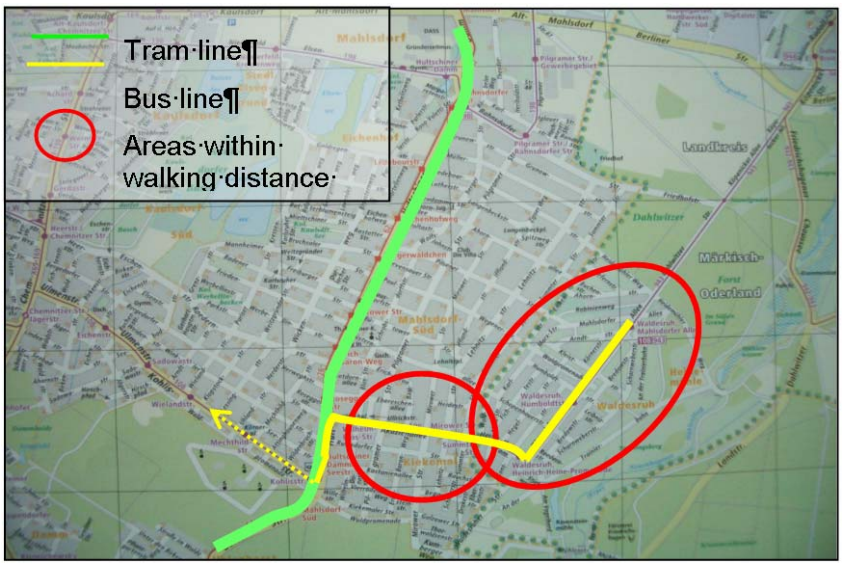


The specific area considered here is located at the fringe of the district. It is connected to the inner city by an S-Bahn line in the north, complemented by bus and tram lines (Figure 2). A tram line runs along the western main road and intersects with a bus line that goes farther to the east, covering a distance of 3 km.

However, the bus line runs at low frequency (on average every 20 minutes) 72 times a day in each direction between 5 a.m. and midnight. Passenger numbers add up to a total of 450 in each direction on an ordinary working day. On average there are about six passengers per tour in a bus that has the capacity to transport 155 people (51 seats and 104 standing).

[1] The lack of data availability in the original TELLUS demonstration area was partly due to the fact that the area is serviced by transport providers that are not based in Berlin. Also, the transport network there is too complex and too many factors would make estimations on the effects of replacing a bus line with a CC service difficult.

Figure 2: Mahlsdorf transport connections



5 Analysis of potentials

The potentials have been estimated based on two considerations: First, what are theoretical options, i.e. what could generally happen if a flexible service was to replace a bus line; and second, what is the most likely line of development with particular (but not exclusive) focus on the case study area.

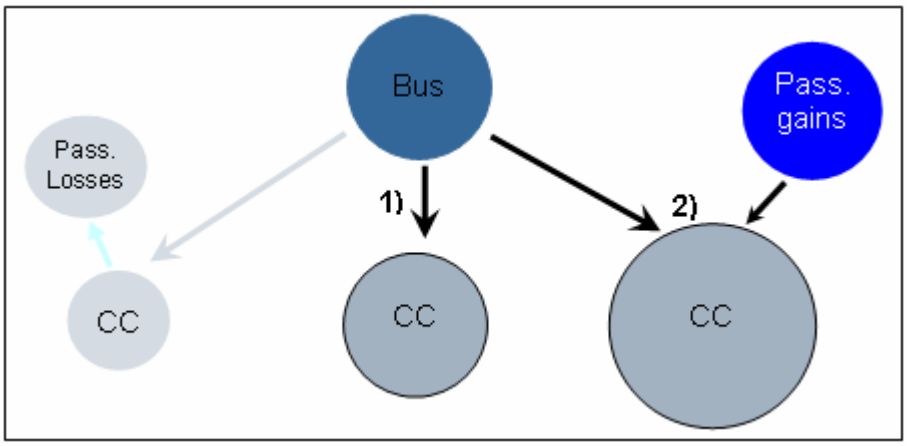
5.1 Transport

Passenger development

As Figure 3 indicates there are different ways, in which passengers might react when a bus line is replaced by a flexible transport service. Option 1) assumes that all of the bus passengers switch to the new service. Option 2) expects that because of the demand orientation of the service, the increase in comfort (door-to-station service) and a number of new passengers might be attracted to the service that had previously not used public transport. However, the passenger gains thus achieved will only be limited in numbers, since the willingness of individuals to switch from individual to collective transport is strongly influenced by the general framework conditions for car ownership and use. The transport development plan of Berlin assumes that by implementing the entire bundle of measures contained in the plan a pas-

senger increase of about 7% in the public transport sector can be achieved. The 7% therefore also mark the upper limit of the passenger gains to be expected for a CC-service.[2]

Figure 3: Options for passenger development (size of circles indicating passenger numbers)



A third possibility would be that the service loses passengers probably because of the need to pre-order the service, the reluctance of former bus passengers to make use of a new service, etc. However, this possibility is not taken into account in the scenario.

In Mahlsdorf, car ownership is between 400 and 500 cars per 1,000 inhabitants, which is higher than the motorisation rate for the entire city (330 cars per 1,000 inhabitants). This pattern – low motorisation rate in the inner city and higher rates in the peripheral areas – is typical for big cities. The car is the dominating transport tool for suburban dwellers, and changing that pattern even in the long term appears to be difficult. Nevertheless, for the analysis of the CharterCab potentials it is assumed that an increase in passenger numbers can be achieved in the area.

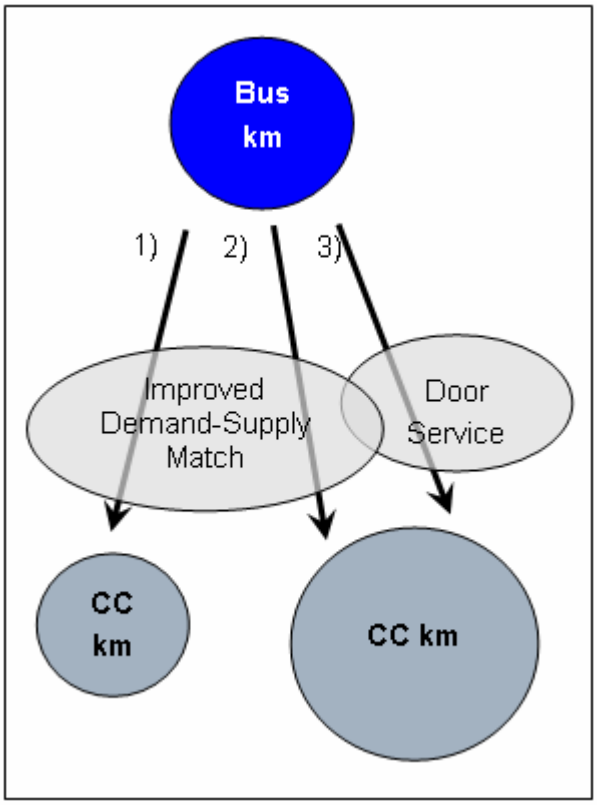
In the base year, the bus line runs at low frequency (on average every 20 minutes) 72 times a day in each direction between 5 a.m. and midnight. Passenger numbers add up to a total of 450 in each direction on an ordinary working day. On average there are about six passengers per tour in a bus that has the capacity to transport 104 people (51 seats and 53 standing). A 7% increase would thus translate to an additional number of 30 passengers per day. This in turn means that 480 passengers will be using the flexible serve in each direction, adding up to a total of 960 passengers a day.

[2] What is more, in case the service gains passengers (option b) further considerations need to take into account w this modal shift from car to public transports further influences the transport patterns of the people. Especially in big urban agglomerations, transport movements are seldom for a single purpose only: the daily commute might also serve to drive by a shop, parents collect their kids from school on their way to a health centre, people move directly from their place of work to a gym or leisure centre, etc. If these movements are now undertaken by public transport instead the car, this will also serve to reduce emissions from daily travel. The extent of this, however, is difficult to calculate, since detailed knowledge on transport movements and activity patterns of the people needs to be at hand.

Mileage development

The mileage driven depends on the absolute length of the route itself, and the number of times this route is being serviced, i.e. the service frequency. At the current stage it is determined by the transport plan provisions that set minimum service levels and thus, the lowest possible frequencies. However, a demand oriented service such as CC has no set service frequencies, but the number of times it travels along the route in each direction is determined directly – and only – by the number of passengers using the service.

Figure 4: Possible mileage developments (circles indicating total daily mileage)



This means that if there are no passengers that require transport service, CharterCab does not travel, whereas a bus would drive along the route empty. At the same time, however, if the number of passengers calling the Cab exceeds its (seating) limits, a shortage of transport provision might occur at specific peak times. Thus, before such a service starts operation reasonable precautions need to be taken, lest a shortage of transport options – even if only temporary – occurs. Figure 4 shows the probable developments concerning mileage when transforming a bus operated into a CC operated service. Theoretically, a better matching of transport demand and supply could lead to a decrease of mileage travelled, for example if during certain times of the day when there is no demand by passengers the CC service does not run empty as a bus would (1).

Yet the same rationale, i.e. balancing demand and supply, might also result in a mileage increase (2), for example if the flexible service travels at the costumers demand, which might appear at times when a bus would not have travelled, or if the bundling of tours is not possible due to a temporally scattered demand. Also, additional passengers might cause a need for the service to operate more often along the route, which will also generate a mileage increase.

Furthermore, the provision of a door-to-station service and the coverage of a wider corridor instead of a single street-bound line might also add to the mileage (3).

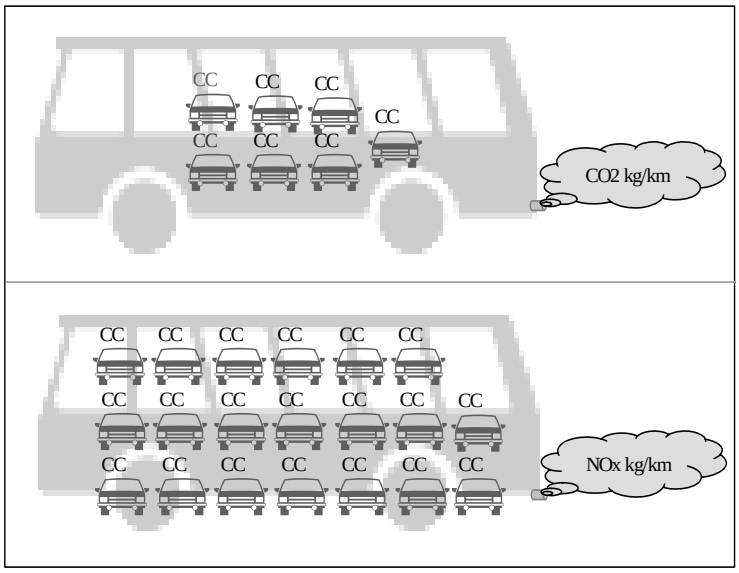
In the case study area, the bus travels 432 km a day (single tour length: 3 km, travelled 144 times daily). If the passenger numbers follow the aforementioned development line, 80 tours

per direction will be necessary if the CC to accommodate all of the passengers, supposing that the vehicle used for the service is used to its full seating capacity of six plus driver.[3] However, it can not be assumed that passenger demand can be thus bundled. Therefore, and because the intention is to provide a more comfortable, flexible and demand oriented service, the CC runs more often. For the case study it is estimated that 90 tours per day in each direction will serve these purposes, meaning that the daily mileage will increase to 540 km a day.

5.2 Environment and Energy

Despite the increase in mileage, it is to be expected that the emissions can be reduced considerably if a flexible service replaces the bus line. This is mainly because the fuel consumption of taxi vans is lower because of the lower weight of the vehicle and the smaller size of the engines (Figure 5). Regarding CO2 emissions, a bus produces seven times more CO2 per km than CC. Regarding NOx the difference is even more obvious with a ratio of 1:20. Looking at these figures it appears to be virtually impossible to overcompensate the emission advantage of the taxi van with mileage increase.

Figure 5: Comparison of vehicle emission factors[4]

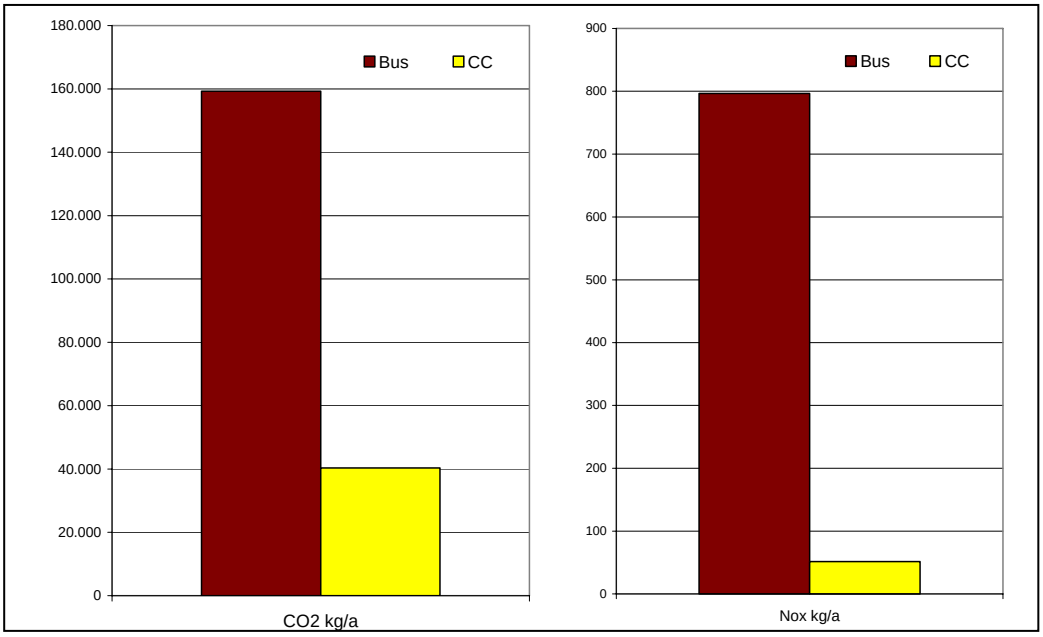


For the calculation in Figure 6 it was estimated that the CC service would run 180 times (including door service) during the day as opposed to the 144 bus tour. Nevertheless, the CO2 emissions add up to only 25 per cent of the emissions generated by the bus, i.e. CO2 emission reduction is 75%. Even more obvious, the CC service reduces NOx emissions by about 94 per cent annually.

[3] In the TELLUS demonstration measure, a Mercedes Vaneo with the mentioned seating capacity had been used.

[4] The calculations of emissions, etc. are based on the engine characteristics of the Mercedes Vaneo in comparison with a conventional bus. For the latter, assumptions as to engine and vehicle improvements as well as the renewal of the bus vehicle fleet in Berlin have been taken into account. Thus, the emission calculations are based on the projected vehicle 'state of the art' of the year 2015.

Figure 6: Comparison of annual emissions in the case study area



While these reductions look somewhat impressive, it has to be noted that these calculations only concern the replacement of a 3 km bus line in the case study area. If put into the context of the entire city and its transport emissions, however, the reductions that can be achieved by replacing bus lines with flexible services appear to be of minor relevance.

The reason for that is that there is only a limited number of areas where flexible, demand-oriented services can be applied. While it was well beyond the scope of the present analysis to identify the amount and extent of these potential CC areas in Berlin, the following assumptions had been made for the purpose of upscaling:

Bus lines that can either partly or fully be replaced with a flexible service generally run along side roads in peripheral areas.

According to the transport plan of Berlin, in 2015 about 15% of the total bus mileage will be generated on these side roads, translating to 17% of the CO2 and 18% of NOx emissions.

It is estimated that a maximum of 25% of the mileage on side roads can be taken over by CC under the same conditions as outlined in the case study area example (i.e. passenger numbers increase, mileage increase, emission decrease).

If the assumptions and calculations that were considered for the case study area are similarly applied to the 3.75 Mio km annual mileage that CC can take over, emission reductions of about 4,1 t CO2 and 26 t NOx can be achieved annually.

However, the share of buses on total transportation in Berlin is only 0.1% of the mileage, 0.6% of CO2 emissions and 1.8% of NOx emissions. Thus, the reductions achieved by CC within the side road network are truly marginal.

Summarising the above it can be held that from an environmental point of view CC does achieve positive impacts, however compared to the total emissions of transportation in the city these are only minor. It has to be considered, however, that locally, i.e. in the areas where CC runs, air quality improvements as well as noise reduction[5] (not considered in the present calculations) might turn out to have a positive impact on the local residents' quality of life.

5.3 Society

Regarding flexible, demand oriented services there seems to be a general agreement among transport experts that positive impacts regarding social aspects, which can be expected from a CC-service, might be of much more importance than the environmental impacts.[6] Transportation is a vital part of people's lives. The transport network provides the conditions for daily travel and thus, it acts as a determining factor for participation in the economic, social, political life of a city. Even though individual transportation takes up the overwhelming share of transport movements, especially in a city like Berlin where motorisation rates are considerable lower than in other cities, public transport is of major importance. Consequently, changes in public transport provision might also affect the ability of people to use transportation as a means to support the carrying out of daily activities. However, these effects can only be described in qualitative terms, since empirical data is missing.

Acceptance

Success or failure of innovative, flexible and demand-oriented transportation strongly depends on the acceptance of the service by the users. Research on this issue estimates that flexible services might generate acceptance rates that are about twice as high as the corresponding values for conventional, route-bound public transport (Sieber 2002).[7] While it must be granted that a 100% increase in acceptance will occur under very specific conditions only, the conclusion that can be drawn from this and similar studies is that flexible transportation might not only be accepted as an alternative option to conventional public transport, but moreover it might also present an alternative to individual motorised transport.

[5] Regarding noise, a flexible service is only advantageous if the number of tours does not rise to double the number of bus tours. However, regarding the subjectively 'felt' noise exposure it might also be that an increase in vehicle numbers results in an increase of noise sensation. This however strongly depends on the actual traffic situation in an area and is therefore neglected for the purpose of this scenario.

[6] This was particularly emphasised by the experts participating in the workshop in June 2005.

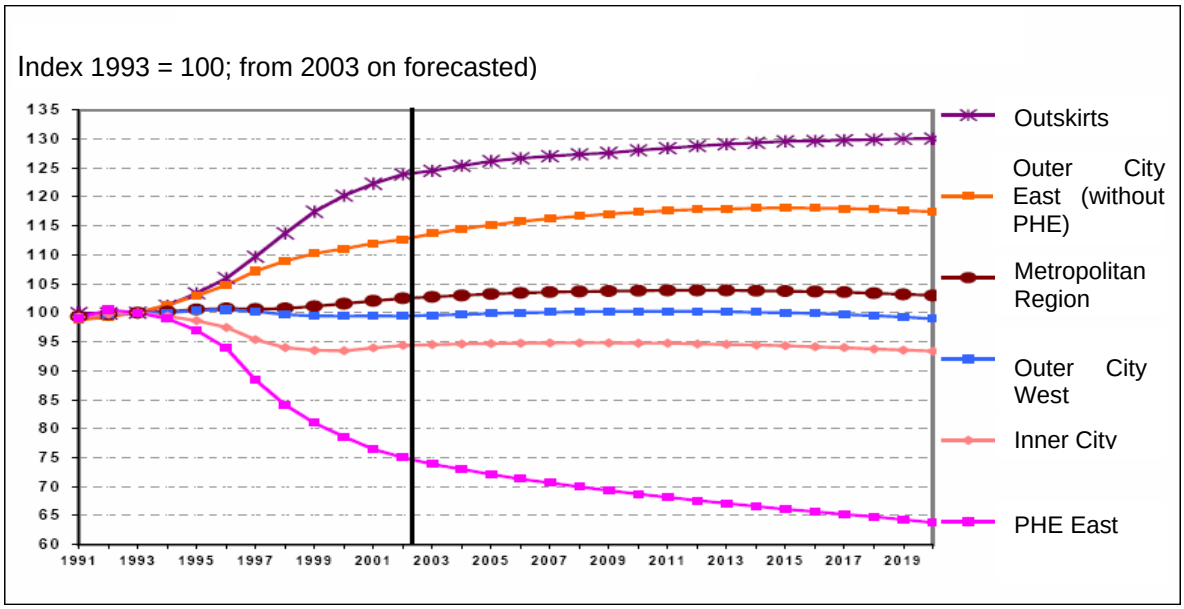
[7] It must be noted, however, that all of the projects that had been analysed for the cited study did take place in rural, low-density areas. The results can therefore not be directly related to the urban context. The increase in acceptance, for example, might be lower for urban areas, since here use of public transport is already higher and thus, the possibility of attracting new costumers is somewhat limited.

However, this would only hold true if verbally issued acceptance translated more or less directly into active behaviour. Additionally, the same study showed that acceptance grows in line with increasing flexibility. That is to say, the less routes and trips are bundled and the more individualised transportation gets, i.e. the more similar it becomes to travelling individually by car, the higher the acceptance. Economic and ecological considerations, however, will put a limit to the possible degree of individualisation and flexibility.

Population dynamics and their consequences for public transport

Peripheral areas, including suburbia and sprawling areas at the urban fringe, are those parts of the city that continue to grow in size and population while the inner city experiences a stagnating development. As Figure 7 shows, the outskirts (i.e. areas outside the administrative boundaries where the city merges with the surrounding federal state of Brandenburg) and the outer city east experience population growth, while the other parts of the city continue to lose population. Population losses most notably occur in the peripheral high density housing estates (PHE) in East Berlin, and in most cases people move from there further out, thus generating a considerable share of the growth in the outskirts. Apart from population movements and the related shifts between the different parts of the city, the developments regarding the ongoing shifts in age structure are of even more importance with regard to an increased demand for flexible public transport options. In general, Germany has an aging society, and even though Berlin holds the image of a 'young' city the average age of 41.7 years is only slightly below the national average (Statistisches Bundesamt 2004).

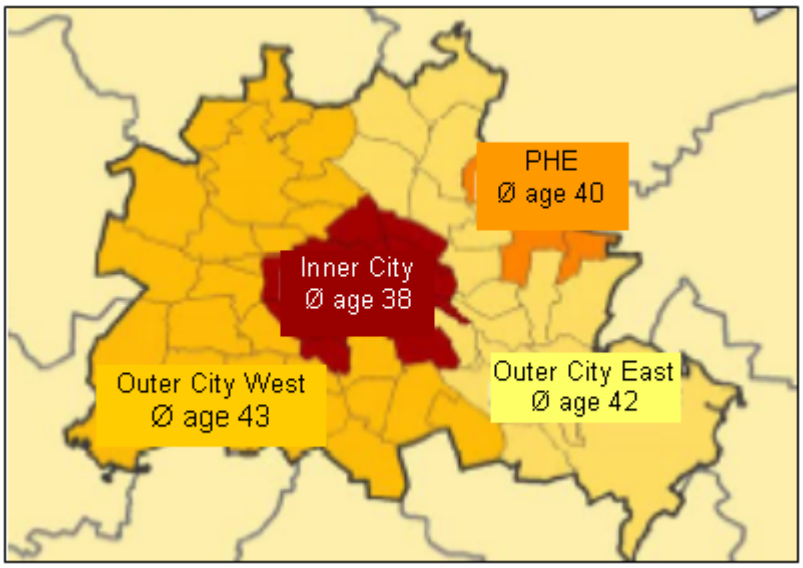
Figure 7: Population development in different parts of Berlin



Source: Senatsverwaltung für Stadtentwicklung 2002, p. 7

ecause of the current demographic trends, the city is expected to 'grey' in the next years to come, meaning that the number of old people will increase while the share of the younger generation will decrease due to declining birth rates. What is more, younger people tend to live in the inner city, while the more peripheral an area the older its residents outwards with increasing age (Figure 8).

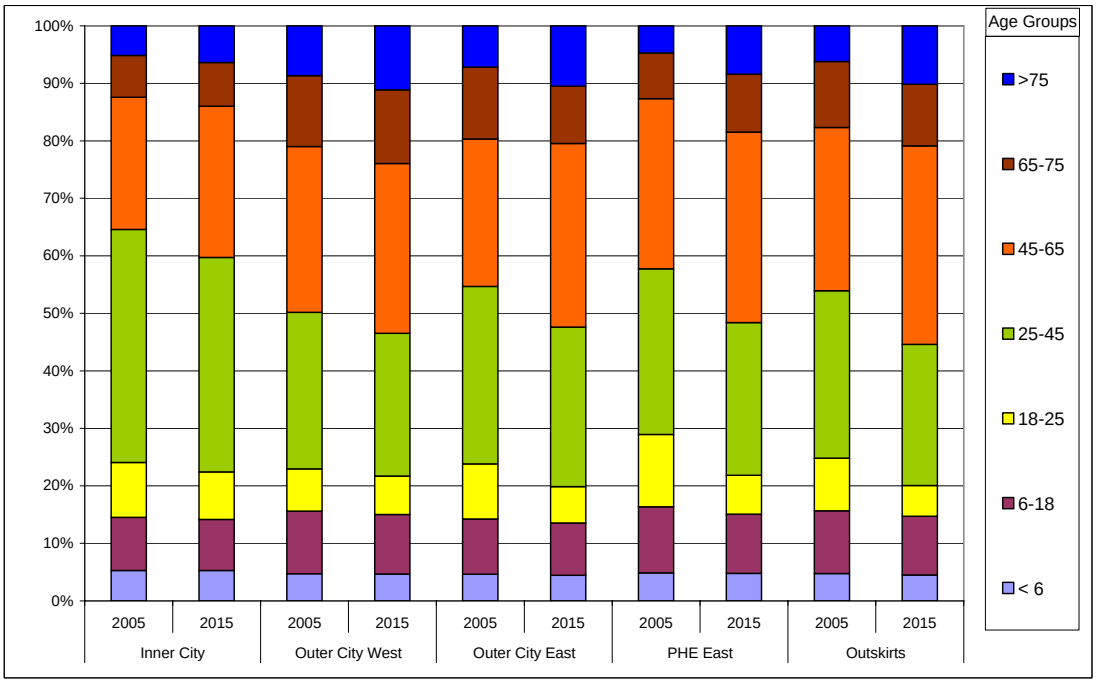
Figure 8: Average age 2004 in different parts of the city



Source: Statistisches Bundesamt 2004

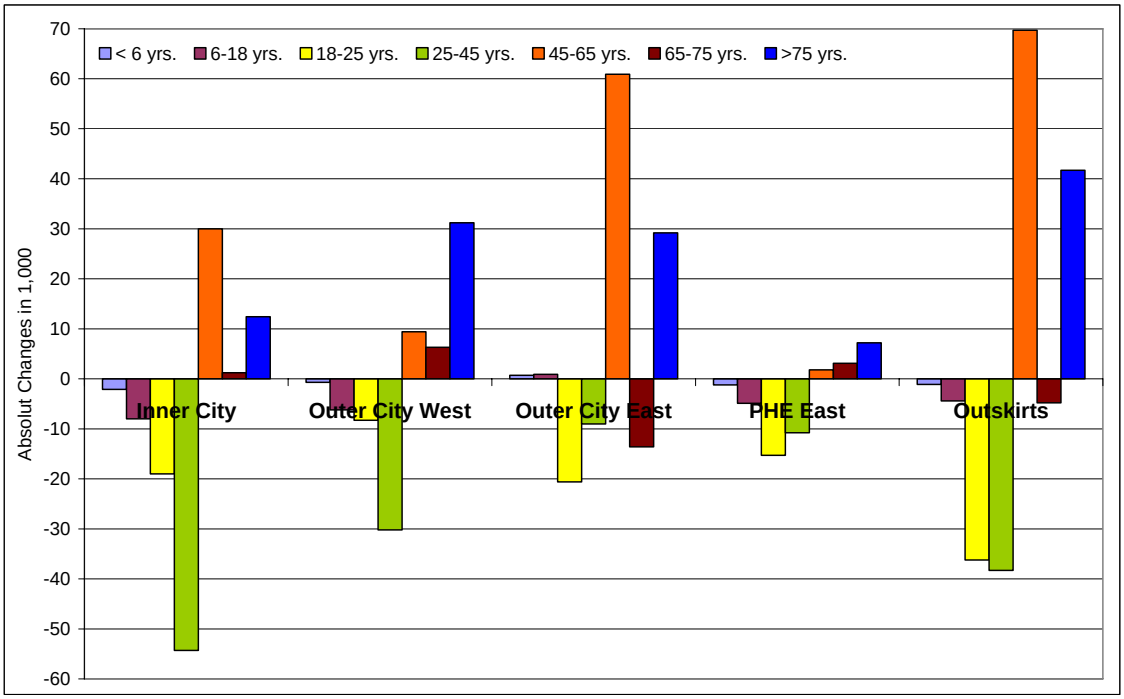
Currently the age differences between the different parts of the city appear to be only slight, however, the gap between the young inner city and the old outer city is projected to increase until 2015 and beyond (see Figure 9 and 10).

Figure 9: Age structure development 2005 – 2015 in different parts of the city



Source: Senatsverwaltung für Stadtentwicklung 2002

Figure 10: Changes in age structure between 2005 and 2015 (projected)



Source: Senatsverwaltung für Stadtentwicklung 2002

From a transport point of view, the shifts in demographics and particularly the changing age structure and growing differences between the inner and outer parts of the city will have a major impact on the future transport demand, because the mobility patterns of the elderly are different from those of the younger generations. For example, commuting as a reason to travel plays a decreasing role when more and more people are retired. Travelling for leisure time purposes takes on different patterns as well; generally older people tend to spend more time in the closer proximity to their place of residence (Stete 2004). However, the emergence of a new 'generation of seniors', the so-called 'young elderly', who remain active long after the date of retirement and strive to largely maintain the (leisure) activity patterns, also indicates the persistence of a orientation towards the centres, where cultural, educational and entertaining establishments are concentrated (Rudinger et al. 2004)

Thus it can be concluded that the 'young elderly' will be more mobile than former cohorts of seniors. Additionally, the number of senior citizens holding driving licenses is increasing and will continue to do so, and the elderly will thus use their cars until old age puts a natural limit to their ability to drive, or else they refrain from it for other reasons. At the latest at this instant, public transport will be important for the older people, particularly in outer districts where the economic, cultural and social infrastructure is less available.

The provision of traditional timetabled public transport appears not appropriate for many seniors seeking flexibility in their transport services, based on what they are used to and what they require. Already many existing non-drivers, are increasingly dissatisfied with the conventional fixed-route public transport currently available and find this alternative far less attractive compared to driving or being driven. It has become the mode of last resort. [8] If public policy (or innovative private activity) is to attract seniors away from individual car based mobility, it is likely that alternative transport must also have high levels of flexibility. With such large numbers of seniors in future years, the market opportunity to justify such services will be much improved. Demand oriented public transport taking into account the need of the elderly has many advantages, which might make it an alternative to car use and in particular to substitute car uses, such as lifts provided by social networks, e.g. family and friends (Rahaf, Hensher 2003). The table below summarises the attitudes of seniors towards different alternative transport options. What appears to be most obvious from the allocation of positive and negative attributes is that the elderly attach great importance to the following: Transport for them has to be reliable, affordable, comfortable, and – most important – it has to enable them to be independent.

[8] The literature suggests that the dissatisfaction with conventional (fixed route) public and community transport is similar in many western countries.

Table 1: Range of perceptions of selected alternatives to driving

Transport Option	Positive Attributes	Negative Attributes
Ride with friends/family	"Socialise and mobility together" "Almost like doing it yourself"	"Imposing on people" "Cannot always have it (ride) when you want it"
Bus	"Do not have to bother anyone" "Gets you around traffic"	"Bad elements on bus" "Waiting"
Light Rail	"Quick on time" "Comfortable in all weather"	"Do not necessarily go where you need to go" "Too far to walk"
Taxi	"Good for an emergency" "Reliable"	"Too expensive" "Cannot always get one"
Demand Responsive	"Door to door" "Cheap"	"Late picking you up" "Do not know of any"

Source: Coughlin (2001), cited after Rahaf, Hensher (2003): 910

It appears that CharterCab is well able to fulfil all of the mentioned requirements. This notion is underlined by the results of the CharterCab costumer survey[9], in which the categories reliability and flexibility were rated positive by 91% and 80% respectively of the respondents. The average time between order and arrival of the Cab was 14 minutes, which seems to be reasonable in areas with low bus frequencies.[10] What is more, already during the TELLUS demonstration of CharterCab, the average age of the users was 50 years. What was more surprising was that 80% of them had always or almost always access to a car. It appears that the users did see CharterCab as a comfortable alternative.

The upcoming generation of seniors, i.e. the current 'young elderly' and even more so those that will be retiring in the year 2015, will have a different attitude towards (communication) technologies. Ergo, the use of mobile phones (e.g. for ordering the CharterCab at the S-Bahn station) will be more widespread and older people will be less reluctant to use them.

[9] Carried out in September 2003 by the Evaluation group in co-operation with P.O.P. consulting among the members of the Car Modal Mobilclub.

[10] Moreover, a study commissioned within the framework of TELLUS measure 7.5 revealed, that a waiting time of up to 15 min is seen as equivalent to a 600 m walk to the bus stop. Additionally it is estimated that the added comfort of the pick-up at home service might generate an increase in costumer satisfaction.

The greying of society, however, poses also different challenges to the field of transportation than the once described above. For example, even when – as estimated her – certain peripheral areas will experience a rapid aging process, there will still be young people, for which the transport service must also hold adequate offers. Transport problems in peripheral, badly connected areas might be most relevant for e.g. teenagers, who desire to enlarge their activity radius but are not yet able to travel individually. Anecdotal evidence shows that this age group appreciates the benefits offered by flexible collective transport, and they are even willing to pay a little more for it. It can be assumed that the age group of 16 – 18, i.e. those teenagers that still live at home but do not want to rely on their parents for transportation, might be particularly open minded about a CC-service especially during the late hours and at the weekends when transport connections in peripheral areas do not meet their activity schedules.[11]

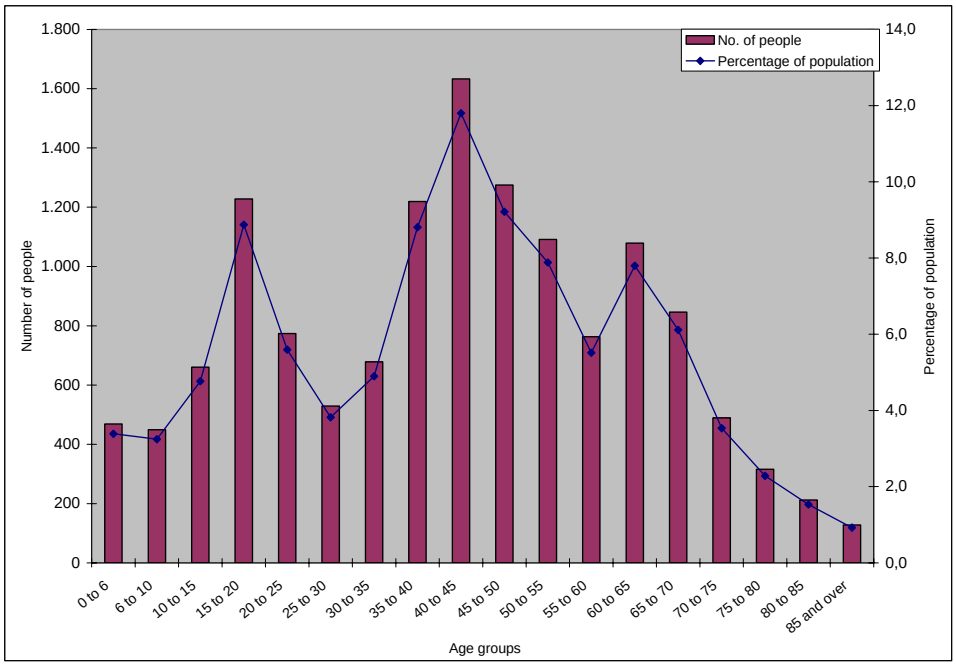
Relevance for case study area

Looking merely at the average age in the eastern part of the city (Figure 8) might somewhat conceal the relevance of the age-related changes for the case study area. Even though Mahlsdorf belongs to the administrative district of Hellersdorf-Marzahn, its built environment and the population structure is a lot different. The area is not part of the high density housing estate, but instead Mahlsdorf, together with neighbouring two other former village settlements (Kaulsdorf and Biesdorf), makes up the biggest coherent suburban detached housing estate of Berlin. As Figure 11 shows, more than 1/3 of the inhabitants of Mahlsdorf are in the age cohort ranging from 35 to 55, and a further peak can be allocated to the age cohort 60 – 65. Nevertheless, about 10% of the population are of younger age (15-20). However, the picture reveals that after reaching adult age, there is a considerable drop in absolute numbers as well as percentage shares, which might be due to the fact that these young people move out of their parents' homes. If this trend was to be projected into the future, the assumption that the older age groups will increase their shares considerably in the next years to come could be made. This would further lead to the conclusion that by 2015 Mahlsdorf will be a "grey" district, especially since people who live here have often owned their house for a long time. Thus, it is unlikely that they will want to move, which is why rather sooner than later Mahlsdorf will be home to a majority of elderly. The problems arising from the peripheral location of the territory together with probable infrastructure shortages and the resulting need for the elderly to travel longer distances have already been acknowledged.[12] However, no concepts or strategies to deal with this foreseeable and partly already existing development exist.

[11] Information provided by one expert during the expert workshop in June 2005.

[12] During the expert workshop held on the analysis of the measure's potentials by the Evaluation Team, particular concerns as to that issue have been raised by the experts.

Figure 11: Age structure of population in the case study area 2004



Source: Statistisches Landesamt Berlin 2005

Considering the situation it appears reasonable to suggest that a flexible service in Mahlsdorf might improve the situation of the elderly in the area. Even though any statements issued as to the probable social impacts of the service in the case study area has to deal with great uncertainties, the following attempts to draw a picture of a possible future.

A glimpse of the future

A flexible service is introduced to the area, which pays special attention to the needs of the elderly.[13] This also includes the offer of a special door-to-door service for selected centres of activity within or in close proximity to the corridor, such as the nearest hospital, in order to spare the seniors the transfer to another bus or the tram.

After a short period of reluctance and following a major information and advertisement campaign, the senior citizens of Mahlsdorf now use the service frequently in order to satisfy their mobility needs. The high utilisation of the service by the (older) users is also a result of changes in policies that affect car ownership and use, such as ownership and fuel tax increases, upper age limits do driving and the restriction of car access to prominent areas of the inner city[14].

[13] Nevertheless, the service is also used by other age groups.

[14] All of these are discussed controversially at the time of writing.

A survey revealed what the elderly value most about the service:

- It enables them citizens to remain independent from family rides.
- Because of the door-service, the elderly do not have to undertake the strenuous walk to the bus stop anymore.
- The vehicles used are accessibly to the physically impaired as well, which enables them to fully participate in transport.
- Comfort, reliability and cleanliness of the vehicles add to the positive attitudes.
- Integration with the transport network ensures that the area remains well connected to the inner city.
- Because of the tariff integration, and especially because of reduced tickets for the elderly, the service is affordable also to seniors with a small pension.
- Furthermore, the survey concluded with the following impact assessment:
- Seniors in Mahlsdorf travel longer distances with more ease and confidence than elder people in peripheral areas that are not (yet) serviced by CharterCab. Moreover, they participate in activities outside their local area more often, which adds to their quality of life.
- The monthly costs for transportation for seniors in Mahlsdorf are lower than the costs for people in car-centred communities.
- The good transport connections make the area more attractive for people that look for a place to live in the periphery, but who do not want to be car-dependent. Because of that, Mahlsdorf also shows a better mix of different age groups and lifestyles than areas that appear less attractive from a transport connection point of view.

5.4 Economy

The clarification of the economic conditions for flexible services is the major pre-requisite for successful operation. A lot of pressure is currently being built up regarding subsidies to public transport and the need to balance the societal relevance of services with cost-effectiveness. Evidence from implementation of flexible services in rural areas shows, that even though flexible services can not be expected to cover their own costs, they do well allow for a reduction of subsidies. In the case of Berlin it is frequently being argued that if the present public transport provider BVG was to offer the flexible service, no major cost savings could be expected since the provider would have to keep drivers and vehicles on stand by anyway. If, however, a private company was to offer the service, their business scheme and operating procedures could differ considerably from that of a large transportation provider. Thus, economic impacts on their side could prove to be viable. A comparison of different operating forms showed that most reductions arise from lower personnel costs and a reduction of the vehicle fleet. In fact, reductions of subsidies in the range of 15-45 percent are not

unheard of (Sieber 2002). However, a number of necessary framework conditions need to be met before these reductions can be achieved. For the purpose of the considerations underlying this scenario, however, it is estimated that by the year 2015 these framework conditions should be put in place, so that the economic potentials of flexible services can be put to use. Additionally, with the expected large numbers of seniors in future years the market opportunities of flexible services might improve considerably.

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The analysis of the potentials and possible benefits of a flexible, demand oriented transport service like CharterCab showed that positive impacts are to be expected, both from an environmentally and a social point of view for the year 2015 if the service was put into place city wide. However, calculations indicate that the environmental effects are on a much lower scale than one would expect, which is mainly due to the fact that such a service can only be implemented in certain, closely defined areas of the city, namely the periphery and suburban housing estates.

Nevertheless, the service could contribute to the achievement of the goal of a more environmentally friendly urban transport, especially if it is looked at as one of many modules of future urban public transport, which will complement and reinforce each other.

Considering social aspects, the projections for the future demographic development of the city and particularly of its fringes emphasis the fact that new and innovative transport options must be provided that fulfil the special demands and expectations of the seniors. Because of its operational characteristics, flexible services offer a range of functions that might make them particularly attractive to older people. Nevertheless, up to the current stage no data on these developments and their likely outcome in connection with transportation is available, so that the assumptions presented here are merely educated guesses.

Thus, identifying interrelations to other transport measures and clarifying the particular conditions of which CharterCab might run is a prerequisite for achieving more detailed insights. Also, the economic aspects that had not been looked at here must be considered more carefully before large scale implementation becomes an option. This relates in particular to the operational modes of such a service, applicable business schemes, and the integration into the public transport network.

ANNEX 4:

Methods of Participatory Evaluation (CTS)

1 Methods of participatory evaluation

How could we reach these objectives? How could we integrate the competency of the target groups into the evaluation and implementation of the TELLUS projects in a fruitful and meaningful manner?

Essentially, we have two types of methods: instruments of qualitative social research (above all focus groups and interviews); and methods for the visual processing of traffic measures (above all a computer simulation: the “TELLUS game”).

The qualitative paradigm stands to reason, for it stresses as a matter of principle the process character of the social world and thus of every research subject: patterns of action are not fixed beforehand, but are always developed in interactions and - broken through the interpretations of the individuals - realized in new actions. The open, flexible and interpretative methods, which are deduced from this perspective of the social world, enable an understanding of fluctuating and dynamic research subjects such as the TELLUS measures.

Visual methods are obvious for they could appeal directly and in an intuitive and sensuous way to the participants and so prepare and supplement the actually intended intellectual analysis.

1. Focus groups with traffic experts

Traffic experts in three focus groups discussed the Berlin TELLUS projects. The main purpose of these discussions was to develop indicators for optimising the measures, i.e. provide assistance in implementation, now and in the future.

What is a focus group? The method of focus group is a form of group discussion. Above all it is used for market research, but more and more in other contexts of the social sciences as well, for example for the evaluation of programmes. Here, the focus groups serve to prepare and to optimise political and planning processes. A focus group is made up of 4-12 persons and discusses undisturbed a specific, clearly defined topic for a limited period of time, here, during a morning. There has to be a moderator. The moderator focuses the subject and has to make sure that the goals are reached.

In relation to our goals: Why was it practical to organize focus groups?

In the traffic planning and policies in Berlin there are different, in part contradictory views and interests. If a method is to realize evaluation and participation in this complicated field, then it needs to be open and flexible. The protagonists of the target group have to given an opportunity to unfold their views. – And focus groups are suitable for precisely this reason: a focus group is a qualitative instrument that, on the one hand, guarantees frankness, while, on

the other, enabling a targeted orientation towards special subjects and goals. Through the interaction in the group and the thematic concentration, many ideas can be generated in a short time and an activation of the participants set in motion.

The focus group is also an instrument that can be integrated flexibly into larger research designs. Thus, it is e.g. possible within the scope of the TELLUS evaluation in Berlin to concentrate a focus group of experts on a special topic or measure. - For the evaluation team, the participation and activation of experts fundamentally offers the chance to examine and to correct its own work.

What was the concrete procedure for realizing the focus groups and how are they to be integrated into the local evaluation plan?

The 15 participating experts are employed in different fields: economics (3 experts), science (3), administration (3), politics (1) and associations (5) in Berlin. Of course, they have different points of view on traffic policies. This heterogeneity in the composition offers an opportunity to integrate the various interests evident in traffic policy and to achieve a solution capable of gaining a broad consensus. This procedure had another positive effect: the generation of public awareness for TELLUS in different fields of traffic.

These focus groups are part of the ex-ante-evaluation. The TELLUS measures in Berlin are to be assessed in general and discussed with a view to possible improvements. The evaluation team has decided to work with a special questionnaire in these focus groups. Its questions refer to the "demonstration measure level" and the "city level". Apart from these specific references, they should generate a free discussion:

1. How do you assess the different measures according to their particular objectives?

   ("Q 1: Did the demonstration measure achieve the desired effects?")

2. How do you assess the different measures according to the TELLUS objectives?

   ("Q 2: Did the individual demonstration measure contribute to the TELLUS objectives?")

3. How do you assess the different projects according to the goal of organizing urban mobility in terms of sustainability (social, economic and ecological)?

4. To what extent could one integrate these projects into traffic policy in Berlin? Or: To what extent could conflict arise due to diverging interests? How could this be dealt with constructively and a solution found?

(Here, we want to discuss possibilities of implementation and improvement.)

5. How could we optimise the measures in terms of attaining their objectives (in every respect: concerning technical, social, economical and ecological aspects)?

In the discussion, the measures were discussed one after the other. The basis of the discussion was a summary of the projects. The discussion was recorded and analyzed. The result of the analysis consists in a summary of the assessments and comments.

First of all, this text was taken up in the discussions of the evaluation team and was distributed to those persons carrying out the measures. This provides them with qualified feed back from independent experts assessing the measures.

For feedback purposes, the statements were distributed along three categories: positive comments, negative comments and suggestions.

2. TELLUS-poster exposition

With regard to our objectives of participation and activation, it is important to appeal to the participants not only on the intellectual level. For this reason, 5 projects have been presented on posters. The poster concept closely follows that of the „citizen exhibition" by Dienel/Schophaus (2002). Each poster shows two photographs, one of the measure, one of a person entrusted with its implementation, as well as some quotations by this person concerning the project measure and traffic in general. The posters were shown within the focus groups. They served as a stimulus for the discussion. - On top of this, the presentation of the TELLUS projects on posters serves as a genuine CTS contribution to dissemination. Its use is multi-functional: these can be used in the framework of TELLUS exhibitions, whether for internal communication between the TELLUS partners in Berlin or for a broader public.

3. TELLUS-simulation-game and focus groups with non-experts

The TELLUS simulation game implements virtually the basic ideas of seven of the ten TELLUS measures in Berlin:

This project is founded on the basic assumption that a computer simulation is suitable for arousing the understanding of new mobility concepts, precisely among the non-experts. It is this understanding we want to take up. We want to process anew the principles of our projects in another medium and subject them to evaluation. Concretely: By playing the game, the non-experts become familiar with and learn to understand the ideas of the measures. Afterwards they assess the projects in appropriate methods. Criterion of the assessment is (again) not an individual interest but its general or public use.

The simulation is an example for the fruitful combination of participation and evaluation. By playing the game, the non-experts took part in TELLUS. And in doing this they find out enough about the measures so as to be able to assess their basic ideas and principles.

The use of the simulation has several advantages:

- The player gets involved in a new role setting.
- The player learns by playing. That is to say: He learns gladly.
- The player is active, he can move.
- The player is motivated by his success.

On the one hand, the method should produce many comments concerning the measures, which could support the further development of the measures. On the other hand, through this method we want to find out if this instrument can be helpful fort the evaluation.

In order to reach these goals we used two different constellations of information and activation, which are close to reality and which act like functional equivalents to each other.

In the first constellation, individual test persons were introduced in the game at the computer. They played each measure one or two times and then commented in the interviews. – The correlative to this constellation is the person who learns alone at the computer and then talks to another person.

In the second method test persons came together for group discussions. Based on former reading, they discuss each measure. – This constellation as well has its correlative in daily life: People learn something about a subject by reading, and then they discuss this topic in a group.

Three homogenous groups of participants were assembled, distinguished by their way of taking part in traffic: Representatives of the economic car traffic (professional drivers like lorry, bus and taxi drivers etc.), car drivers and users of public transport. We were aware of a mix with regard to sex and age concerning the test persons. A precondition for participation was a regular use of computers.

All participants discuss all seven measures used in the game. They discuss only three of them in the first constellation and four of them in the second constellation.

Group 1a: Car driver

Measures 5-7: Game + interview

Measures 1-4: Reading + group discussion

Group 1b: Car driver

Measures 1-3: Game + interview

Measures 4-7: reading + group discussion

Group 2a: User of public transport services

Measures 5-7: Game + interview

Measures 1-4: Reading + group discussion

Group 2b: User of public transport services

Measures 1-3: Game + interview

Measures 4-7: reading + group discussion

Group 3a: Representatives of the economic car traffic

Measures 5-7: Game + interview

Measures 1-4: Reading + group discussion

Group 3b: Representatives of the economic car traffic

Measures 1-3: Game + interview

Measures 4-7: reading + group discussion

In both methods, the same questions were asked. Some of these questions are very similar to those questions, asked in the focus groups with the experts. Therefore, it is possible to compare the results.

Description/ Understanding:

What should be done in this measure? Would you describe it, please?

General assessment:

What do you think about this measure?

What was your spontaneous impression?

Which features of this measure do you appreciate? Why?

Which features don't you appreciate? Why?

Special assessment (Aims, aspects)

How do you assess the measure according to its particular objectives?

How do you assess the measure according to the goal of organizing urban mobility in terms of sustainability (social, economic and ecological)?

How do you assess the measure in their special aspects? (Talk about individual aspects)

Possibilities for improvements, conditions for success

What do you think, which are the conditions for success of this measure?

Which are the obstacles?

How could we optimise the measures in terms of attaining their objectives (in every respect: concerning technical, social, economical and ecological aspects)?

Application in other areas

Is it possible to applicator this measure in other fields/areas?

Rest

Do you have any ideas, comments?

At the end of this setting the participants answered some questions concerning the aspects information and activation, comparing the two different constellations:

With regard to information and activation: Which method is in your opinion more useful?

In which setting did you feel better?

What does the visualisation means to you? Manipulation or illustration/explanation?

30 participants were asked in interviews (1-2 hours) and group discussions (each 2-3 hours). The rich recordings were transcribed and analyzed.

Reflections on the approach and the methods (research goals)

The approach of the participatory evaluation is useful in order to involve perspectives of people not taking part in the project but taking part in every day's traffic. These people, if experts or non-experts, are directly or indirectly affected of the TELLUS measures for they take part in traffic in Berlin. They could think about the measures from a different point of view, so they could give important advices.

However, the question is not *if* we should use a participatory evaluation, but *how*. Different methods with different target groups have different effects:

Focus groups are the right method, if one wants to get different statements from different points of view. Especially with experts, it is very useful: The experts are self-confident, so they do not hold each other back. However, they control each other towards a responsibility for the community. Moreover, at the same time they stimulate each other for new ideas - especially if they are working in different fields, if they have different perspectives on traffic policies.

In comparison to experts, non-experts are working better with interviews for they have in interviews the possibility to concentrate on themselves. In focus groups sometimes, they hold each other back. Or at times some participants dominate the others.

The TELLUS-game was used as an information medium for the interview. The testers were sometimes very sceptical concerning the TELLUS-game. However, after all, they accepted the game as a medium for information and an instrument for activation. Therefore, the game

worked: The tester made many statements on the measures (advantages and disadvantages). By doing this, they were usually able to make a difference between the game and the real measures. On the one hand, the visualizing of the TELLUS-measures was judged not to be very useful. On the other hand, they gave a positive mention to the possibility to be active in the game (“learning by doing”)

In the future, there should be more research on the use of simulation for evaluations. In further studies tester should have more time to think about the measures. Given that, the game could contain more complexity. In addition, the conception of the game should be aware of special user groups: Which group of user should serve the evaluation for which goals?

ANNEX 5:

Transfer Guide to METEOR Templates

	METEOR **Measure-level Result Template**		**TELLUS Berlin** **Evaluation on demonstration measure level (B2 – B11)**
The Measure	M1: Measure objectives	Refer to the project's "Description of Work" for the measure objectives. In case the measure objectives have been changed over the course of the project, for example in the "Inception Report" or the "Local Evaluation Plans", please indicate these changes. Furthermore, changed objectives may be considered below in the process evaluation section (M12) in the "lessons learned block" of this template.	2.3 Objectives (original) 2.1 Demonstration design 3. Implementation Process (changes)
	M2: Description of the measure	Describe what the measure was about. Provide a comprehensive and easy-to-understand (i.e. not a "technical") measure description, if possible, not exceeding 200 words.	2.1 Demonstration design (planned) 2.2 Transport Plan context 3. Implementation Process (actual)
The Implementation	M3: Innovative aspects	Refer to the measure fiches in the project's "Description of Work" where "innovative aspects" are already mentioned. Any updates compared to the information provided in the "Description of Work" should be reported.	2.4 Situation before TELLUS / Innovative aspects
	M4: Situation before CIVITAS	Refer to the measure fiches in the project's "Description of Work" where the situation before CIVITAS "innovative aspects" is described.	2.4 Situation before TELLUS / Innovative Aspects
	M5: Design of the measure	Refer to the measure fiches in the project's "Description of Work" and, if applicable the Projects Implementation Report in order to report on the design of the measure.	2.1 Demonstration design 3 Implementation process
	M6: Actual implementation	Describe which activities were carried out to implement the measure.	3 Implementation process
	M7: Deviations from the plan	Report on any deviation from the plan laid out in the "Description of Work". From an evaluation perspective, it will be important to explain such deviations from the original plan, for example, if a measure was moved from one workpackage to another or if it needs to be explained why only a part of the measure could be implemented. If a conflict between the dissemination and the evaluation purpose of the template is perceived, indicate any "sensitive" information that should not be made public.	3 Implementation process 5.3 Resume

The Evaluation	M8: Method of measurement	• Provide an overview of the evaluation indicators used; • Describe the various evaluation activities carried out; • Report on the data sources, i.e. which "tools" (interviews, questionnaire, task observations, etc.) were used; • Describe the frequency of measurement (how often, when, during which period of time, etc.) and in which form data are available (for example time series data)?	4.1 Evaluation methods
	M9: Achievement of quantifiable targets	Refer to quantifiable targets identified in the "Description of Work" and compare the actual achieved results with the originally envisaged targets. A tabular comparison would be sufficient. In case quantifiable targets have been changed over the course of the project, for example in the "Inception Report" or the "Local Evaluation Plans", please indicate these changes. Furthermore, changed targets may be considered in the process evaluation section (M12) in the "lessons learned block" below.	4.2 Impacts 5.3 Resume ANNEX 1: Details on Achievement of Objectives
	M10: Achievement of evaluation-related milestones	Compare milestones formulated in the "Description of Work with actual achievement, for example: community travel plan completed. In case milestones have been changed over the course of the project, for example in the "Inception Report" or the "Local Evaluation Plans", please indicate these changes. Furthermore, changed milestones may be considered below in the process evaluation section (M12) in the "lessons learned block" of this template.	ANNEX 1: Details on Achievement of Objectives
	M11: Report on the measure results	In this main, most elaborated and thereby expected to be longest section of the measure-level result template: • Report, discuss, interpret evaluation results; • Provide facts and explain them; • Elaborate on the actual contributions to measure objectives; • Describe whether there is a need for supplementary measures (not only within CIVITAS) to make the measure (more) successful; • Describe the potential up-scaling of the measure; • Offer visual presentations, for example graphs, maps, tables, etc.3 Information about achievements of quantifiable targets and/or milestones has been provided above (M9 and M10), however, in this section a textual explanation of the achievements is sought. Where possible units measured and results obtained should be referenced back to CIVITAS Core Indicators by stating indicator numbers in brackets (see METEOR Deliverable D2 "Assessment Framework and Evaluation Guidelines for Data Collection"); Where applicable, measures should contain the reference number used in the Local Evaluation Plans.	4.2 Impacts 5.3 Resume 6. Scenarios

Lessons Learned	M12: Barriers and drivers of the measure implementation/ Process evaluation	The information provided in this section will be particularly useful for determining the transferability potential of the measure. Measure Leaders are asked to: • Provide a description of the measure context; • Elaborate on political/administrative, societal, economical, technical, and other factors influencing the measure implementation in a negative (barriers) or positive way (drivers); • Provide any other background information on the conditions prevailing during the measure implementation (process evaluation information), including changed objectives (see M1), quantifiable targets (M9) or evaluation-related milestones (M10).	5.1 Drivers 5.2 Barriers 3 Implementation process (details)
	M13: Interrelationships with other measures	No templates need to be completed for the package level, since this level may not apply to every city, if, for example, only a handful measures are implemented in a city which are not in any way grouped or packaged. Nevertheless, it will be an imported part of the evaluation-, and more specifically the transferability-exercise, to analyse interrelationships between measures which complement each other and thereby form a group or package. List and explain the interrelationship of the measure with other complementary measures implemented in the CIVITAS city. Provide an assessment concerning the extent of the interrelationship between measures by choosing one of the following two categories: a) Low interrelationship or b) High interrelationship.	1 Introduction
	M14: Lessons learned	CIVITAS is interested in identifying particularly successful measures with a high potential for replication and take up by other cities. This kind of information may directly lead into policy recommendations. Therefore, in this section: • Provide an assessment whether you consider the described measure to be a take-up measure for other cities. Explain why or why not? • Explain what the specific good lessons learned are. • Explain what the specific bad lessons learned are. • Formulate specific recommendations for cities considering replication or take-up of the measure as well as for other actors and the European Commission.	5 Conclusions