Executive summary

This measure comprises the elaboration of a technical and economic feasibility study to set up a car sharing service in Coimbra, including the development a state of the art report and technical and economic feasibility study to set up a car sharing service. This study will assess the "acceptability" among stakeholders and potential users, develop a business plan for implementing a car sharing service, as well as compromise the Planning and Implementation of a communication campaign and dissemination of the end results.

The innovation of this measure is very relevant because will contribute to a greater sustainability of local and regional of PT. More precisely, the study proposes the introduction of an innovative transport solution (electric vehicles) that is unique in the region (car-sharing) and which will imply the direct involvement of the Municipality and the Urban public PT operator (SMTUC) thus promoting the integration with the rest of the public transport services and products and improving the use of the Municipal PT fleet.

The feasibility study prepared within the CIVITAS MODERN period concluded that this measure is feasible at a relatively low cost and has the potential to generate revenues that support the operation and permit the gradual recovery of the investment.

The results of the measure indicate that in a short period of time the operational car-sharing system could generate positive impacts over the balance between the operating revenues and the operating costs (+ 0.04 €/vkm), the vehicle fuel efficiency (-0,84 MJ/vkm), and vehicle fuel emissions (-10 ton CO2 per year).

The development of the study demonstrated that:

- car sharing services are very important in cities that want to have an integrated mobility system, being an important complement to the public transport network.
- If institutional fleets are to be used in supplying the system, a previous assessment of the car usage by the current users of the fleet is strongly recommended.
- launching the service with the use of a reduced fleet, based on comparisons with the usage of similar services in other cities, is a good alternative to launching of a large scale service based on expensive and unrealistic demand potential assessments through surveys.
- The involvement or commitment of the key decision-makers in the implementation of a new system, especially in certain cultural settings or where there is a general lack of knowledge, is very important in order to identify problems and anticipate recovery actions, e.g., to avoid delays or irreversible consequences.

A. Introduction

A1 Objectives

The measure objectives are:

(A) High level / longer term:

- To decrease the city traffic levels in the city;
- To improve the city air quality;
- To reduce dependence on fossil fuels.

(B) Strategic level:

- To increase the number of trips made in a sustainable way over the use of private car.

(C) Measure level:

(1) To release a feasibility study of new mobility services, mainly that concerns car sharing exploited by "clean" fleets and pre-existent cars from the municipality;

(2) To reduce the emission of greenhouse gases in Coimbra in case of real implementation of the measure.

A2 Description

This measure is a technical and economic feasibility study made in order to set up a car sharing service in Coimbra as a pilot case in Portugal. Similar services are only beginning to be implemented in Lisbon and Oporto.

The proposed action fully complies with the strategy of the City of Coimbra which seeks to improve the public transport system. The strategy aims not only at improving the more traditional mobility modes and methods, but also to offer citizens new forms of complementary public transport such as can be car sharing, car pooling, and DTR services.

The study was carried out to evaluate the feasibility of a car sharing service in Coimbra, but simultaneously several dissemination activities have been developed to test the acceptability of this concept amongst stakeholders and potential users in Coimbra, as well as to test its implementation in other cities in Portugal.

The innovative features of this service in the Portuguese context justified the need of a brief review of state of art, in order to understand how the existing car sharing schemes in other countries can be applied to Coimbra and other Portuguese cities with minimal adaptations, since the basic technology, know-how, software and experience exist in several EU countries and have been applied through several EU projects, such as MOSES, and is part of the CIVITAS projects. This aspect constituted the first part of the measure development.

However, this study has not simply adapted other pre-existent concepts and policies. It has created its own innovation by directly involving the municipality to implement a special type of 'mixed' car sharing service that includes cars from the municipality in the fleet, significantly reducing therefore the initial cost of the implementation of the service. These municipal cars will be available not only to the car sharing customers during working days after working hours, and during weekends and

holidays, but also they will be available during working hours, which will oblige the civil servants to use the car sharing service as a fleet management service of the municipality. This study forecasts that the car sharing service can be initiated with the introduction of 5 vehicles from the municipality, with an average age of 12 years. Four of the vehicles are diesel motors (2 + 2 compact urban dwellers) and one is a gasoline motor (urban).

Moreover, in terms of the car sharing fleet, the study - besides the proposal of procurement procedure and selection of suitable fleets - considers the car sharing fleet to be partly composed by clean vehicles (5 electric cars urban type), requiring in this case an initial investment to implement the service. So the entire car-sharing fleet in a first phase will be constituted by 10 vehicles, 5 from the municipality fleet and 5 new electric cars (175000 € of investment, including equipment associated with the service). These vehicles will be placed in 5 car-sharing parking stands (Fig. A.2.1), whose location in the city was chosen using the combination of several criteria.

Fig. A.2.1 – The 5 car sharing parking locations

The study comprises all relevant elements for contracting, procurement, implementation, and monitoring the car sharing service.

The study also presents the analysis of several scenarios for the service implementation, concluding that the most recommended for the initial phase would be the scenario that considers 25 member per vehicle with 3 average bookings/monthly trips. In this scenario an average monthly offer of 11250 v/km, which implies an annual consumption of 152618 MJ, is expected. Concerning the economic impact per year, the operating costs of the service will be 99590 € and the operating revenues are expected are 105296 €. In terms of the environmental impact the CO2 and particle emissions is expected to decrease from 10,3 ton to 7,8 ton.

The articulation with other public transport supply (public and private, including taxi services and fare integration possibilities) was also analysed. The new e-ticketing system, implemented in the scope of the CIVITAS MODERN measure 02.05, already has the capability to integrate a future car-sharing service in the existing e-cards.

Promotional and communication campaigns were organized, namely the setting-up of meetings with other car sharing operators and experts. A workshop was organized on 7th June 2011 during the 3rd CIVITAS MODERN Official Event in Coimbra, with the participation of the Director of Iniziativa Car Sharing of the Environmental Ministry of Italy (Marco Mastretta) and with presentations from other experts from the University of Coimbra and car-sharing services from Lisbon and Brescia as well as the communication of the Municipality expectations by the Councillor for Mobility of the City of Coimbra. Several technicians from the Municipality and SMTUC participated in this workshop.

Also relevant for the evaluation of the "acceptability" of the service among stakeholders and potential users, a demonstration activity of a car-sharing service was organized on 22nd September 2011, during the European Car Free Day in Coimbra. This activity had the attendance of the Mayor of Coimbra, stakeholders, media and public in general. The event included explanations about the system, trips in a hybrid car of the "MOB Car-Sharing" Service of Lisbon, presentation of the study and an opinion survey about the system. A stakeholder survey about the activities during the European Mobility Week was also carried out by the Municipality and the car-sharing demonstration had the note 4,0 in a scale from 1 to 5.

The success of this measure (a feasibility study) can be judged by the results of the "acceptability" test among stakeholders and potential users in Coimbra and selected other cities in Portugal and through the monitoring of the dissemination activities and the seminar series at university and other educational institutions. The ultimate success of the measure would be if Coimbra or another Portuguese city, as a result this feasibility study and of the dissemination efforts, would undertake a pilot demonstration project.

B. Measure implementation

B1 Innovative aspects

The innovative aspects of the measure are:

- **New mode of transport exploited, regionally**
    - The car sharing service represents by itself an innovative mobility service for the Coimbra region because in Portugal only Lisbon and Oporto are implementing a car sharing system,.
- **New policy instrument, regionally**
    - The study considered the car sharing fleet to be partly composed by clean vehicles (electric), which is in line with the municipality policy for improving city air quality and reducing the dependence on fossil fuels.
- **New conceptual approach and targeting specific user groups, nationally**
    - The development of a of mixed car sharing service directly involving the Municipality and Municipal services like SMTUC –: foresees the exclusive availability of part of the Car Sharing fleet during working hours for the Municipality services. These cars will be available to other car sharing customers for the remaining hours of the day (the major part of the rush hours) and during weekends and holidays. In case of success, the idea could be extended to other entities;
    - As a service implemented by the public transport operator, it is integrated with the rest of the public transport products, namely smart cards, monthly passes, etc.

B2 Research and Technology Development

Being a feasibility study no demonstration was expected in the measure, despite the possibility of future implementation of car sharing. Accordingly, all the work developed was focused on research and technology development, according to the measure description, with the exception of the parts concerning the dissemination and evaluation activities.

B3 Situation before CIVITAS

Until 2008, no **car sharing** study was ever undertaken in Portugal, and the concept is sparsely known, even among professionals and municipal managers and employees. Car sharing services exist in Lisbon and Porto, but they have limited dissemination. Only the Public Transport provider of Porto (STCP) is member of the UITP car-sharing platform.

Even **car pooling** is not practised in an organized way. The EU project Mobils (DGTren, 6th FP) tested car pooling in Lisbon hospitals (and some in the partner cities Barcelona and Toulouse). Some trials are presently occurring in the Lisbon region in an INTERREG project (MARE).

Even **flexible public transport** services are exceptional, the municipality of Beja (In the Southern region of Portugal) being one of the exceptions, with a shared taxi service in the rural areas of the municipality (since 2000).

With the measure, both the results of the study, as well as the results of the dissemination campaigns, will contribute to a change of mentalities and to greater involvement of the stakeholders, increasing the acceptance level for this new mobility service. The Municipality became more participative in this issue. Accordingly, one of the objectives that the measure aims to achieve is make people aware about the benefits of using an innovative model for mobility, i.e., using electric vehicles, that should take advantage of the electric charging infrastructure that is already implemented in Coimbra.

B4 Actual implementation of the measure

The measure was implemented in the following stages:

Stage 1: State of the art report and technical and economic feasibility study to set up a car sharing service *(April 2011-October 2011) – During this stage the research activity to access the state-of-the-art of new mobility services was carried out, with special attention paid to car sharing, and developed of a technical and economic feasibility study to set up this last kind of service. The work undertaken consisted mainly in:*

- *Knowledge acquisition on new mobility services, mainly those linked to the car-sharing and the bike-sharing, by researching the thematic literature and dedicated Internet websites;*
- *Meetings with other car sharing operators and experts;*
- *Participation of technicians from the Municipality and SMTUC in workshops, namely on 7th June 2011 during the 3rd CIVITAS MODERN Official Event in Coimbra, performed by the Director of Iniziativa Car Sharing of the Environmental Ministry of Italy and with the intervention of experts from the University of Coimbra and car-sharing services from Lisbon and Brescia as well as the communication of the Municipality expectations by the Councillor for Mobility of the City of Coimbra (Fig. B4.1)*;

Workshop on Car-Sharing performed in Coimbra by Marco Mastretta, Director of ICS (left) and with the speech of experts from the University of Coimbra and car-sharing services from Lisbon and Brescia and the Councillor for Mobility of Coimbra City (right)

Figure B4.1 - Workshop in Coimbra

- *Data research and collection for the development of the study;*
- *Analysis of some opinions received from experts;*

- *Site visits to other car-sharing operators;*
- *On July 2011 the working document reporting the state-of-the-art research was released at internally. Later this document was integrated with the feasibility study.*
- *Development and release of a study and implementation plan for a bike-sharing service in Coimbra (this issue was an additional achievement taking in attention that it wasn't foreseen in the DoW of CIVITAS MODERN);*
- *Visit of the Councillor for Mobility of the City of Coimbra and technicians from the Municipality and SMTUC to the "MOB Car-Sharing" of Carristour - Lisbon, that also included a work meeting with the Board of Directors and technicians of Carristour;*

In September 2011 a document integrating the state-of-the-art report and the technical and economical feasibility study was also delivered.

Stage 2: Results of the "acceptability" test among stakeholders and potential users *(September 2011 – April 2012) – The "acceptability" of the service among stakeholders and potential users was assessed through the following steps:*

- *First internal analysis of a draft of the study in SMTUC between the end of August and the first week of September 2011.*
- *On 22nd September 2011, during the European Car Free Day in Coimbra, a demonstration activity of a car-sharing service with the attendance of the Mayor of Coimbra, stakeholders, media and public in general was carried out (Fig. B4.2). The event included an explanation about the system, travel in a hybrid car of the "MOB Car-Sharing" Service of Lisbon, presentation of the feasibility study and collection of the opinion about the system. A stakeholder survey about the activities during the European Mobility Week was carried out by the Municipality and the car-sharing demonstration received a grade of 4,0 in a scale from 1 to 5. The event also included a bike-sharing demonstration.*

Mayor of the City of Coimbra promotes new mobility services during the European Mobility Week – Press conference over the river in the middle of the pedestrian bridge (top), experiencing bike-sharing from the Infomobility Centre to the Municipal Market (bottom left) to assists the car-sharing demonstration (bottom right).

Figure B4.2 - Mobility services promotion

- *Other dissemination activities about car sharing had important feed back, namely from the municipalities or public transport operators.*

Stage 3: Development of a business plan for a car sharing service (*October 2011 – June 2012) –a business plan to set up a car sharing service in Coimbra was developed that consisted mainly in the following:*

- *Literature review focusing on the features of other (existing) car sharing services, in order to identify key indicators of these systems, such as number of cars, number of members, number of stations, and relations between these indicators, e.g. number of cars per station, members per car, etc.*
- *Analysis of the Portuguese car sharing services, namely in Lisbon and Oporto, in order to identify the key features of the systems and the actual awareness.*
- *Identification of the key features of a car sharing system, namely its objectives, roles, limitation, and principal market.*
- *Brief characterization of the demographic features of Coimbra, to identify the potential users of the system.*
- *Brief characterization of the land use and mobility features of the city of Coimbra, in order to identify the key places for the location of the stations.*
- *Analysis of the existent public transport systems and their major features (extension, number of passengers, etc.)*
- *Identification of key places for the location of the stations.*
- *Determination of the fleet dimension and characteristics.*
- *Determination of the proposed fees.*
- *Technical issues regarding the proposed management system, on-board hardware, reservation processes.*

- *Indication of the strategy to be followed in order to implement the system in Coimbra, if the municipality decides to do it.*
- *Identification of potential partners for the system.*
- *SWOT analysis.*

Stage 4: Planning of the promotional and communication campaigns (*September 2011 – April 2012) –Initial planning for the activities of the European Car Free Day in Coimbra reported in stage 2 was carried out. Another campaign to present the business plan for a car sharing service to the stakeholders was planned, with emphasis on the municipalities, universities, car sharing operators and public transport operators. During the planning phase 2 methodologies were foreseen. The first was to integrate the campaign in the Annual Meeting of Cities with Public Transportation Services. Later this annual Meeting was postponed, making it impossible to carry out this methodology for the campaigns. Therefore the other solution was the delivery of a presentation of the business plan to the stakeholders. The organization of a webinar or teleconference in September 2012 are in discussion, but it will be an additional achievement to the project.*

Stage 5: Promotional and communication campaign and dissemination of the results (*June 2012) – In June 2012 the presentation of the business plan to set up a car sharing service in Coimbra was delivered by e-mail to the stakeholders. The target group consisted mainly of the municipalities, universities, car sharing operators and public transport operators. contacts with some PT operators and Municipalities to assess results about their opinion and acceptability was carried out and the results were later sent to the stakeholders. A deliverable with the final report, including the business plan and the results of the acceptability and promotional and communication campaigns, was released. A press release was also delivered to the media with the main outputs of the measure. The study was placed on-line on the site of the National Institute of Mobility and Inland Transportation.*

B5 Inter-relationships with other measures

Taking into account that the measure is a feasibility study, no inter-relationship with other measures are foreseen during CIVITAS MODERN implementation, especially in terms of measurable impacts. If the measure would come to be implemented it could generate impacts at modal split level as well as Measures 02.05, 04.02, 04.05 and 08.03.

C. Evaluation – methodology and results

C1 Measurement methodology

C1.1 Impacts and Indicators

Table C1.1.1 – Impacts and Indicators for the measure

No.	Impact	Indicator	Data used	Comments
1	Operating Revenues	Average Operating Revenues	Total operational revenues from the operation of the car sharing service; Total vehicle-km	Feasibility study scenario
2	Operating Costs	Average Operating Costs	Total operational costs expended with operation of the car sharing service; Total vehicle-km	Feasibility study scenario
3	Costs	Capital Costs	Total capital costs expended in setting up the measure	Feasibility study scenario
4	Fuel consumption	Fuel Mix	Energy consumption for the fuel considered; Total energy consumed	DGEG – General Directorate for Energy and Geology
5	Fuel consumption	Vehicle fuel efficiency	Total energy consumed; Total vehicle-km	DGEG and Manufacturer information about the average consumption of each type of vehicles and feasibility study scenario for the usage
6	Emissions	CO Emissions	Fuel type; Annual consumption; Type and number of vehicles; Vehicle-km	Manufacturer information about the emissions of each type of vehicles and feasibility study scenario for the usage
7	Emissions	CO2 Emissions	Fuel type; Annual consumption; Type and number of vehicles; Vehicle-km	Manufacturer information about the emissions of each type of vehicles and feasibility study scenario for the usage
8	Emissions	NOx Emissions	Fuel type; Annual consumption; Type and number of vehicles; Vehicle-km	Manufacturer information about the emissions of each type of vehicles and feasibility study scenario for the usage
9	Emissions	PT Emissions	Fuel type; Annual consumption; Type and number of vehicles; Vehicle-km	Manufacturer information about the emissions of each type of vehicles and feasibility study scenario for the usage
10	Emissions	HC Emissions	Fuel type; Annual consumption; Type and	Manufacturer information about the emissions of each

			number of vehicles; Vehicle-km	type of vehicles and feasibility study scenario for the usage

This measure consists in the elaboration of a feasibility study for the setup of a car sharing service in Coimbra. The implementation of the measure includes the definition of the methodology to determine the potential costs and benefits concerning the "Feasibility Study of New Mobility Services in Coimbra" and the estimation of those costs and benefits according to the defined methodology. No practical action will result from this measure during the CIVITAS project. Therefore, the concept of impact evaluation is not straightforward resulting in the fact that only potential impacts of the measure may be derived from the study.

In relation to the scenario to set up the car sharing service, in the feasibility study, and related evaluation effects, a fleet composed by 10 vehicles in 2 groups (conventional plus electrics) has been considered. For the conventional vehicles 5 vehicles will be available: 4 diesel (2 urban + 2 compact) and 1 gasoline (urban). For the electric group, 5 vehicles would be purchased for the service.

In relation to the trips, the feasibility study considers an average extension of 15 km with duration of 2 hours. The scenario chosen to perform the impact evaluation corresponds to the situation in which the car sharing system would have 25 members/vehicle with each of its users performing an average of 3 Reservations / Trips per Month.

Detailed description of the indicator methodologies:

- **Indicator 1** (*Average Operating Revenues*) – Ratio of total income generated from car sharing service divided by the total vehicle-km per year (€/vehicle-km).

  A = B / C

  where: A = Average operational revenue for the service (€/vehicle-km)

  B = Total operational revenue, coming from the sales of the car sharing service (€)

  C = Total vehicle-km

  All data is related to the car sharing service and fleet. The vehicle-kilometres and the operational revenues for the car sharing service are based on the hypothesis considered in the feasibility study.

- **Indicator 2** (*Average Operating Costs*) – Ratio of total operating costs incurred in the operation of the car-sharing system divided by the total vehicle-km per year (€/vehicle-km).

  A = B / C

  where: A = Average operational costs for the service (€/vehicle-km)

  B = Total operational costs incurred in the operation of the car sharing service, including expenditures with the fuel/energy and the maintenance of the vehicles used in the operation of the car sharing service, costs with the personnel necessary for the operation and management of the service, and rent space necessary for management and administrative activities (€)

  C = Total vehicle-km

All data is related to the car sharing service and fleet. The vehicle-kilometres and the operating costs are based on the hypothesis considered in the feasibility study.

- **Indicator 3** (*Capital Costs*) – Total capital costs expended in setting up the measure (€).

  Expenditures with the purchase and installation of the equipment (vehicles and infrastructure) that support the operation of the car sharing service and with the development and research related to the planning of the new service (€)

  All data is related to the car sharing service and fleet. The capital costs of the service are based on the hypothesis considered in the feasibility study.

- **Indicator 4** (*Fuel Mix*) – Percentage of the market share of transport fuel for each type of fuel used in a given period (%).

  $A = B / C \times 100$

  where: A = Fuel mix, or percentage for the fuel considered (%)

  B = Total energy consumption for the fuel considered (MJ)

  C = Total energy consumed for all vehicles (MJ)

  All data is related to the trips made by the users of the car sharing service. The energy consumption for these trips is based on the hypothesis considered in the feasibility study.

- **Indicator 5** (*Vehicle fuel efficiency*) – Ratio of energy consumed by the private car and public transport vehicles in the Coimbra metropolitan area divided by the total vehicle-km performed by these vehicles per year (MJ/vehicle-km).

  $A = B / C$

  where: A = Average vehicle efficiency (MJ/vehicle-km)

  B = Total energy consumed in the car sharing service and private car vehicles used on the trips made by the users of the car sharing service (MJ)

  C = Total vehicle-km performed on the trips made by the users of the car sharing service

  All data is related to the trips made by the users of the car sharing service. The vehicle-kilometres and the energy consumption for these trips are based on the hypothesis considered in the feasibility study.

- **Indicator 6** (*CO Emissions*) – Average CO emissions per vehicle-km (g/vehicle-km)

  $A = B / C$

  where: A = Average CO emissions per vehicle-km (g/vehicle-km)

  B = Total CO emissions for the vehicles considered (g)

  C = Total vehicle-km performed by the vehicles considered

All data is related to the trips made by the users of the car sharing service. The vehicle-kilometres and the emission factors for these trips are based on the hypothesis considered in the feasibility study.

- **Indicator 7** (*CO2 Emissions*) – Average CO2 emissions per vehicle-km (g/vehicle-km)

  A = B / C

  where: A = Average CO2 emissions per vehicle-km (g/vehicle-km)

  B = Total CO2 emissions for the vehicles considered (g)

  C = Total vehicle-km performed by the vehicles considered

  All data is related to the trips made by the users of the car sharing service. The vehicle-kilometres and the emission factors for these trips are based on the hypothesis considered in the feasibility study.

- **Indicator 8** (*NOx Emissions*) – Average NOx emissions per vehicle-km (g/vehicle-km)

  A = B / C

  where: A = Average NOx emissions per vehicle-km (g/vehicle-km)

  B = Total NOx emissions for the vehicles considered (g)

  C = Total vehicle-km performed by the vehicles considered

- All data is related to the trips made by the users of the car sharing service. The vehicle-kilometres and the emission factors for these trips are based on the hypothesis considered in the feasibility study.

- **Indicator 9** (*PT Emissions*) – Average PT emissions per vehicle-km (g/vehicle-km)

  A = B / C

  where: A = Average PT emissions per vehicle-km (g/vehicle-km)

  B = Total PT emissions for the vehicles considered (g)

  C = Total vehicle-km performed by the vehicles considered

  All data is related to the trips made by the users of the car sharing service. The vehicle-kilometres and the emission factors for these trips are based on the hypothesis considered in the feasibility study.

- **Indicator 10** (*HC Emissions*) – Average HC emissions per vehicle-km (g/vehicle-km)

  A = B / C

  where: A = Average HC emissions per vehicle-km (g/vehicle-km)

  B = Total HC emissions for the vehicles considered (g)

  C = Total vehicle-km performed by the vehicles considered

All data is related to the trips made by the users of the car sharing service. The vehicle-kilometres and the emission factors for these trips are based on the hypothesis considered in the feasibility study.

C1.2 Establishing a Baseline

The year 2007 is considered as the baseline, before the "start of the study" in April 2011.

The measure results are obtained taking into consideration the feasibility study scenario on indicators 4, 5, 6, 7, 8, 9 and 10.

Indicators 1, 2 and 3 (Operating Revenues, Operating Costs and Capital Costs):

The source of the information has been the feasibility study on both the estimated costs and revenues of operating the car sharing system, as well as on the vehicle-km performed by those services

In relation to the ex-ante situation it was considered that before the existence of the service all costs and revenues are equal to zero.

Accordingly, the results of the baseline for each indicator are indicated in the tables C1.2.1 to C1.2.3:

Table C1.2.1 – Indicator 1 – Ex-ante

Indicators and respective parameters	Ex-Ante values
Revenues from the operation of the system	0,00 €
Total vechicle-km	n.a.
Average operating revenue	0,00 €/vkm

Table C1.2.2 – Indicator 2 – Ex-ante

Indicators and respective parameters	Ex-Ante values
Total Operational Costs	0,00 €
Total vechicle-km	n.a.
Average operating costs	0,00 €/vkm

Table C1.2.3 – Indicator 3 – Ex-ante

Indicators and respective parameters	Ex-Ante values
Total capital cost	0,00 €

Indicators 4 and 5 (Fuel Mix and Vehicle fuel efficiency):

The feasibility study provides information on both the estimated energy consumption related to the car sharing system and the respective vehicle-km.

In relation to the ex-ante situation, it was established that all trips (with potential to be shifted to the car sharing before the implementation of the service) were performed using of the private car.

The fuel mix data source results from the share of the fuel consumption in Portugal in 2007 (source: DGEG – in Annex 1) and was calculated by the ratio of the each fuel type with all types of fuel commercialized in the road transport sector.

The table C1.2.4 shows the baseline for fuel mix.

Table C1.2.4 – Indicator 4 – Ex-ante

Indicators and respective parameters	Ex-Ante values
Fuel Mix – Diesel	74,5%
Fuel Mix – Gasoline	25,2%
Fuel Mix – GPL	0,4%
Fuel Mix – Electricity	0,0%

The vehicle fuel efficiency was calculated by the ratio between the energy consumption considering the trips made by private car and the total vehicle-km estimated per year in the feasibility study scenario.

The energy consumption was calculated by a weighted average given by the following expression:

A = B x C1 x D1 + B x C2 x D2

where,

A = Energy consumption (MJ)

B = Estimated Annual Fuel Consumption (l)

C1 = Gasoline Fuel mix (%)

D1 = Energy density for Gasoline (MJ/l)

C2 = Diesel Fuel mix (%)

D2 = Energy density for Diesel (MJ/l)

The values of Fuel Mix are in table C1.2.4 and the values of the energy density are displayed in Annex 3.

The estimated annual fuel consumption (A) is calculated in accordance with the following expression:

A = B1 X C1+ B2 X C2

A = Estimated Annual Fuel Consumption (l)

B1 = Distance (vehicle-km) driven by private cars with potential to be shifted with the car sharing implementation according the feasibility study scenario for the city cars (vkm)

C1 = Fuel consumption of urban cars (l/100 km)

B2 = Vehicles-Km made by private cars with potential to be shifted with the car sharing implementation according the feasibility study scenario for the compact cars (vkm)

C2 = Fuel consumption of compact cars (l/100 Km)

The values of the distance (vkm) were calculated by using the considered trip scenario (15 vkm X 25 members per vehicle X 3 Average trips per month X 12 months = 13.500 vkm) multiplied by the number of each car type (5 urban cars and 5 compact cars in the baseline);

The values of the Fuel consumptions per car types are considered in table C2.1.4, that is the urban combustion is 6,0 l/100km, the compact combustion is 7,0 l/100km and the urban electric is 15 kWh/100km.

The results of the baseline for each indicator are shown in the table C1.2.5.

Table C1.2.5 – Indicator 5 – Ex-ante

Indicators and respective parameters	Ex-Ante values
Total Energy Consumption	289.435 MJ
Total vechicle-km	135.000
Vehicle fuel efficiency	2,14 MJ/vkm

Indicators 6, 7, 8, 9 and 10 (CO, CO2, NOx, PT, and HC emissions):

The source of the information has been the feasibility study on the estimated emissions related to the car sharing system and the respective vehicle-km. The study considered the following emission factors (g/vkm) for each type of vehicle based on the manufacturers information about each type of vehicle (table 1.2.6).

Table C1.2.6 – Indicators 6, 7, 8, 9 & 10 – Emissions Factor

Emission Factor (g/km)	**Urban**	**Compact**
NOx	0.08	0.09
HC	0.10	0.12
CO	1.00	1.17
PT	100.00	125.00
CO2	139.00	162.1

In relation to the ex-ante situation it was considered that all trips (with potential to be shifted to the car sharing before the implementation of the service) were performed using private cars.

The ex-ante emissions scenario per vkm results from the balance of the emissions per vehicle type, taking into consideration the vkm foreseen for each car type in the feasibility study scenario (15 vkm x 25 members per vehicle x 3 Average trips per month x 12 months = 13.500 vkm) multiplied by the number of each car type (5 urban cars and 5 compact cars in the baseline).

The results of baseline for each indicator are indicated in the table C1.2.7:

Table C1.2.7 – Indicators 6, 7, 8, 9 & 10 – Ex-Ante

Indicators and respective parameters	Ex-Ante values

CO emissions	1,08 g/vkm
CO2 emissions	150,57 g/vkm
NOx emissions	0,09 g/vkm
PT emissions	112,50 g/vkm
HC emissions	0,11 g/vkm

C1.3 Building the Business-as-Usual scenario

Indicator 1 (Average Operating Revenues)

The change in the Operating Revenues related to the operation of the carsharing service is obtained after setting up the measure. Therefore, without the implementation of the measure, the Operating Revenues would be as before. It was established that there are no effects of other factors that have any influence in this indicator. In this case the Business-as-usual is equal to the baseline situation.

The next graph (Fig. C1.3.1) shows the evolution of the Average Operating Revenues (€/vKm) obtained for the B-a-U scenario:

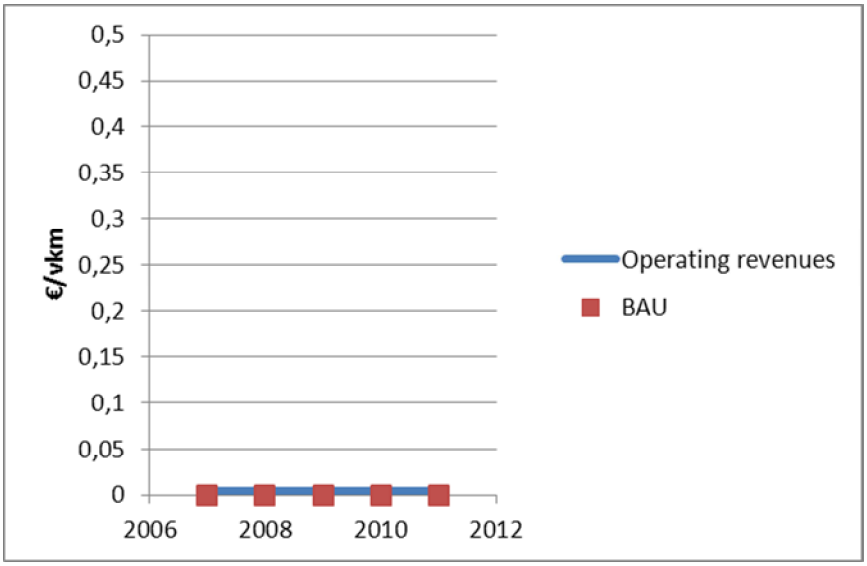

Figure C1.3.1 - Operating revenues

Therefore, the results of BAU scenario for this case are the folowing (table C1.3.1):

Table C1.3.1 – Indicators 1 – BAU

Indicators and respective parameters	BAU Values
Average operating revenue (2008)	0,00 €/vkm
Average operating revenue (2009)	0,00 €/vkm
Average operating revenue (2010)	0,00 €/vkm
Average operating revenue (2011)	0,00 €/vkm

Indicator 2 (Average Operating Costs)

The change in the Operating Costs related to the operation of the carsharing service is obtained after setting up the measure. Therefore, without the implementation of the measure, the Operating Costs would be as before. It was considered that there are no effects of other factors that have any influence in this indicator. In this case the Business-as-usual is equal to the baseline situation.

The following graph (Fig.C1.3.2) shows the evolution of the of the Average Operating Costs (€/vkm) obtained for the B-a-U scenario:

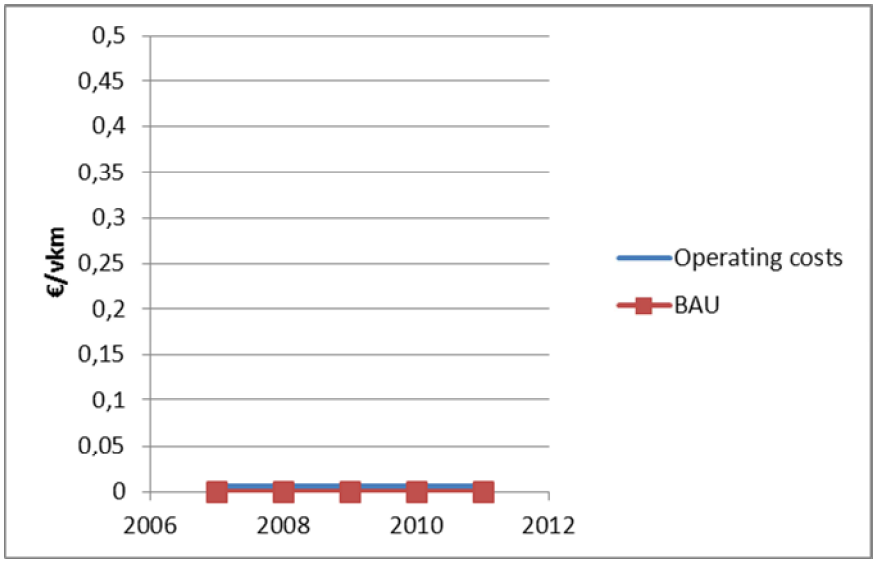

Figure C1.3.2 - Operating costs

Therefore, the results of BAU scenario for this case are shown in the table C1.3.2.

Table C1.3.2 – Indicators 2 – BAU

Indicators and respective parameters	BAU Values
Average operating costs (2008)	0,00 €/vkm
Average operating costs (2009)	0,00 €/vkm
Average operating costs (2010)	0,00 €/vkm
Average operating costs (2011)	0,00 €/vkm

Indicator 3 (Capital Costs)

The change in the capital costs related to the operation of the carsharing service is obtained after setting up the measure. Therefore, without the implementation of the measure, the capital costs would be as before. It was considered that there are no effects of other factors that have any influence in this indicator. In this case the Business-as-usual is equal to the baseline situation.

The following graph (Fig. C1.3.3) shows the evolution of the Capital Costs (€) obtained for the B-a-U scenario.

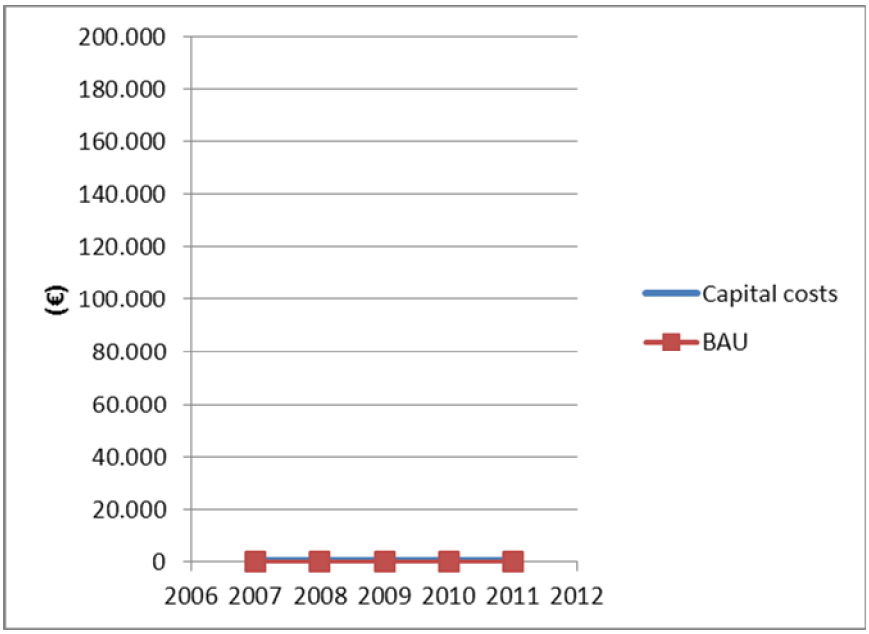

Figure C1.3.3 - Capital costs

Therefore, the table C1.3.3 shows the results of BAU scenario for this case.

Table C1.3.3 – Indicators 3 – BAU

Indicators and respective parameters	BAU values
Total capital cost (2008)	0,00 €
Total capital cost (2009)	0,00 €
Total capital cost (2010)	0,00 €
Total capital cost (2011)	0,00 €

Indicator 4 (Fuel Mix)

In order to determine the B-a-U scenario for this indicator, the available data about the evolution of the Share of different fuels (diesel, gasoline) in the Fuel consumption in Portugal has been used because there is no data available at local level and because it was possible to obtain data at the national level since 2004 (for further details, read Annex 1 Fuel Mix Data). Thus, it is possibile to extrapolate for the next few years (BAU 1).

Considering that the evolution of the series obtained is independent from the measure and considering that this measure had no real implementation, in order to determine the B-a-U scenario for this indicator for the period 2008-2011 the actual data about the fuel mix has been used (BAU 2 that is equal to BAU1).

The B-a-U scenario for the indicator Fuel Mix (%) is presented in the following graph (ex-ante untill 2007 and BAU2 from 2008 to 2011):

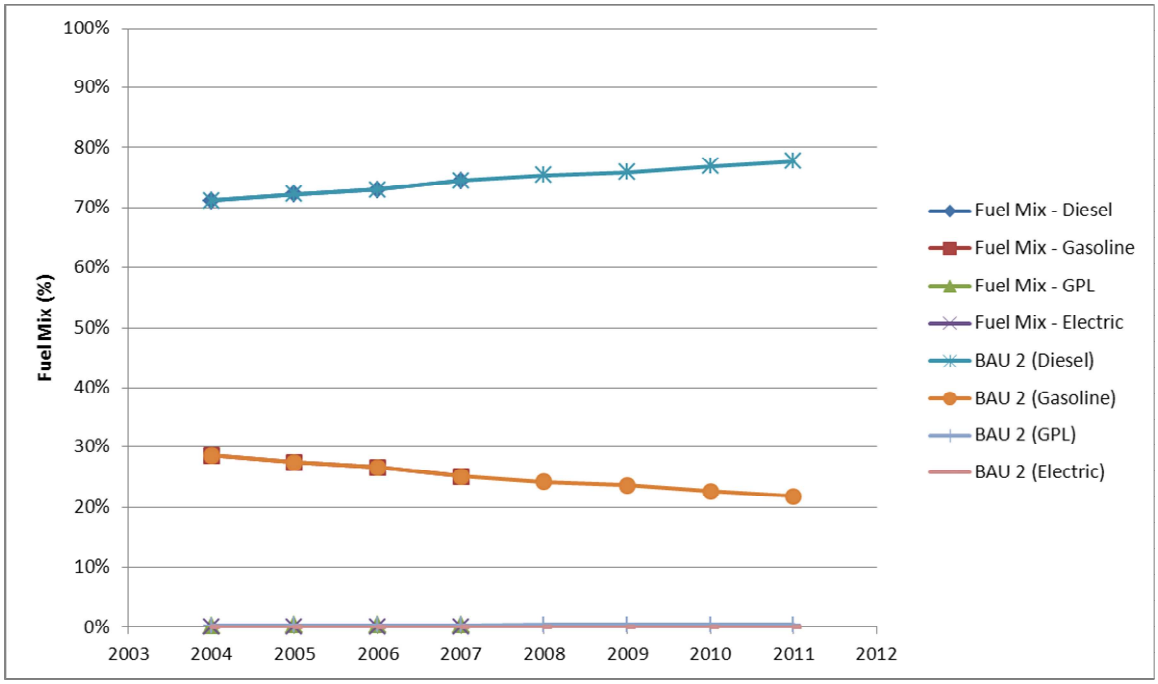

Figure C1.3.3 - Fuel Mix

Therefore, the table C1.3.4 shows the results of BAU scenario for this case (BAU 2).

Table C1.3.4 – Indicators 4 – BAU

Indicators and respective parameters	BAU Values			
	Diesel	Gasoline	GPL	Electricity
Fuel Mix (2008)	75,4%	24,2%	0,4%	0,0%
Fuel Mix (2009)	75,9%	23,6%	0,5%	0,0%
Fuel Mix (2010)	76,9%	22,7%	0,4%	0,0%
Fuel Mix (2011)	77,7%	21,8%	0,5%	0,0%

Indicator 5 (Vehicle Fuel Efficiency)

In order to determine the B-a-U scenario for this indicator the approach used was the evolution of energy consumption (MJ) and the distance vehicle-km (passenger cars - pkm). With this ratio value the vehicle fuel efficiency (MJ/vkm) is calculated. The energy consumption data source is the evolution of fuel consumption in Portugal (2007-2011) because there is no data available at local level and because it was possible to obtain data at national level since 2006 (for further details, read Annex 2 Vehicle Fuel Efficiency Data). Since there are only historic series for the distance pkm for the period 2007-2009 it facilitated a forecast for the years 2010 and 2011, i.e.,considering that the average occupancy of the car mantains stable (table C1.3.5).

Table C1.3.5 – Energy consumption and pkm – BAU

Year	2007 (base year)	2008	2009	2010	2011
Energy Consumption (GJ)	279.401.131	271.853.161	272.458.842	270.955.163	253.870.585
Passanger-cars (mio pkm)	86.600	87.000	86.000	n.a.	n.a.
Δ Energy Consumption	100%	97%	98%	97%	91%
Δ pkm	100%	100%	99%	n.a.	n.a.
Δ pkm (trend)	***100,00%***	***100,46%***	***99,31%***	***99,23%***	***98,88%***
Δ MJ/pkm (vkm)	**100,00%**	**96,85%**	**98,20%**	**97,73%**	**91,89%**

The following graph (Fig. C1.3.4) presents a comparison between the evolution of fuel energy consumption (MJ) and passenger cars (pkm), considering 2007 as the base year (100%).

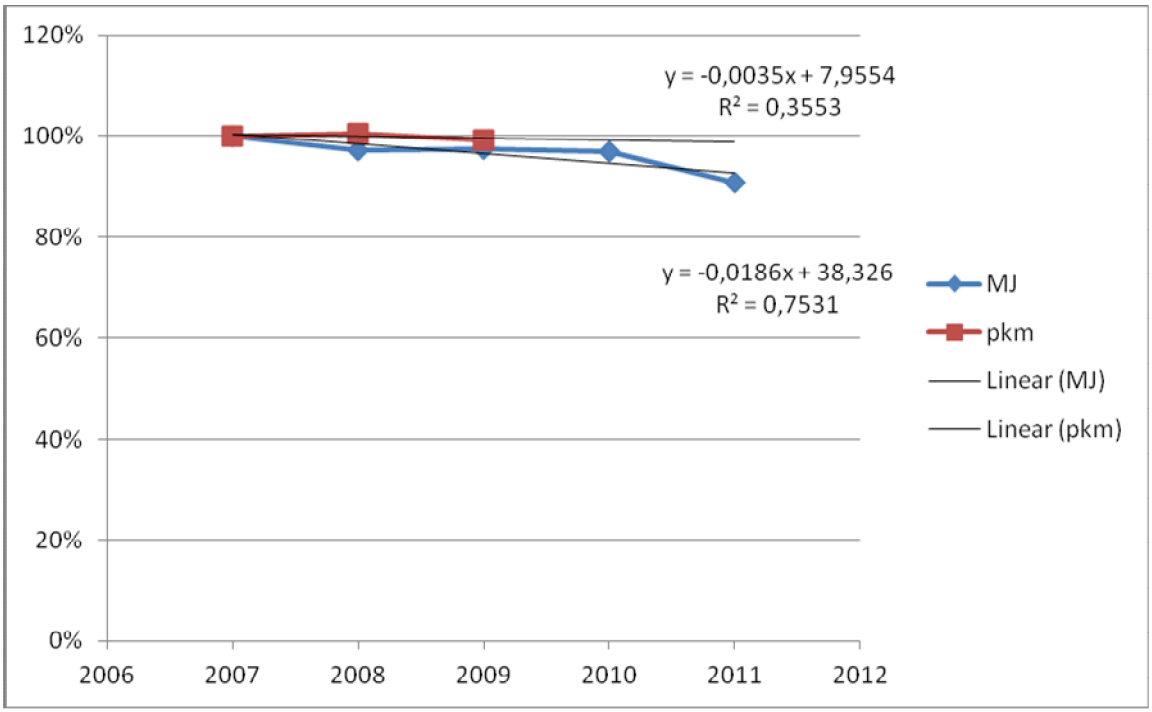

Figure C1.3.4 - Fuel Mix and pkm forecast

The graph reveals a trend for a decrease in fuel energy consumption that is steeper than the one registerd on passenger cars, thus, meaning that vehicle fuel efficiency (MJ/pkm and thus MJ/vkm) tends to decrease. The trend used for forecasting passanger kilometres (pkm) has as low correlation coeficient (0,3535) that shows a low degree of linear relationship between the variables. To analyse it

more carefuly, other types of trends were tested (exponencial, logaritmic,…) but at all of them showed similar correlation coeficients. This is also reinforced by the fact that the financial crises in Portugal also induced a low demand for PT, and it will have an impact both for the passangers kilometres and for the energy consumption in the coming years.

Considering that the evolution of the series obtained is independent from the measure and considering that this measure had no real implementation, in order to determine the B-a-U scenario for this indicator for the period 2008-2011, the actual data about the fuel energy consumption, actual data about pkm from 2008-2009 and the data trend from 2010-2011 have been used. Thus, it is possibile to extrapolate for the next few years (BAU 2).

The B-a-U scenario for the indicator Vehicle Fuel Efficiency (MJ/vkm) is presented in the following graph (BAU 2):

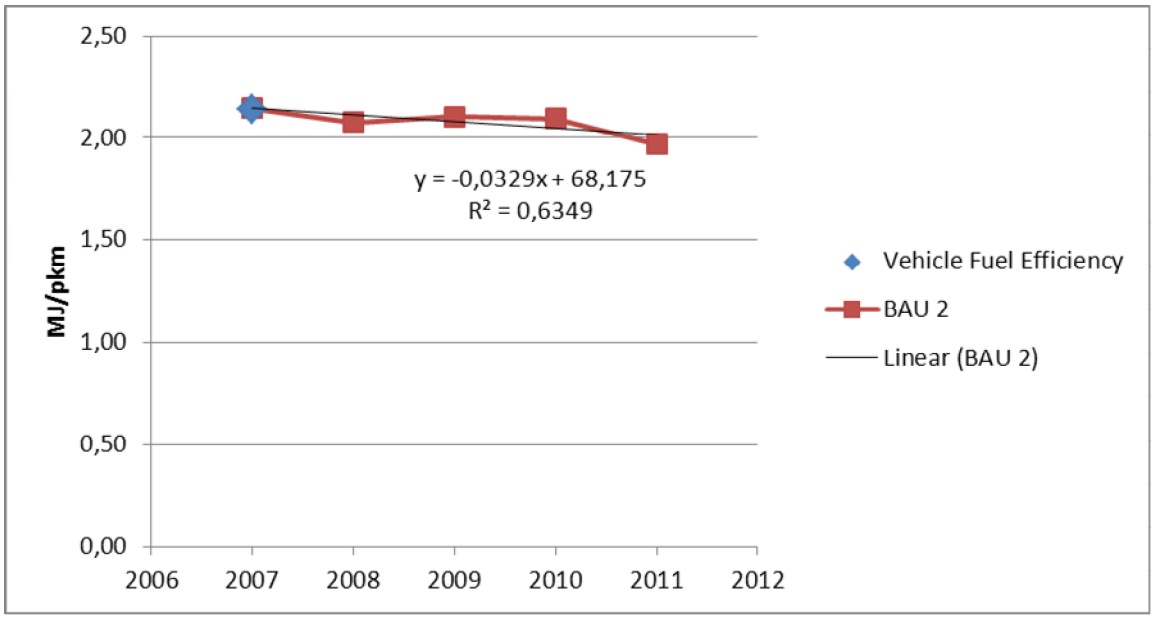

Figure C1.3.5 - Vehicle efficiency pkm forecast

Therefore, the table C1.3.6 shows the results of BAU scenario for this case (BAU 2).

Table C1.3.6 – Indicator 5 – BAU

Indicators and respective parameters	BAU values
Vehicle fuel efficiency (2008)	2,08 MJ/vkm
Vehicle fuel efficiency (2009)	2,11 MJ/vkm
Vehicle fuel efficiency (2010)	2,10 MJ/vkm
Vehicle fuel efficiency (2011)	1,97 MJ/vkm

Indicator 6 (CO emissions)

The change in the CO emissions related to the operation of the carsharing service is obtained after setting up the measure. Therefore, without the implementation of the measure, the CO emissions would be as before. It was established that there are no effects of other factors that have any influence in this indicator. In this, case the Business-as-usual is equal to the baseline situation.

The following graph (Fig. C1.3.6) shows the evolution of the CO emissions (g/vkm) obtained for the B-a-U scenario.

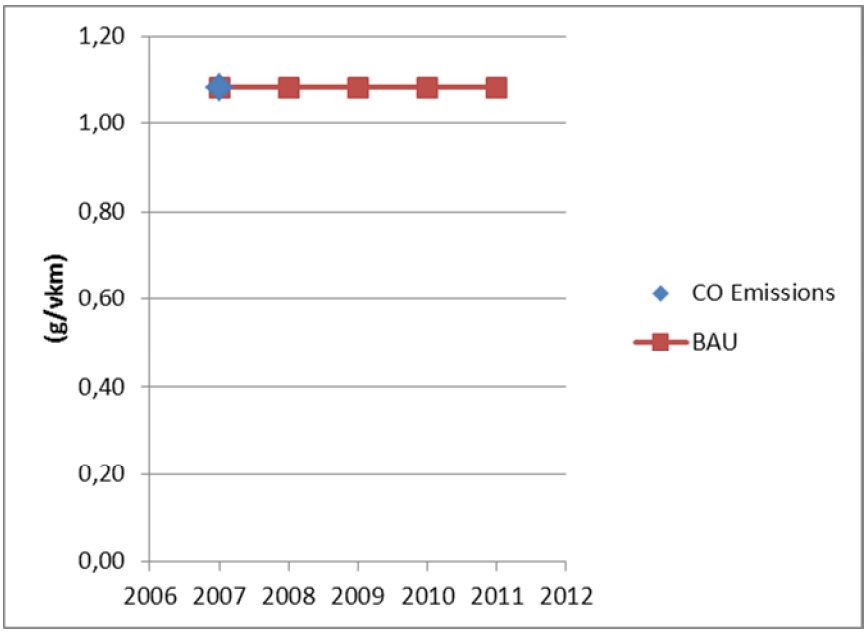

Figure C1.3.6 - CO emissions

Therefore, the table C1.3.7 shows the results of BAU scenario for this case:

Table C1.3.7 – Indicator 6 – BAU

Indicators and respective parameters	BAU values
CO emissions (2008)	1,08 g/vkm
CO emissions (2009)	1,08 g/vkm
CO emissions (2010)	1,08 g/vkm
CO emissions (2011)	1,08 g/vkm

Indicator 7 (CO2 emissions)

The change in the CO2 emissions related to the operation of the carsharing service is obtained after setting up the measure. Therefore, without the implementation of the measure, the CO2 emissions would be as before. It was considered that there are no effects of other factors that have any influence in this indicator. In this case the Business-as-usual is equal to the baseline situation.

The following graph (Fig. C1.3.7) shows the evolution of the CO2 emissions (g/vkm) obtained for the B-a-U scenario.

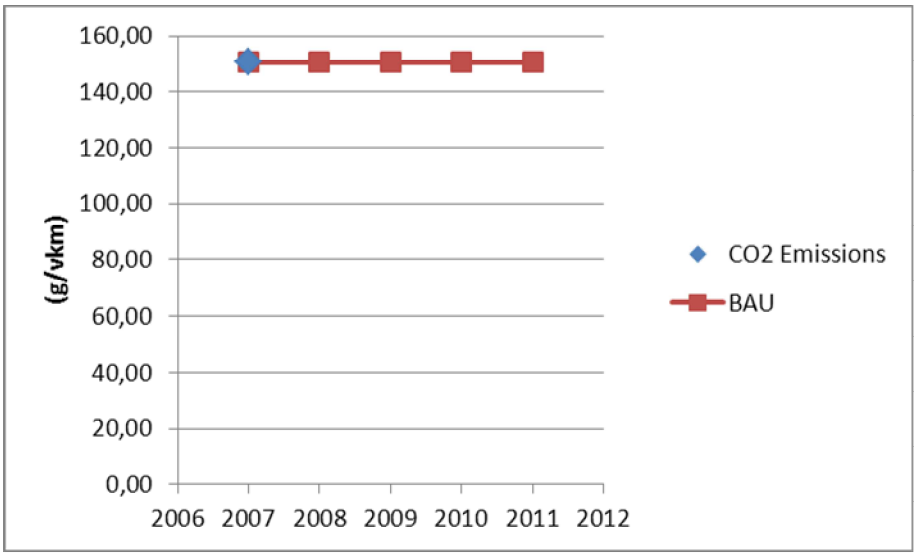

Figure C1.3.7 - CO2 emissions

Therefore, the table C1.3.8 shows the results of BAU scenario for this case.

Table C1.3.8 – Indicator 7 – BAU

Indicators and respective parameters	BAU values
CO2 emissions (2008)	150,57 g/vkm
CO2 emissions (2009)	150,57 g/vkm
CO2 emissions (2010)	150,57 g/vkm
CO2 emissions (2011)	150,57 g/vkm

Indicator 8 (NOx emissions)

The change in the NOx emissions related to the operation of the carsharing service is obtained after setting up the measure. Therefore, without the implementation of the measure, the NOx emissions would be as before. It was considered that there are no effects of other factors that have any influence in this indicator. In this case the Business-as-usual is equal to the baseline situation.

The following graph (Fig. C1.3.8) shows the evolution of the NOx emissions (g/vkm) obtained for the B-a-U scenario.

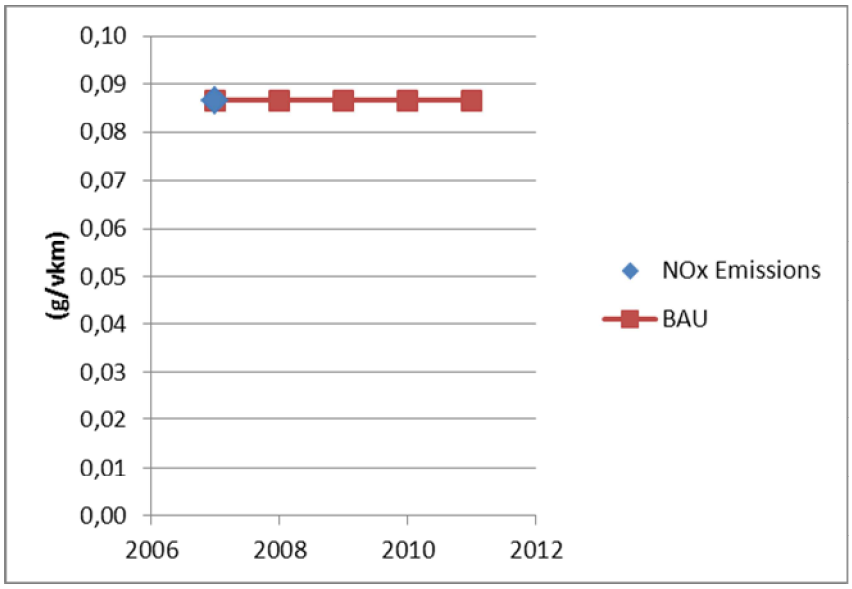

Figure C1.3.8 - NOx emissions

Therefore, the table C1.3.9 shows the results of BAU scenario for this case.

Table C1.3.9 – Indicator 8 – BAU

Indicators and respective parameters	BAU values
NOx emissions (2008)	0,09 g/vkm
NOx emissions (2009)	0,09 g/vkm
NOx emissions (2010)	0,09 g/vkm
NOx emissions (2011)	0,09 g/vkm

Indicator 9 (PT emissions)

The change in the PT emissions related to the operation of the carsharing service is obtained after setting up the measure. Therefore, without the implementation of the measure, the PT emissions would be as before. It was considered that there are no effects of other factors that have any influence in this indicator. In this case the Business-as-usual is equal to the baseline situation.

The following graph (Fig.C1.3.9) shows the evolution of the PT emissions (g/vkm) obtained for the B-a-U scenario.

Figure C1.3.9 - PT emissions

Therefore, the table C1.3.10 shows the results of BAU scenario for this case.

Table C1.3.10 – Indicators 9 – BAU

Indicators and respective parameters	BAU values
PT emissions (2008)	112,5 g/vkm
PT emissions (2009)	112,5 g/vkm
PT emissions (2010)	112,5 g/vkm
PT emissions (2011)	112,5 g/vkm

Indicator 10 (HC emissions)

The change in the HC emissions related to the operation of the carsharing service is obtained after setting up the measure. Therefore, without the implementation of the measure, the HC emissions would be as before. It was established that there are no effects of other factors that have any influence in this indicator. In this case the Business-as-usual is equal to the baseline situation.

The following graph (Fig. C1.3.10) shows the evolution of the HC emissions (g/vkm) obtained for the B-a-U scenario.

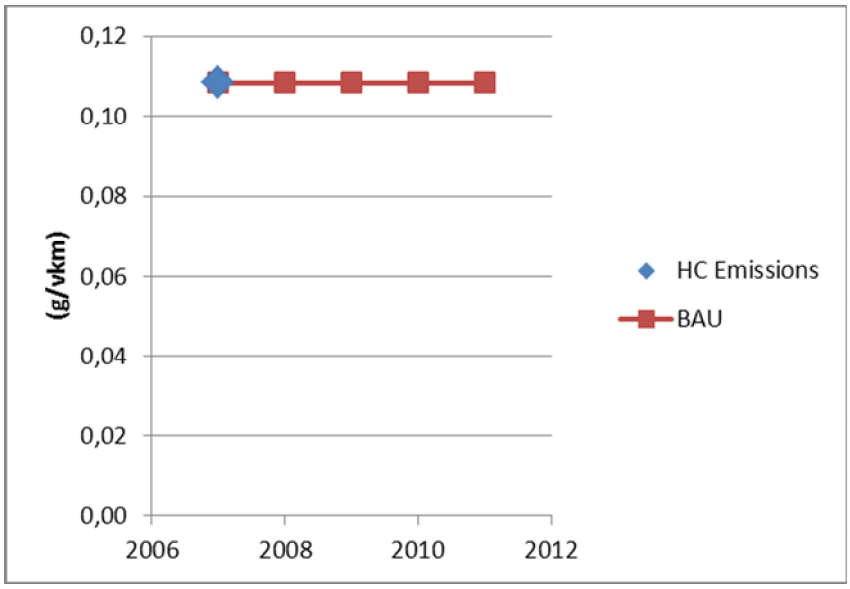

Figure C1.3.10 - HC emissions

Therefore, the table C1.3.11 shows the results of BAU scenario for this case.

Table C1.3.11 – Indicator 10 – BAU

Indicators and respective parameters	BAU values
HC emissions (2008)	0,11 g/vkm
HC emissions (2009)	0,11 g/vkm
HC emissions (2010)	0,11 g/vkm
HC emissions (2011)	0,11 g/vkm

C2 Measure results

The results are presented under sub headings corresponding to the areas used for indicators – economy, energy, environment, society and transport.

The evaluation of the measure reports to a Feasibility Study of New Mobility Services in Coimbra.To be more comprehensive all key aspects are expressed and related in the study.

C2.1 Economy

In the same way as for the baseline, the results of the indicators for the situation after implementing the measure were obtained. Indicators 1 - Average Operating Revenues, 2 - Average Operating Costs and 3 Capital Costs were evaluated considering a scenario of real implementation of the measure during CIVITAS MODERN. The table C2.1.1 shows the Car-sharing implementation scenario considered:

Table C2.1.1 – Measure implementation stages

Year	Stage
2008	Purchase of the vehicles, installation of the necessary equipment and Operation
2009	Operation
2010	Operation
2011	Operation

The source of information has been the feasibility study on both, the estimated costs and revenues of operating the carsharing system and revenues, as well as on the vehicle-km performed by those services.

The revenues were calculated for car-sharing system profitability result from the fee associated with the usage of vehicles index with the unit prices of the tariff (€/hour and €/km) for a standard trip – 15 Km extension and 2h duration (Table C2.1.2).

Table C2.1.2 – Car sharing fees and values for a standard trip

Vehicles		**8:00 a.m. to 7:59 p.m.**		**Standard Trip**		**Total**
Motor	**Type**	**€/vh**	**€/vkm**	**2h**	**15km**	**€**
Combustion	**Urban**	2.50	0.25	5.00	3.75	8.75
	Compact	3.00	0.30	6.00	4.50	10.50
Electric	**City**	4.00	0.40	8.00	6.00	14.00

For example, for one a city car with 25 members/ vehicle usage and with an average booking of 3 monthly trips has a monthly revenue of 23.625 €, i.e, a revenue of 7.875 €/city car. For the compact car and for urban electric the revenues are calculated with the same methodology as illustrated in following figures.

The overall revenues are calculated by the sum of the 3 typologies of vehicle, that is 105.525€ per year, as is expressed in the table C2.1.3.

Table C2.1.3 – Annual Renevues

Type of vehicle	N.º vehicles	N.º Users	N.º Reservations	Daily Distance (km)	Hour Fee €/vh	Usage (h)	Distance Fee €/vkm	Revenues (€)
Combustion urban vehicle	3	25	3	15	2,50	2	0,25	23.625
Combustion compact vehicle	2	25	3	15	3,00	2	0,30	18.900
Electric vehicle	5	25	3	15	4,00	2	0,40	63.000
Total	**10**	**25**	**3**	**15**	**-**	**-**	**-**	**105.525**

The table C2.1.4 shows the indicative values of the costs "Vehicle x hour" and "vehicle x km", associated with the different types of vehicles and that allow to obtain an operation cost per vehicle.

The methodology used for calculation considered the staff, the training, fuel, maintenance (cleaning + tires), insurance, parking, booking of the vehicle, Call Centre operationalization and Communication costs.

Table C2.1.4 – Costs of the service operation

Vehicles		COSTS (€)																
		Constant Annual				Constant / hour (7.5km/h)				Variable / Km				Total / km				Operation
						Annual Usage				Maintenance + tyres								
Engine	Type	Acquisition Costs	Amortization	Insurance	Management (1)	5000km/year	7500km/year	10000km/year	12500km/year	5000km/year	7500km/year	10000km/year	12500km/year	Fuel	5000km/year	7500km/year	10000km/year	12500km/year	per vkm (10000km/year x vehic)
Combustion	City	10000	1250	600	1750	5,40	3,60	2,70	2,16	0,11	0,09	0,08	0,07	0,10	0,21	0,19	0,18	0,17	0,54
	Compact	15000	1875	900	1750	6,79	4,53	3,39	2,72	0,14	0,11	0,10	0,09	0,11	0,25	0,22	0,21	0,20	0,66
	Family	25000	3125	1500	1750	9,56	6,38	4,78	3,83	0,20	0,15	0,13	0,11	0,13	0,33	0,28	0,25	0,24	0,89
Electric	City	29500	3688	1770	1750	10,81	7,21	5,41	4,32	0,23	0,17	0,14	0,12	0,03	0,26	0,20	0,17	0,15	0,89

(1) 1 employee per 10 vehicles fleet

The feasibility study considered an analysis of the emissions, energy, costs and revenues and are build up in the following table. The analisys is based in the 3 types of cars (3 combustion urban, 2 combustion compact and 5 electric urban) based in a usage profile of 25 users per vehicle, 15 km for an average trip and an average of 3 reservations per month. The analisys are summarized in the table C2.1.5.

Table C2.1.5 – Car-sharing service anaysis summary

N.º users/ vehicle		
25		
Average N.º Reservations		
3		
Average Trip (km)		
15		
N.º of Cars		
3	**2**	**5**
Combustion City	Combustion Compact	Electric City
Average consumption (l/100 km) - Electric in kWh/100km		
6	7	15
NOx (g) / year		
3.240	2.520	5.400
HC (g) / year		
4.050	3.150	6.750
CO (g) / year		
40.500	31.496	67.500
PT (g) / year		
4.050.000	3.375.000	6.750.000
CO2 (g) / year		
5.629.500	4.377.875	9.382.500
Average Monthly Offer - vkm		
3.375	2.250	5.625
Estimated Annual Fuel Consumption (litres)		
2.430	1.890	1.125
Estimated ENERGY(MJ)		
84.159	67.775	36.450
Capital Costs (€)		
7.500	5.000	162.500
Operating Costs (€)		
21.708	17.807	60.750
Operating Revenues(€)		
23.625	18.900	63.000
Rendibility (%)		
8%	**6%**	**4%**

Taking into consideration the Average Montly Offer shown in the previous table and the operation costs obtained in the table C2.1.4 results the annnual costs (table C2.1.6)

The overall costs are determinated by the sum of the typologies of urban car, compact car and electric urban (partial costs expressed on above figures) of vehicles, that is 100.265 € per year, as ilustrated in the table.

Table C2.1.6 – Annual Costs

Type of vehicle	**A** **Average Monthly Offer (vkm)**	**B** **Operation Costs €/vkm**	**C = (A x 12) x B** **Costs (€)**
Combustion urban vehicle	3.375	0,54	21.708
Combustion compact vehicle	2.250	0,66	17.807
Electric vehicle	5.625	0,89	60.750
Total	**-**	**-**	**100.265**

Taking into account the implementation scenario above, the tables C2.1.7 and C2.1.8 shows the results of indicators 1and 2, respectively.

Table C2.1.7 – Indicator 1 – Ex Post

Indicators and respective parameters	Ex-Post values
Revenues from the operation of the system	105.525,00 €
Total vechicle-km	135.000 vkm
Average operating revenue (2008)	0,78 €/vkm
Average operating revenue (2009)	0,78 €/vkm
Average operating revenue (2010)	0,78 €/vkm
Average operating revenue (2011)	0,78 €/vkm

Table C2.1.8 – Indicator 2 – Ex Post

Indicators and respective parameters	Ex-Post values
Total Operational Costs	100.265 €
Total vechicle-km	135.000 vkm
Average operating costs (2008)	0,74 €/vkm
Average operating costs (2009)	0,74 €/vkm
Average operating costs (2010)	0,74 €/vkm
Average operating costs (2011)	0,74 €/vkm

The capital costs are related with the sum of the initial investiment for the vehicles, the embedded devices, the system and software operational management, assembly, branding and promotional campaign, and the "start-up" of the service.

In relation to the capital costs, it has been considered a cost of 30.000,00 € to purchase each 5 electric vehicle and a cost of 2.500,00 € to purchase and install the equipment and software necessary to the integration of the vehicles in the fleet of the car-sharing system, as well as the other costs above mentioned. The other 5 cars from the Municipality already purchased and depreciated were not considered. The overall capital cost is expressed in the table C2.1.9.

Table C2.1.9 – Indicator 3 – Ex Post

Indicators and respective parameters	Ex-Post values
Total capital cost (2008)	175.000,00 €
Total capital cost (2009)	0,00 €
Total capital cost (2009)	0,00 €
Total capital cost (2011)	0,00 €

The table C2.1.10 sumarize the Economy indicators.

Table C2.1.10 – Economy indicators summary – Ex Post, BAU and Ex-ante

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
1. Average Operating Revenues	0,00 €/vkm (2007)	0,00 €/vkm (2008) 0,00 €/vkm (2009) 0,00 €/vkm (2010) 0,00 €/vkm (2011)	0,78 €/vkm (2008) 0, 78 €/vkm (2009) 0, 78 €/vkm (2010) 0, 78 €/vkm (2011)	0, 78 €/vkm (2008) 0, 78 €/vkm (2009) 0, 78 €/vkm (2010) 0, 78 €/vkm (2011)	0, 78 €/vkm (2008) 0, 78 €/vkm (2009) 0, 78 €/vkm (2010) 0, 78 €/vkm (2011)
2. Average Operating Costs	0,00 €/vkm (2007)	0,00 €/vkm (2008) 0,00 €/vkm (2009) 0,00 €/vkm (2010) 0,00 €/vkm (2011)	0,74 €/vkm (2008) 0,74 €/vkm (2009) 0,74 €/vkm (2010) 0,74 €/vkm (2011)	0,74 €/vkm (2008) 0,74 €/vkm (2009) 0,74 €/vkm (2010) 0,74 €/vkm (2011)	0,74 €/vkm (2008) 0,74 €/vkm (2009) 0,74 €/vkm (2010) 0,74 €/vkm (2011)
3. Capital Costs	0,00 € (2007)	0,00 € (2008) 0,00 € (2009) 0,00 € (2010) 0,00 € (2011)	175.000,00 € (2008) 0,00 € (2009) 0,00 € (2010) 0,00 € (2011)	175.000,00 € (2008) 0,00 € (2009) 0,00 € (2010) 0,00 € (2011)	175.000,00 € (2008) 0,00 € (2009) 0,00 € (2010) 0,00 € (2011)

The following graph shows the evolution of average operating revenues (€/vkm) with CIVITAS and the evolution of this indicator according to the B-a-U scenario (without CIVITAS).

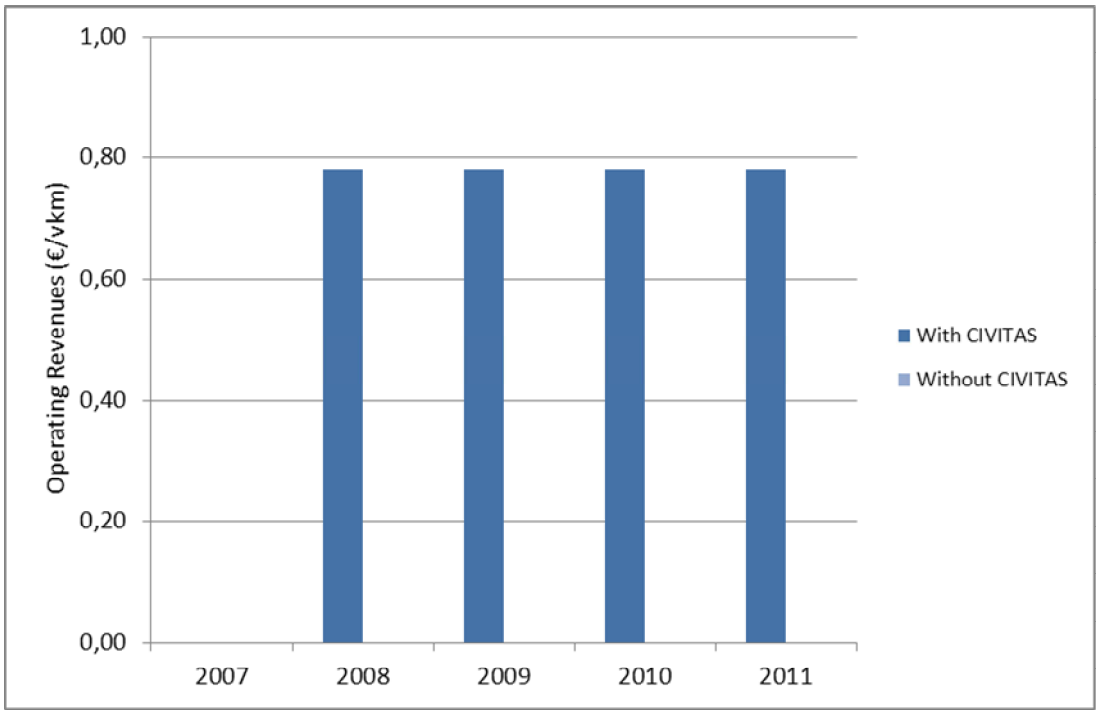

Figure C2.1.1 - Operating revenues (with/without CIVITAS)

The following graph shows the evolution of average operating costs (€/vkm) with CIVITAS MODERN and the evolution of this indicator according to the B-a-U scenario (without CIVITAS MODERN).

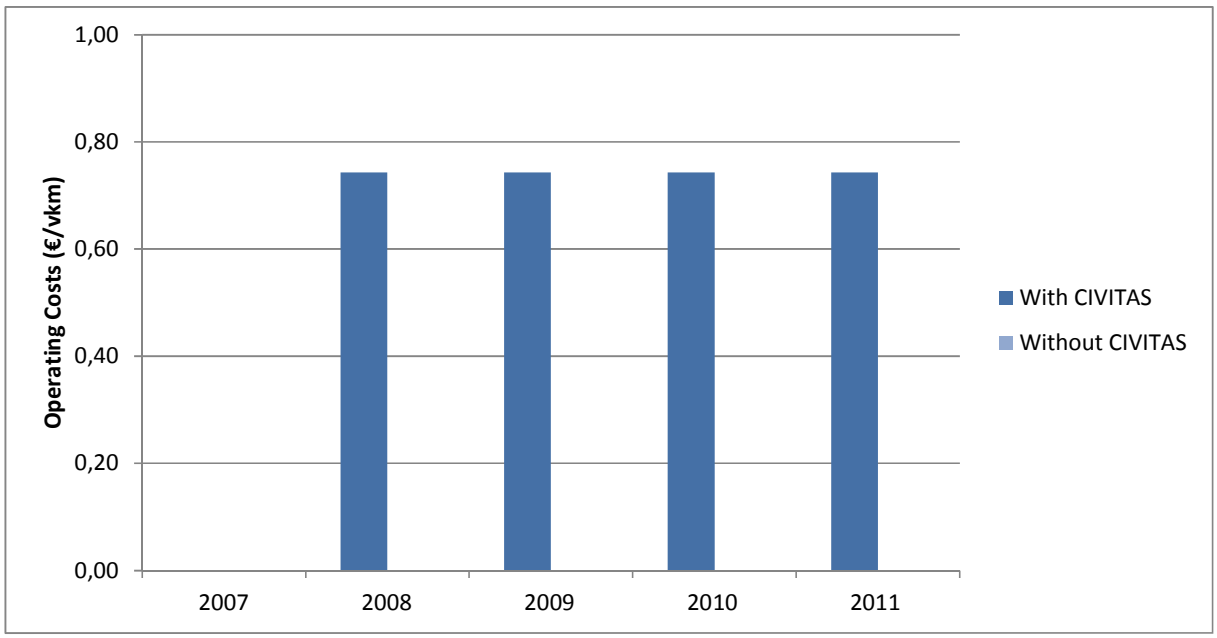

Figure C2.1.2 - Operating costs (with/without CIVITAS)

The following graph shows the evolution of capital costs (€) with CIVITAS and the evolution of this indicator according to the B-a-U scenario (without CIVITAS).

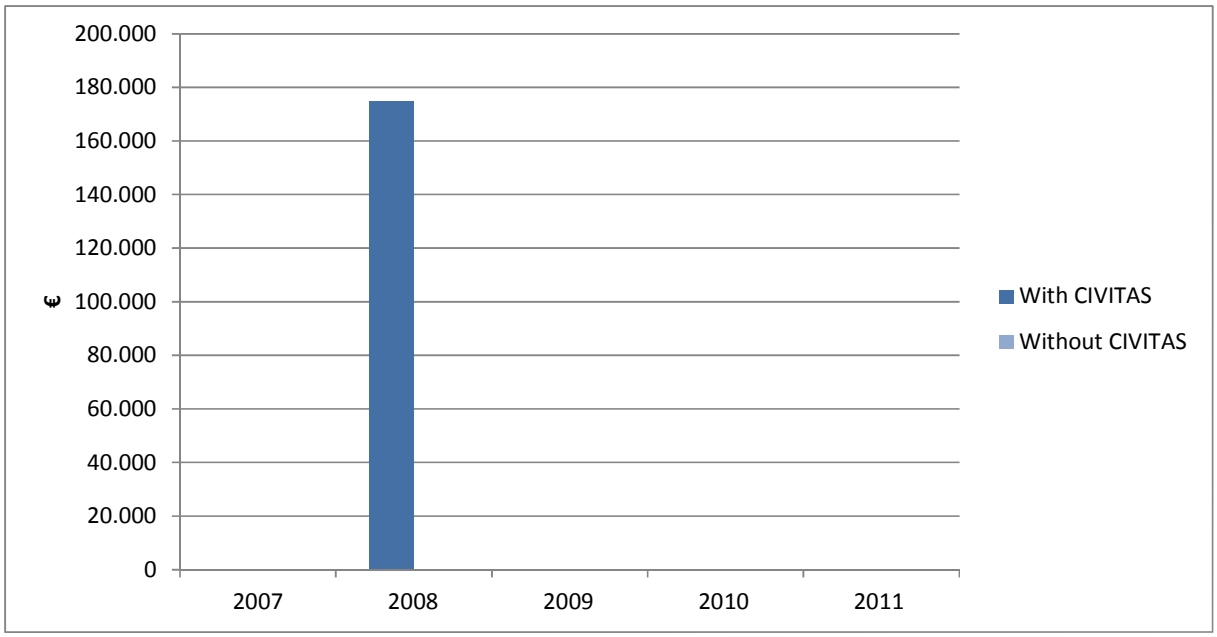

Figure C2.1.3 - Capital costs (with/without CIVITAS)

As expected, capital and average operating revenues and costs experienced an increase as a result of the implementation of the measure. However, as expected, capital costs return to zero after the installation of the power station. In relation to operating costs and revenues.The measure revealed to be efficient by contributing to a greater increase in average operating revenues in comparison with costs, generating a surplus of 0,04 €/vkm.

C2.2 Energy

The source of information has been the feasibility study on both the estimated energy consumption related to the car-sharing system and the respective vehicle-km.

In relation to the ex-post situation it was considered that all trips (with potential to be shifted to the car-sharing before the implementation of the service) were performed using private cars. The fuel mix data is determined by the share of the Portuguese fuel consumption (litres) based on the average yearly statistics given by the Portuguese Directorate for Energy and the conversion factors of litres to MJ are in Annex 3.

The results of the Ex-post values for indicator 4. (fuel Mix) is determinated by the ratio of the consumption in litres of each type of fuel (diesel, gasoline) introduced in the car-sharing service and the overall consumption of the vehicles introduced in the service. The values and the relative weight of each type of fuel are calculated in the following table.

Table C2.2.1 – Fuel Mix calculation – Ex Post

Vehicles			Energy Consumption		
Motor	**Type**	**N.º**	**(l/100km) / kWh/100km***	**MJ**	**%**
Diesel	Combustion Urban	2	6	58.093	66,8%
Diesel	Combustion Compact	2	7	67.775	
Gasoline	Combustion Urban	1	6	26.066	13,8%
Electric	Electric Urban	5	15*	36.450	19,3%
TOTAL		10	-	188.384	

Please note that for the above calculations the annual distance considered a daily trip of 15 km, with 25 users and 3 reservations per month for each car. With this profile and considering its stablisation in the 4 years, the fuel mix indicator is expressed in the following table.

Table C2.2.2 – Indicator 4 – Ex Post

Indicators and respective parameters	Ex-Post values
Fuel Mix – Diesel (2008 / 2009 / 2010 / 2011)	66,8%
Fuel Mix – Gasoline (2008 / 2009 / 2010 / 2011)	13,8%
Fuel Mix – GPL (2008 / 2009 / 2010 / 2011)	0,0 %
Fuel Mix – Electricity (2008 / 2009 / 2010 / 2011)	19,3%

The Ex-post scenario of indicator 5 (Vehicle Fuel Efficiency) is calculated by the ratio of the energy consumption in litres (table C2.1.5), converted in MJ, of the vehicles assigned to the car sharing service with the vehicle kilometres. The table C2.2.3 shows the Vehicle Fuel Efficiency indicator.

Table C2.2.3 – Indicator 5 – Ex Post

Indicators and respective parameters	Ex-Post values
Vehicle fuel efficiency (2008)	1,13 MJ/vkm
Vehicle fuel efficiency (2009)	1,13 MJ/vkm
Vehicle fuel efficiency (2010)	1,13 MJ/vkm
Vehicle fuel efficiency (2011)	1,13 MJ/vkm

Table C2.2.4 – Energy indicators – Ex Post, BAU and Ex-ante

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
4. Fuel Mix (Diesel/ Gasoline/ GPL/ Electricity)	74,5% /25,2% / 0,4% / 0,0% (2007)	75,4% /24,2% / 0,4% / 0,0% (2008) 75,9% /23,6% / 0,5% / 0,0%	66,8% /13,8% / 0,0% / 19,3% (2008) 66,8% /13,8% / 0,0% / 19,3%	-8,6% / -10,4% / -0,4% / -19,3% (2008) -8,6% / -10,4% / -0,4% / -19,3%	-11,4% / -0,4% / +19,3% (2008) -9,1% / -9,8% / -0,5% / -19,3%

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
		(2009) 76,9% /22,7% / 0,4% / 0,0% (2010) 77,7% /21,8% / 0,5% / 0,0% (2011)	(2009) 66,8% /13,8% / 0,0% / 19,3% (2010) 66,8% /13,8% / 0,0% / 19,3% (2011)	(2009) -8,6% / -10,4% / -0,4% / -19,3% (2010) -8,6% / -10,4% / -0,4% / -19,3% (2011)	(2009) -10,1% / -8,9% / -0,4% / -19,3% (2010) -10,9% / -8,0% / -0,5% / -19,3% (2011)
5. Vehicle Fuel Efficiency	2,14 MJ/vkm (2007)	2,14 MJ/vkm (2008) 2,14 MJ/vkm (2009) 2,14 MJ/vkm (2010) 2,14 MJ/vkm (2011)	1,13 MJ/vkm (2008) 1,13 MJ/vkm (2009) 1,13 MJ/vkm (2010) 1,13 MJ/vkm (2011)	-1,01 MJ/vkm (2008) -1,01 MJ/vkm (2009) -1,01 MJ/vkm (2010) -1,01 MJ/vkm (2011)	-1,01 MJ/vkm (2008) -1,01 MJ/vkm (2009) -1,01 MJ/vkm (2010) -1,01 MJ/vkm (2011)

The next graph shows the evolution of the Fuel Mix (%) With CIVITAS and the evolution of this indicator according to the B-a-U scenario (Without CIVITAS).

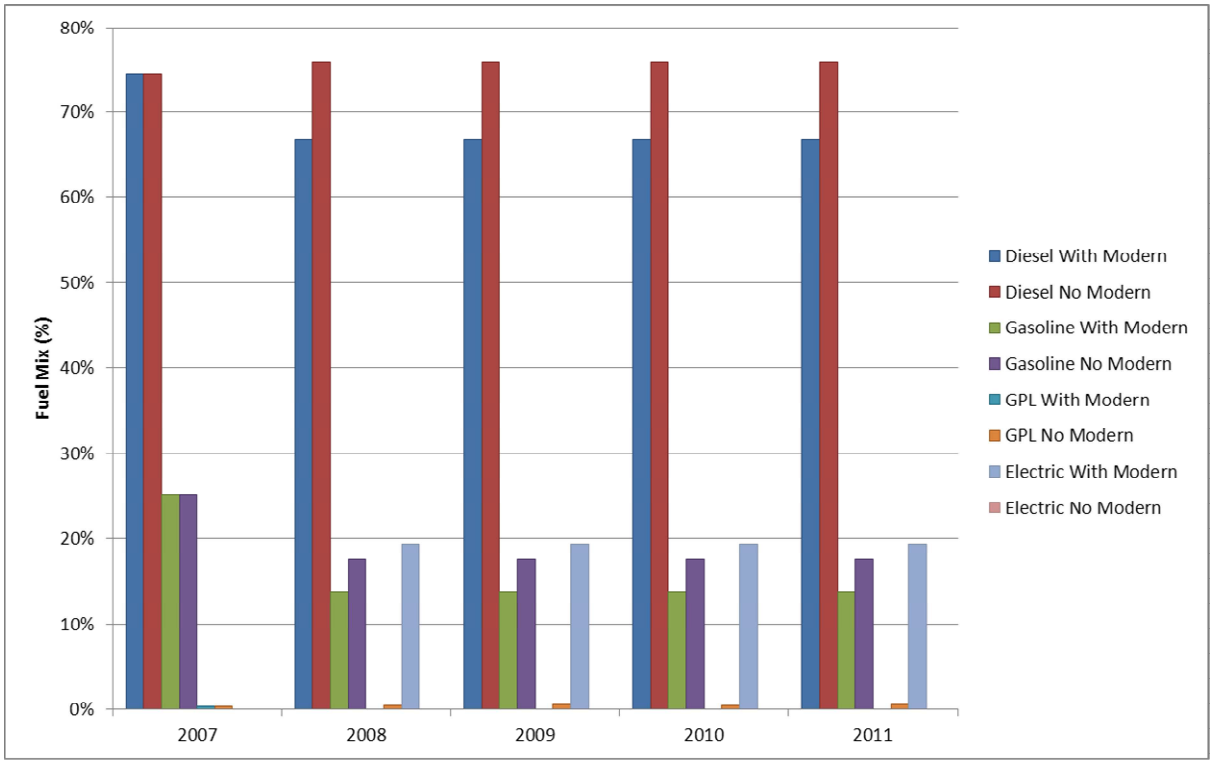

Figure C2.2.1 - Fuel Mix evolution (with/without CIVITAS)

This evolution shows that the most relevant influence of the measure on fuel mix is the increase of the share in the consumption of the electric vehicles together with the decrease in the share of the consumption of the gasoline ones (pushing the decrease beyond the trend downwards). However, since 2008, the share in the consumption of the gasoline vehicles without the measure keeps the trend downwards while the share in the consumption of these vehicles with the measure keeps stable. Thus, the gap in the consumption of the gasoline vehicles with the implementation of the measure in relation to the BAU scenario tends to decrease.

In relation to the share of the consumption of diesel vehicles, initially, the measure contributes to a slight increase in relation to the BAU scenario but after 2010 with the measure the consumption of diesel vehicles keeps stable and below the trend upwards of the consumption of diesel vehicles on BAU scenario. The main reason for these changes are related with the transference of conventional combustion vehicle to electric vehicle that induces a reduction of final energy consumption. Note that in Portugal the national electrical energy production benefits electric vehicles, because there are a good share (e.g 48,9% in 2011[1]) of renewables energy sources, mainly wind and hydro.

The following graph shows the evolution of Vehicle fuel efficiency (MJ/vkm)With CIVITAS and the evolution of this indicator according to the B-a-U scenario (Without CIVITAS).

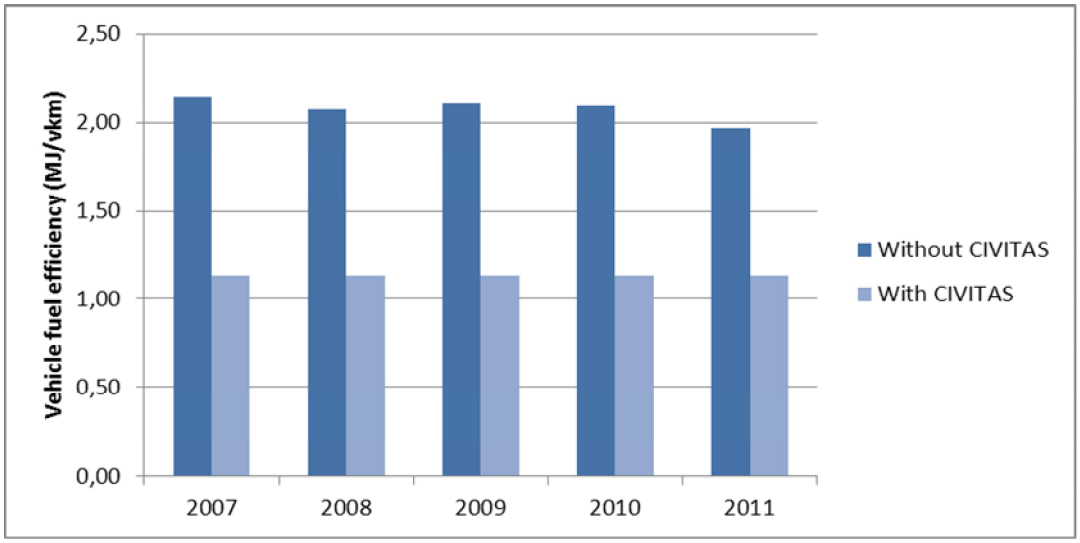

Figure C2.2.2 - Fuel efficiency (with/without CIVITAS)

This evolution shows that from the use of smaller vehicles together with the use of electric vehicles results a significant reduction in vehicle fuel efficiency (MJ/vkm), meaning that the operation of the carsharing system in such conditions brings significant energy advantages. However, considering the trend in the a reduction in vehicle fuel efficiency with no measure, the significant energy savings obtained from the operation of the carsharing system (as result of the use of a fleet with an important share of small electric vehicles) tend to slowly decrease.

C2.3 Environment

The source of information has been the feasibility study on the estimated polluent emissions related to the carsharing system (Emission factor in table C1.2.6) and the respective vehicle-km.

In relation to the ex-post situation it was considered that all trips (with potential to be shifted to the carsharing before the implementation of the service) were performed using private car.

[1] Source: Portuguese Association of Renewable Energy Producers

The results of for each indicator are:

Table C2.3.1 – Indicators 6, 7, 8, 9, 10 – Ex Post

Indicators and respective parameters	Ex-Post values
CO emissions (2008 / 2009 / 2010 / 2011)	0,53 g/vkm
CO2 emissions (2008 / 2009 / 2010 / 2011)	74,13 g/vkm
NOx emissions (2008 / 2009 / 2010 / 2011)	0,04 g/vkm
PT emissions (2008 / 2009 / 2010 / 2011)	55,00 g/vkm
HC emissions (2008 / 2009 / 2010 / 2011)	0,05 g/vkm

Table C2.3.2 – Environmental indicators - Summary– Ex Post, BAU and Ex-ante

Indicator	**Before (date)**	**B-a-U (date)**	**After (date)**	**Difference: After –Before**	**Difference: After – B-a-U**
6. CO emissions	1,08 g/vkm (2007)	1,08 g/vkm (2008) 1,08 g/vkm (2009) 1,08 g/vkm (2010) 1,08 g/vkm (2011)	0,53 g/vkm (2008) 0,53 g/vkm (2009) 0,53 g/vkm (2010) 0,53 g/vkm (2011)	-0,55 g/vkm (2008) -0,55 g/vkm (2009) -0,55 g/vkm (2010) -0,55 g/vkm (2011)	-0,55 g/vkm (2008) -0,55 g/vkm (2009) -0,55 g/vkm (2010) -0,55 g/vkm (2011)
7. CO2 emissions	150,57 g/vkm (2007)	150,57 g/vkm (2008) 150,57 g/vkm (2009) 150,57 g/vkm (2010) 150,57 g/vkm (2011)	74,13 g/vkm (2008) 74,13 g/vkm (2009) 74,13 g/vkm (2010) 74,13 g/vkm (2011)	-76,44 g/vkm (2008) -76,44 g/vkm (2009) -76,44 g/vkm (2010) -76,44 g/vkm (2011)	-76,44 g/vkm (2008) -76,44 g/vkm (2009) -76,44 g/vkm (2010) -76,44 g/vkm (2011)
8. NOx emissions	0,09 g/vkm (2007)	0,09 g/vkm (2008) 0,09 g/vkm (2009) 0,09 g/vkm (2010)	0,04 g/vkm (2008) 0,04 g/vkm (2009) 0,04 g/vkm (2010)	- 0,04 g/vkm (2008) - 0,04 g/vkm (2009) - 0,04 g/vkm (2010)	- 0,04 g/vkm (2008) - 0,04 g/vkm (2009) - 0,04 g/vkm (2010)

Indicator	**Before (date)**	**B-a-U (date)**	**After (date)**	**Difference: After –Before**	**Difference: After – B-a-U**
		0,09 g/vkm (2011)	0,04 g/vkm (2011)	- 0,04 g/vkm (2011)	- 0,04 g/vkm (2011)
9. PT emissions	112,5 g/vkm (2007)	112,5 g/vkm (2008) 112,5 g/vkm (2009) 112,5 g/vkm (2010) 112,5 g/vkm (2011)	55,0 g/vkm (2008) 55,0 g/vkm (2009) 55,0 g/vkm (2010) 55,0 g/vkm (2011)	- 57,5 g/vkm (2008) - 57,5 g/vkm (2009) - 57,5 g/vkm (2010) - 57,5 g/vkm (2011)	- 57,5 g/vkm (2008) - 57,5 g/vkm (2009) - 57,5 g/vkm (2010) - 57,5 g/vkm (2011)
10. HC emissions	0,11 g/vkm (2007)	0,11 g/vkm (2007)	0,05 g/vkm (2008) 0,05 g/vkm (2009) 0,05 g/vkm (2010) 0,05 g/vkm (2011)	-0,05 g/vkm (2008) -0,05 g/vkm (2009) -0,05 g/vkm (2010) -0,05 g/vkm (2011)	-0,05 g/vkm (2008) -0,05 g/vkm (2009) -0,05 g/vkm (2010) -0,05 g/vkm (2011)

The following graph shows the evolution of CO emissions (g/vkm) With CIVITAS and the evolution of this indicator according to the B-a-U scenario (Without CIVITAS).

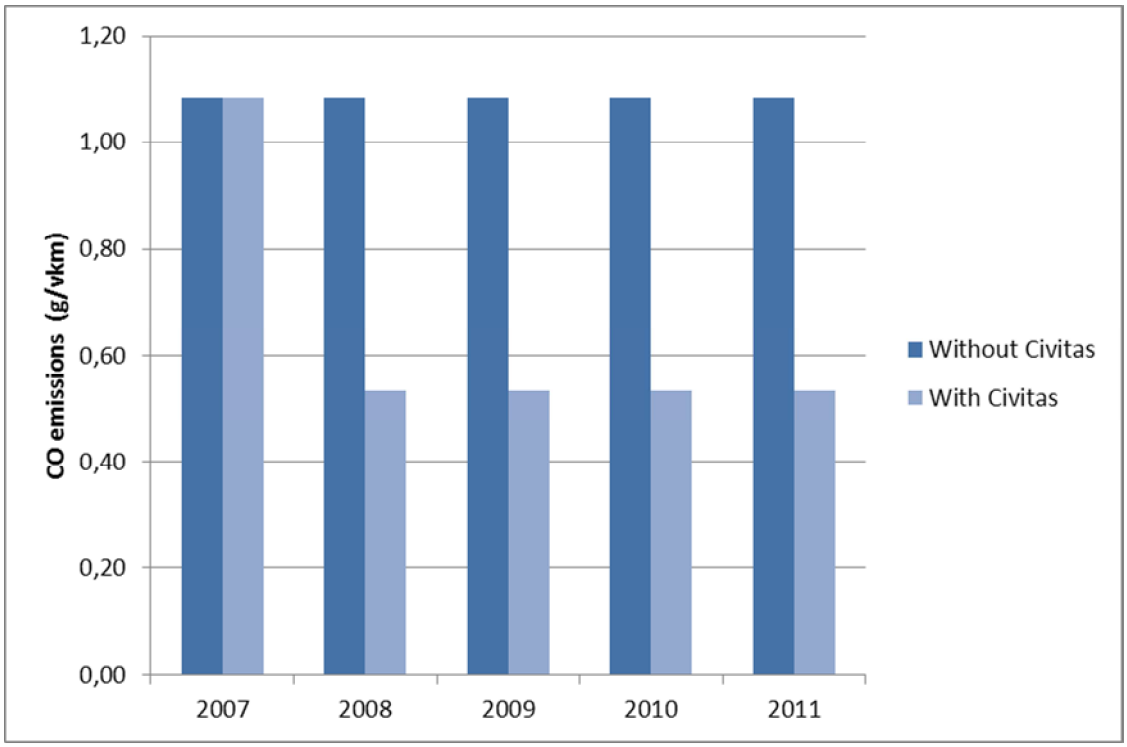

Figure C2.2.3 - CO emissions (with/without CIVITAS)

The following graph shows the evolution of CO2 emissions (g/vkm) With CIVITAS and the evolution of this indicator according to the B-a-U scenario (Without CIVITAS).

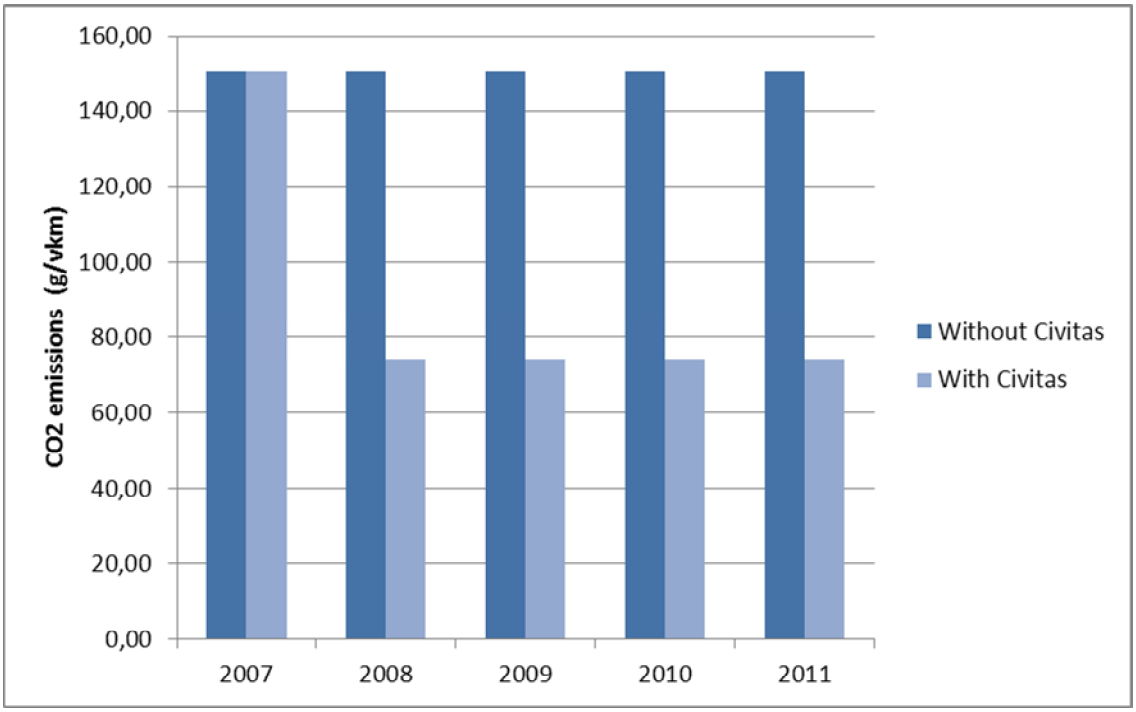

Figure C2.2.4 – CO2 emissions (with/without CIVITAS)

The following graph shows the evolution of NOx emissions (g/vkm) With CIVITAS and the evolution of this indicator according to the B-a-U scenario (Without CIVITAS).

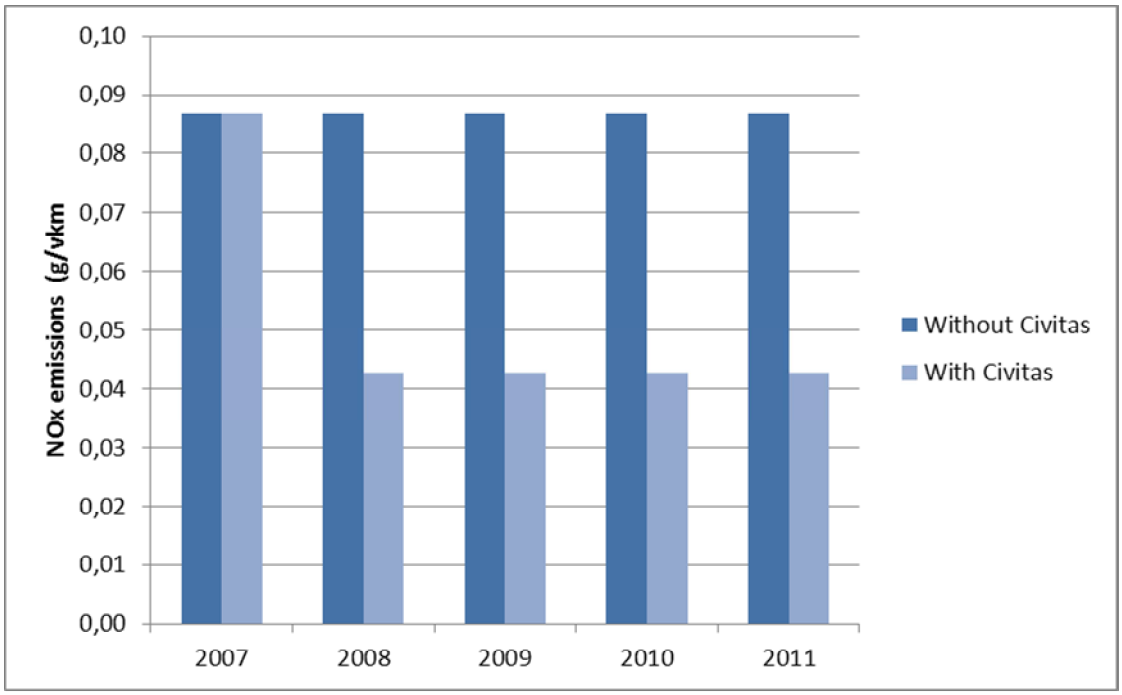

Figure C2.2.5 – NOx emissions (with/without CIVITAS)

The following graph shows the evolution of PT emissions (g/vkm) With CIVITAS and the evolution of this indicator according to the B-a-U scenario (Without CIVITAS).

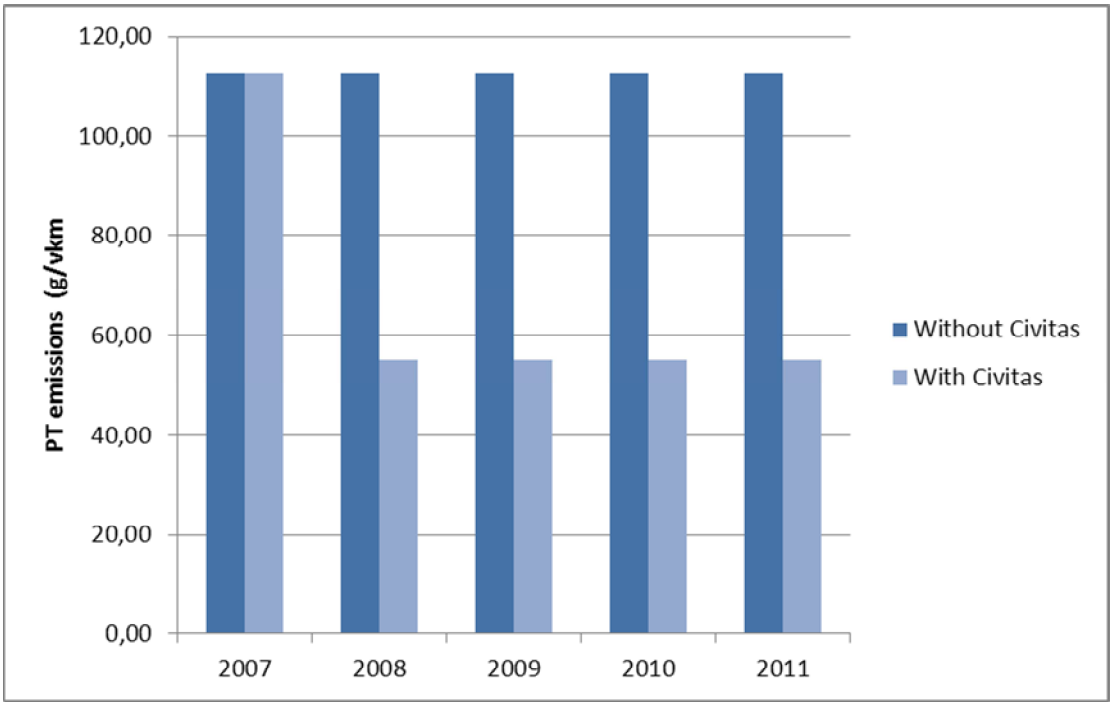

Figure C2.2.6 – PT emissions (with/without CIVITAS)

The following graph shows the evolution of HC emissions (g/vkm) With CIVITAS and the evolution of this indicator according to the B-a-U scenario (Without CIVITAS).

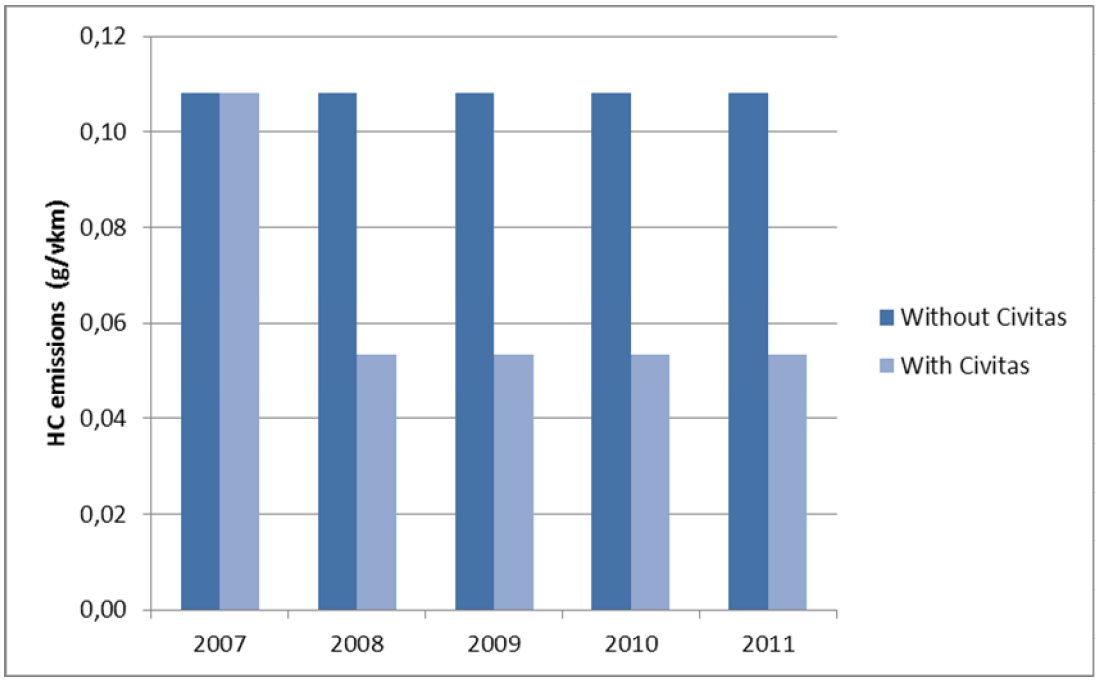

Figure C2.2.7 – HC emissions (with/without CIVITAS)

As expected, with an increased share of (smaller) urban vehicles and specially with the utilization of electric vehicles (whose emissions were considered to be equal to zero given that they have no emissions at local level), the emissions dropped significantly.

C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	To release a feasibility study of new mobility services, mainly that concerns car sharing exploited by "clean" fleets and pre-existent cars from the municipality; The feasibility study of new mobility services has been released	**
2	To reduce the emission of greenhouse gases in Coimbra in case of real implementation of the measure. The study forecast a reduction in the emissions of -0,55, -76,44, -0,04, -0,05 and -57,5 g/vkm in CO, CO2, NOx and HC emissions, respectively).	**
NA = Not Assessed O = Not Achieved * = Substantially achieved (at least 50%) ** = Achieved in full * = Exceeded**		

C4 Up-scaling of results

The hypothesis undertaken in the feasibility study considered that the carsharing system would be implemented for the whole city, so there is no similar plan to expand this kind of measure to other areas of Coimbra. This measure includes 10 vehicles and covers the entire city. If the measure was applied to a larger scale the impacts will be greater since in the indicators will have an expected substancial decrease. For instance, by upscalling the 10 tested vehicles to 30 potential vehicles the reductions of final energy will be 3,03 MJ/vkm (a reduction of 1,01 MJ/vkm (2010) for 10 vehicles induces a reduction of 3,03 MJ/vkm in a universe of 30 vehicles). With this potencial reduction it will also affect the local emissions (CO, CO2, NOx, PT, HC) in similar proportions.

C5 Appraisal of evaluation approach

The evaluation strategy of this measure sought to focus on a number of indicators accross the areas of economy, transport, energy, environment and society, which were to be measured in different ways.

The evaluation strategy that based the Local Evaluation Plan (LEP) was defined a long time before the final definition of the measure and during the LEP elaboration the hypothesis considered in relation to the foreseen evaluation approach of the measure was very different from the approach that actually was taken.

In relation to Modal Split (at city level) it was considered that the measure would have little influence and therefore this indicator could be eliminated.

Inspite of the possible meaningfulness of the impact of the measure on the modal split, the evaluation strategy of the indicators in the area of Energy and Environment and the definition of revelant data to the indicators in the area of economy (vehicle-km) was based on the information related to the modal split (data/assumptions about potential modal shift) – not at the city level but on the scope of the trips made by the potential users of the service (in order to determine the corresponding abattement in emissions and energy consumption due to the measure).

Thus, the referred change in the approach of the feasibility study together with the elimination of the above mentioned indicators implied also the redefinition of the evaluation approach of the other indicators.

Taking into consideration that this measure is a study no ex-ante data was avalable for the Awareness level, Acceptance level – users and Acceptance level – operators, resulting in the elimination of these indicators.

C6 Summary of evaluation results

The key results are as follows:

- **Good balance between operating revenues and costs** – The increase in the average operating revenues (+0,78 €/vkm) is more significant than the increase in the average operating costs (-0,74 €/vkm), the balance is 0,04 €/vkm.
- **Increase of penetration electric mobility in the city organics** – Folowing the assumptions established by the feasibility study, the measure would result an increase in the share of the electric vehicles (+19,3 %), mainly, through a decrease in the share of Diesel vehicles (+8,6% / -10,4% being neglectible the impact in the share of the diesel vehicles.
- **Contribution to energy efficiency in the city** – The implementation of the measure would result in significant energy savings due to the expected significant reduction of the energy consumption in each trip (-0,84 MJ/vkm).
- **Improvement of ecological footprint** – As result of the use of a fleet with an important share of small electric vehicles, the implementation of the measure would result in relevant emission savings at local level, given that from the operation of the electric vehicles result no emissions at local level (-0,55, -76,44, -0,04, -0,05 and -57,5 g/vkm in CO, CO2, NOx and HC emissions, respectively).

C7 Future activities relating to the measure

After the end of measure it is foreseen to continue efforts to sensitize decision makers in Coimbra for the real implementation of the car sharing service in this city as well as to disseminate the study to other cities and other stakeholders, with the scope to enlarge the car sharing network in Portugal.

The Municipality became more participative in this issue and made a preliminary agreement for the use of 5 cars of its fleet in case of the car sharing implementation. Also the Mobility Councillor requested that the study consider the possibility of using of electric cars and integrate it in the national electric mobility project (Mobi.e).

Finally during the Mobility Week 2012 the Municipality announced that it wants to launch a municipal service of car pooling.

The seminars, workshops and demonstration events, organized in the scope of this measure, also contributed to increment the knowledge about this kind of service for academics and operators of PT and car sharing services.

Measure title: **Feasibility Study of New Mobility Services in Coimbra**

City: **Coimbra** *Project:* **MODERN** *Measure number:* **06.03**

D. Process Evaluation Findings

D.1 Deviations from the original plan

The deviations from the original plan comprised:

- **The responsibility to carry out the study changed from Municipality to the public transport operator** – In the beginning of the CIVITAS MODERN project there was no experience about car-sharing in Portugal and only some months after was the first service launched, so there was a lack of know-how in this area. This lack of expertise was extended also to the Municipal technicians, worsened by the fact that the mobility issues were frequently a responsibility of SMTUC, the urban public transportation service dependent of the municipality and functioning as the municipal mobility entity. For this reason the municipal technicians had great difficulty in gaining expertise in this domain, while SMTUC technicians increased their knowledge, due the involvement in other CIVITAS MODERN measures and benefiting from the international networking allowed by the project. Taking into consideration that the difficulties experienced by the municipality could have delayed the measure, it was decided that SMTUC would support the municipality in this task and after June 2011 all the responsibility was assumed by SMTUC, a decision that allowed the achievement of all the measure goals foreseen .

D.2 Barriers and drivers

D.2.1 Barriers

Preparation phase

- **Barrier 1.1 – Organizational Barrier** – A lack of expertise about car sharing in the Municipality technicians, worsened by the fact that at the Portuguese level the circumstances were not very different, caused difficulties in involving municipal technicians in the measure.

Implementation phase

The measure was only a study, so no implementation phase has been foreseen during CIVITAS. Anyway the following barriers could have been the reason for the initial decision to carry out only a feasibility study during CIVITAS instead to implementing the measure:

- **Barrier 2.1 – Cultural Barrier** – The lack of a culture in car sharing in Portugal contributed to the fact that the Municipality of Coimbra and SMTUC didn't believe in the success of such initiative and to made the decision of providing only a study during CIVITAS (it is also important to retain that the first experiences in Portugal with car sharing only began at the same time that MODERN project started)
- **Barrier 2.2 – Financial Barrier** – In addition to the above mentioned barriers other financial priorities were on the Municipality and SMTUC agenda, which involved great investments in the mobility area, namely to recover the lack of national funding to other CIVITAS measures also contributed the final decision to proceed with only a study.

Operation phase

The measure was only a study, so no operation phase has been foreseen during CIVITAS.

D.2.2 Drivers

Preparation phase

- **Driver 1.1 – Organizational Driver** –SMTUC technicians were motivated to solve mobility issues and increase their knowledge about car sharing, due to their involvement in other CIVITAS MODERN measures and the benefits coming from international networking and exchange of experiences. These factors has been used for their involvement in the measure instead the technicians of the Municipality.
- **Driver 1.2 – Involvement Driver** – The Director of *Iniziativa Car Sharing* of the Environmental Ministry of Italy offered to help people involved in the measure and other stakeholders to increase their knowledge and involvement in this area. For the same effect the CEO of *Carris Tour*, the entity for the Car sharing service in Lisbon, invited the Municipality representatives and SMTUC technicians for a technical visit to his service.

Implementation phase

The measure was only a study, so any implementation phase has been foreseen during CIVITAS. Nevertheless, the following driver was essential in catalysing the possibility of implementing the measure:

- **Driver 2.1 – Planning Driver** – The study foresees the possibility of using the Municipal fleet in the car sharing service. This innovative aspect was well received by municipal decision-makers for 2 reasons: the first reason was the possibility of managing the municipal fleet by the car sharing operator (probably SMTUC); the second was the profitability of the fleet for other uses.

Operation phase

The measure was only a study, so no operation phase has been foreseen during CIVITAS.

D.2.3 Activities

Preparation phase

- **Activities 1 – Organizational Activities** – Taking into consideration the lack of knowledge of Municipal technicians about car sharing services (barrier 1.1) and the fact that SMTUC technicians are motivated and more skilled for this issue (driver 1.1), it was decided to change the responsibility for carrying out the study from the Municipality to SMTUC. It was also decided to have the support of consultants used as a training and methodological driver to the SMTUC personnel.
- **Activities 2 – Organizational Activities** – To take advantage of the expertise of the Director of *Iniziativa Car Sharing* of the Environmental Ministry of Italy (driver 1.2), during the 3rd Official CIVITAS MODERN Event, Coimbra hosted an international workshop on car sharing services performed by the referred expert and with the participation of other experts, allowing for SMTUC technicians to increase their knowledge in new mobility services. For the same reason the Councillor for Mobility of Coimbra Municipality and SMTUC technicians visited the car sharing service in Lisbon.

Implementation phase

The measure was only a study, so no implementation phase has been foreseen during CIVITAS. Anyway meetings with Municipality and SMTUC responsible took place, as well as the launching of promotional campaigns to increase the interest in the measure, avoiding the problems related to barriers 2.1 and 2.2 and taking advantage of the driver 2.1.

Operation phase

The measure was only a study, so no operation phase has been foreseen during CIVITAS

D.3 Participation

D.3.1 Measure partners

- **Measure partner 1 - Serviços Municipalizados de Transportes Urbanos de Coimbra (SMTUC);** Public transport company; Leading role

  SMTUC was responsible for the coordination of the activities of the measure, the collection of part of the data needed for the feasibility study to set up a car sharing service in Coimbra, as well as its conception and the release of the business plan.

  Additionally, SMTUC together with Municipality played an important role in the planning and implementation of the promotional campaigns carried out to disseminate the measure and test it acceptability.

  Some of the data collection regarding the evaluation were also carried out by SMTUC.

- **Measure partner 2 – Câmara Municipal de Coimbra (CMC);** City; Principle participant

  CMC supported SMTUC in the feasibility study, namely in the data collection and in the planning and implementation of the promotional campaigns to disseminate the measure. Since October 2011 the Municipality has been also responsible for the dissemination of the CIVITAS MODERN project of Coimbra.

- **Measure partner 3 – Prodeso Ensino Profissional, Lda (PRODESO);** High school; Principle participant

  While responsible for the dissemination activities for the first three years of the MODERN project of COIMBRA, PRODESO gave some support in the 3rd Official CIVITAS MODERN Event in Coimbra, which included the international workshop about car sharing.

- **Measure partner 4 – Perform Energia, Lda (PE);** Private company; Principle participant

  PE was the partner responsible for the evaluation of this measure, namely analysing data and results.

D.3.2 Stakeholders

- **Stakeholder 1 – Car Drivers –** The measure was targeted to the car driver that wants to avoid to be owning a car (or another car for the family), offering him an alternative when he has particular mobility needs .

- **Stakeholder 2 – CarrisTour** – This enterprise was the responsible for the car sharing service in Lisbon and provided technicians to make a presentation of the service in the international workshop of the 3rd Official CIVITAS MODERN Event in Coimbra and in the car sharing demonstration during the European Free Car Day. The CEO of *Carris Tour* also received Municipality representatives and SMTUC technicians for a technical visit to the Lisbon car sharing service.

- **Stakeholder 3 – "Iniziativa Car Sharing Italy"** – The Director of *Iniziativa Car Sharing* of the Environmental Ministry of Italy coordinated and performed the main part of the international workshop during the 3rd Official CIVITAS MODERN Event in Coimbra.

- **Stakeholder 4 – Media** – Media has been a channel for the dissemination and promotion of the measure and all the events organized had the participation at least of the local media.

D.4 Recommendations

D.4.1 Recommendations: measure replication

- **Car sharing services are very important for establishing an integrated transport system –** Car sharing services are very important in the cities that want to have an integrated mobility system, being an important complement to the public transport network, creating alternatives for the special mobility needs of drivers that want to avoid have their own car. Cities that have a good public transport network could have advantages in the implementation of these services because each driver that leaves his car could be a potential public transport user. So, as the case of Coimbra and the other 2 Portuguese cities with car sharing systems, the public transport operator could be responsible for this system. Coimbra has a public transport operator that belongs to the Municipality and in a such case this could be an advantage since that the system could be in accordance with the Municipality objectives and allow for better management of all available resources. This driver allowed that the feasibility study to set up a car sharing service could take in consideration the use of the municipal fleet for the service. Also the use of electric cars was chosen in order to take advantage of the *Mobi.e* project (a national project that installed a network of battery chargers in the major part of Portuguese cities). In any way all these conditions are difficult to congregate together in many cities, so the best recommendation is to give great importance to the specification phase and to allow the complete analyse of each case. It is important not to forget any possibility to find the best solution.

- **The share of already existing municipal or private company fleet could face constraints caused by the normal users** – If the share of the Municipal fleet (or the share of other fleets) is foreseen, it must be retained that constraints caused by the usual users of the fleet could appear. These users could overestimate the importance and the time of their car use, so a previous and impartial assessment of the car usage is strongly recommended. This strategy will allow for a correct planning of the fleet to be used in the future service and to have arguments that could justify the choices. During the study a tendency to appoint the oldest cars of the Municipality for the car sharing service was also detected. It is important that everyone understands that the quality of the fleet will be crucial for the services success, so it is recommended to sensitize the decision makers to this problem and also take this issue in consideration during planning.

- **The assessment of potential users could be difficult** – The assessment of potential users of the car sharing service through surveys is very expensive. Another less expensive approach could be to compare the usage in similar services in other cities and propose the beginning of the service with a compromise between the quality given by a great offer (but more expensive) and the use of a smaller fleet that will be cheaper (in the condition that the quality of the offer don't decrease drastically). As previously referred, in Coimbra the increment in the car sharing fleet will be done by the share of cars already used by personnel of the Municipality.

D.4.2 Recommendations: process

- **Potential constraints must be assessed as soon as possible to allow timely recovery actions–** A cultural lack of knowledge about car sharing services was detected in the former contacts with the personnel of the Municipality that were designated to perform the feasibility study. When a lack of knowledge occurs, involvement or commitment of designated people to carry out a task it is very important to have the perception of the problem sooner and anticipate the recovery actions to avoid delays or irreversible consequences. A permanent and rigorous monitoring and coordination of tasks are crucial for this purpose. In Coimbra's case the problem

was solved by the involvement in the measure of personnel from SMTUC, the urban public transportation service dependent of the municipality and functioning as municipal mobility entity. These personnel were highly motivated by their involvement in other CIVITAS measures. This involvement and the exchange of experience with other CIVITAS cities also allowed this personnel to have more knowledge about these issues.

- **Knowledge acquisition is very important as is taking advantage of all the available drivers –** Complementary to the previous recommendation it can be affirmed that the increase in the knowledge about car sharing issues was also made possible in Coimbra thanks to the training actions, the attendance of workshops and demonstrations, as well as by visiting other car sharing services. These activities have been possible thanks to the offer of some car sharing operators and experts in this area, but also due to the contacts carried out with these kinds of entities. So it is recommended to put all the efforts when it is needed to solve any problem and it is very important to take advantage of all the drivers and opportunities that are offered.

ANNEX 1 Fuel Mix Data

The next table shows the data obtained in relation to the evolution of the Share of different fuels (diesel, gasoline) in the Fuel consumption in Portugal since 2004:

Year	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
% Diesel	71,1%	72,2%	73,0%	74,5%	75,4%	75,9%	76,9%	77,7%
% Gasoline	28,6%	27,4%	26,6%	25,2%	24,2%	23,6%	22,7%	21,8%
% GPL	0,3%	0,3%	0,3%	0,4%	0,4%	0,5%	0,4%	0,5%

Source: DGEG - General Directorate for Energy and Geology, Statistics

ANNEX 2 Vehicle Fuel Efficiency Data

The next table shows the data obtained in relation to the evolution of the fuels sales (diesel, gasoline) in Portugal since 2006:

Year	2006	2007	2008	2009	2010	2011
Diesel (ton)	4.764.738	4.864.374	4.791.541	4.831.597	4.870.663	4.607.986
Gasoline 98 (ton)	277.004	225.386	168.600	152.474	137.734	104.341
Gasoline 95 (ton	1.398.446	1.362.922	1.318.223	1.308.281	1.249.228	1.150.735
Total	**6.440.188**	**6.452.682**	**6.278.364**	**6.292.352**	**6.257.625**	**5.863.062**

Source: DGEG - General Directorate for Energy and Geology, Statistics

The following table shows the evolution of energy consumption (MJ) of different fuels (diesel, gasoline). These values are obtained from the evolution of fuel sales (above) with a conversion factor of 43,3 MJ/kg:

Year	Diesel	Gasoline 98	Gasoline 95	Total
2006	206.313.155.400	11.994.273.200	60.552.711.800	278.860.140.400
2007	210.627.394.200	9.759.213.800	59.014.522.600	279.401.130.600
2008	207.473.725.300	7.300.380.000	57.079.055.900	271.853.161.200
2009	209.208.150.100	6.602.124.200	56.648.567.300	272.458.841.600
2010	210.899.707.900	5.963.882.200	54.091.572.400	270.955.162.500
2011	199.525.793.800	4.517.965.300	49.826.825.500	253.870.584.600

Considering that no historic series has been obtained for passenger cars vehicle-km, the historic series for passenger cars passenger-km has been used with the assumption that the average occupancy of the car is stable.

The following table the data obtained in relation to the evolution of Passenger Cars (pkm) in Portugal since 1990 (source: European Commission, EU transport in figures - Statistical Pocketbook, 2011).:

Year	Passenger Cars (10^9 pkm)
1990	40
1995	52,7
2000	71
2005	85
2007	86,6
2008	87
2009	86

ANNEX 3 Energy Density and conversion factors

Energy Density	
1kWh	3,6 MJ
1 litre Diesel	35,86 MJ
1 litre Gasoline	32,18 MJ
1 litre GPL	23 MJ