*Measure title:* **Solutions for alternative fuels in Toulouse and complementary measures to achieve a 100% clean fleet**

*City:* **Toulouse** *Project:* **MOBILIS** *Measure number:* **5.2**

# A Introduction

In order to achieve a 100% clean bus fleet, Tisséo-SMTC (Public Transport Authority and Operator) has carried out a number of alternative complementary measures. The work was mainly composed of an investigation into the feasibility of the use of bio-gas and bio-diesel and the installation of the last generation soot filters.

## A1 Objectives

The objective is to investigate and demonstrate solutions for alternative fuels: bio, diesel, bio-gas; and complementary measures to obtain a 100% clean public transport fleet by 2008.

There are three main components contained in this measure:

<u>Demonstration of bio-diesel usage and comparative analysis of framework conditions for bio-diesel supply and use:</u>

- To demonstrate bio-diesel usage
- To analyse the specific Toulouse context
- To contribute to a transnational market analysis,
- To launch a dedicated experimentation with 81 buses.

This work will be called "*biodiesel*" in the following.

Study of the production and use of biogas as a source of compressed natural gas (CNG), in Toulouse area.

Two directions will be investigated:

- Inventory of local potential sources,
- Purification process.

  This work will be called "*biogas*" in the following

Equipment of diesel buses with last generation soot filters

- Acquisition and installation of soot filters on 28 EURO II diesel buses: GX 317,
- Procurement of diesel buses (Euro III and Euro IV) equipped with soot filters (101 buses),
- Reduction of pollutant emission.

  This work will be called "*Soot filters"* in the following.

## A2 Description

Biodiesel

Bio fuel technology is fairly developed in Toulouse, but its application still needs to be extended. By choosing the CNG solution for the renewing of the bus fleet, the bio-diesel use is not considered as a priority by Tisseo-SMTC. However, to reach the objective of a fleet composed of 100% clean bus, the bio-diesel was used as a complementary alternative fuel especially for the oldest vehicles.

Biogas

In Europe the biogas production is around 3 000 ktoe (2 762 in 2002). In order to reach European Commission White Paper objectives of 15 000 ktoe in 2010, an annual growth of biogas use in-between 20% and 30% is necessary.

In France, the urban community of Lille has been dealing for ten years with an experience on biogas use for ten buses. The experience is so interesting that a huge raise of production and use of biogas is planed (CIVITAS Project: TRENDSETTER). Apart from this experience, no conclusive attempt of using biogas as fuel vehicle has been achieved in France.

This study had the advantage of supporting the biogas spreading out with a realistic use since Tisséo-SMTC was owning 100 CNG buses in 2004 and was planning to increase this fleet.

The purification of biogas is an important production step for vehicle fuel use. Among the purification processes, the absorption processes have the double advantage to be efficient for the purification of important quantities of gas and to remove at the same time two undesirable biogas components, carbon dioxide and hydrogen sulphide.

Many purification processes of biogas are based on water absorption (urban community of Lille in France, Kristianstad in Sweden), whereas the purification processes of natural gas from Lacq (studied at chemical engineering laboratory, LGC) is based on amine absorption. For the moment, there is no accurate rule of choice and each new biogas purification process should be studied.

Soot filters

A few years ago, it was decided to install new generation soot filters on the last generation of buses (Heuliez – GX 317). Unfortunately this project has been stopped with the AZF disaster. At present only 56 buses are equipped with soot filters.

The aim within the MOBILIS project was to equip a part of the oldest generation of the GX 317 buses with last generation soot filters and to purchase some diesel buses already equipped with soot filters, in order to reduce considerably the pollutants emission.

Moreover the installation of such filters permitted to use the cleanest diesel fuel available with a low degree of sulphur.

## *Description of work*

**Research and Technical Development related activities:**

Bio-diesel

The work has been run with the support of a specialised laboratory of INPT (Institut National Polytechnique de Toulouse). It was mainly consisting in the development of:

- A methodological framework for comparative transnational market analysis
- A site-specific recommendation on legislative framework conditions for bio-diesel supply and usage.

Biogas

This work has been run with exchange of ideas with the urban community of Lille but also with the support of specialised laboratory of INPT (Institut National Polytechnique de Toulouse).

The first part of this work consisted in an investigation of biogas potential sources (waste organic sources and dedicated cultivation) in Toulouse area: a census of biogas potential sources and an evaluation of economic and ecologic impacts of these different supplies of biogas if used for feeding the CNG fleet of buses. For each organic substrate, the data on biogas components was considered.

The second part is the study of cleaning process in order to improve the purity in good technological, economical and environmental conditions.

- First, biogas purification processes were surveyed (adsorptions, combined ad & absorption, etc). A special attention will be put on minor components, sulphur components such as mercaptans and carbonyl sulphides, chlorofluorohydrocarbons and heavy metals such as mercury and zinc.
- Second, from the given source of biogas chosen on the first part, adsorption process was studied by the gas-liquid separation specialists of the LGC. Since absorption is based on solubility, bibliographical and thermodynamic studies have been done about solubility of biogas components in solvents, especially for minor components. Indeed, if the solubility of methane, carbon dioxide and hydrogen sulphur in usual solvents are well known, the solubility of minor components are rarely quantified.

From these results, a solvent or a solvents mixture was proposed. The design of an adsorption-solvent recovery unit has been completed with a sensitivity analysis to inlet composition and functioning parameters.

Soot filters

No R&D activities.

**Demonstration activities:**

Bio-diesel

- Continue effort already undertaken in order to find bio-diesel suppliers,
- Application of the recommendations of the research work, for a fleet of about 80 vehicles and within the building of a new bus depot.

Biogas

Regarding the results obtained in the study described before, and the exchange of experience that has been done with Lille, an implementation plan (including financial aspects) was drawn in order to prepare the production and the use of biogas in the bus CNG fleet.

Soot filters

- Definition of the overall framework of this experimentation and associated evaluation plan.
- Acquisition of soot filters to be installed on old existing buses (28) and procurement of diesel buses equipped with soot filters (101)
- Evaluation of the environmental impacts and of the operating incidences.

## *Expected results and targets*

Bio-diesel

- To assess the feasibility of use of bio-diesel.
- To contribute to a cross evaluation.

Biogas

- A state-of-the-Art of the techno-economical potential of the use of biogas,
- Obtain an exhaustive inventory of biogas potential sources in Toulouse area,
- Evaluation of economic and ecologic impacts of purified biogas fuel for each supply,
- Obtain an absorption-solvent regeneration process well adapted to the purification of biogas for vehicle fuel use with the consideration of minor components.

Soot filters

By installing soot filters, the expect results were:

- Measure the efficiency of soot filters (opacity measurement).
- Reduce the pollutant emission.

Evaluate the operational incidence (estimation of oil and fuel consumption).

# B Measure implementation

## B1 Innovative aspects

The innovative aspects of the measure are:

- **Innovative aspect 1** – Biodiesel

This work permitted to have a global and actualised overview of the biodiesel production, use and performance at the local level. The demonstration that has been done at the local level has moreover contributed to the overall objective of having a 100% clean vehicles fleet in 2009. The included experimentation has indicated the gains in term of environmental performance.

- **Innovative aspect 2** – Biogas

This work is innovative:

- In considering the use of methane coming from biogas as fuel, in south-west of France ;
- For an up-to-date study of biogas upgrading to CNG standards, especially from minor components point of view.
- The ex-ante experimentation should precise the potential gain both in term of environmental and energetical performance.

- **Innovative aspect 3** - Soot filters

Contribute to the overall objective of having a 100% clean vehicles fleet in 2009. The use of soot filters significantly improves the environmental performance of the diesel buses, especially in terms of particles emissions as demonstrated in table 5.1.
An ex-post evaluation has been carried out in order to determine the respective environmental improvements

## B2 Situation before CIVITAS

Before CIVITAS, the bus fleet was composed of CNG buses (100 buses) and diesel buses (399 buses) (see baseline in C.1.2 section) but none of them was using bio diesel nor soot filter.

## B3 Actual implementation of the measure

The measure was implemented in the following stages:

Soot filters

**Stage 1: Acquisition of diesel buses fitted with particle filters** (January 2006 – December 2007) – All through this period, Tisséo-SMTC acquired 101 diesel buses fitted with particle filters (96 buses were assigned to the urban network and 5 buses were assigned to run on a specific line to the airport).

**Stage 2: Ordering and installation of particle filters on the diesel buses already being used** (December 2006 - July 2007) – Tisséo-SMTC ordered and acquired 28 particle filters which were installed on the diesel buses of the existing fleet.

Biodiesel

**Stage 1: Feasibility study and recommendations for the use of biodiesel by the fleet of Tisséo buses** (January 2006 – November 2006) – In collaboration with a school of agronomy of Toulouse, Tisséo-SMTC performed a feasibility study regarding the changeover of a part of its diesel fleet to biodiesel.

**Stage 2: Starting of an experiment using biodiesel fuel on 81 buses** (January 2008 - December 2008) – In connection with the opening of the new bus depot of Langlade, Tisséo-SMTC started an experiment using biodiesel in which 81 diesel buses will run on biodiesel fuel during the year 2008 (biodiesel at 30%). The buses running on biodiesel are the oldest of the fleet.

Biogas

**Stage 1: State of art regarding the sources of biogas available in the Midi-Pyrénées region in view of a possible use by the Tisséo bus fleet** (September 2005 – April 2006) – With the support of a Toulouse agronomy engineering school, Tisséo performed a state of art of the biogas sources available in the Midi-Pyrénées region.

**Stage 2: Feasibility study for an use of biogas by the Tisséo bus fleet** (February 2005 – August 2006) – Again in collaboration with the Toulouse agronomy engineering school, a feasibility study was performed regarding the possible use of biogas in time by the Tisséo bus fleet..

**Stage 3: Starting of a plan for the implementation of the use of biogas by the Tisséo bus fleet** (2007) – Starting of a lobbying aimed at lifting barriers blocking the use of (notably injection of biogas in the natural gas network) biogas at Toulouse by the Tisséo bus fleet.

## B4 Deviations from the original plan

The deviations from the original plan comprised:

- Reduction of the equipment budget due to the integration of depreciation costs, transfer to an awareness communication campaign,

- Small planning change due to the delay of the construction of the new bus depot (from June 2007 to January 2008)

## B5 Inter-relationships with other measures

The measure is related to other measures as follows:

| No. | Measure title | Relation |
|---|---|---|
| 5.2 T | Solutions for alternative fuels in Toulouse and complementary measures to achieve a 100% clean fleet | The use of purified biogas by CNG buses is one goal at term. Moreover the implementation plan would propose recommendations regarding the fuel station building.<br>On the other hand, the work to be done on the quality of fuel would be use in the definition of biogas' upgrading process. |
| 5.3.D | Operation of bio-fuel and CNG vehicles and framework conditions for alternative fuel use in Debrecen | Common work that would be realised on the bio-diesel technology.<br>Share of Experience and Results with other MOBILIS sites that would work on the Bio-Diesel. |
| 5.4.L | Implementation and large-scale deployment of bio-diesel and CNG fleets in Ljubljana | |

# C Evaluation – methodology and results

## C1 Measurement methodology

The evaluation of this measure consists in determining the differences of pollutant emissions between:

- the Euro 2 diesel buses recently fitted with particle filters and the Euro 2 diesel buses not fitted with particle filters,
- the Euro 0 and Euro 1 diesel buses running on biodiesel and Euro 0 and Euro 1 diesel buses running on diesel.

Considering the measure related to particle filters, the evaluation concerns only emission of particles whereas for biodiesel, the evaluation treats all the pollutants mentioned below.

### C1.1 Impacts and Indicators

Table of Indicators.

| No. | Impact | Indicator |
|---|---|---|
| **1** | **Environment** | Emissions of HC, CO, Nox and particulates per 1000 km for soot filters and biodiesel buses |

| | | |
|---|---|---|
| **2** | **Environment** | Emissions of HC, CO, Nox and particulates for the year 2008 for soot filters and biodiesel |
| **3** | **Environment** | Emissions of HC, CO, Nox and particulates at the level of the whole bus fleet |
| **4** | **Economy** | Fuel consumption |
| **5** | **Economy** | Maintenance Cost |
| **6** | **Economy** | Overall operation costs analysis |
| **7** | **Environment and Economy** | CBA analysis |

Detailed description of the indicator methodologies:

- **Indicator 1** (Emissions of HC, CO, Nox and particulates per vehicle and per 1000 km)

  A comparison of emissions of the here above mentioned pollutants will be realized between:

  - Euro 2 diesel buses and Euro 2 diesel buses with soot filters

  - Euro 0 and Euro 1 diesel buses and Euro 0 and Euro 1 biodiesel buses in order to determine the associated environmental gains.

  The measurements have been performed according real-time measurements for particulates and manufacturer instruction manuals and fuel provider datas for HC, CO and Nox.

- **Indicator 2** (Emissions of HC, CO, Nox and particulates at the level of the 28 CNG buses)

  This indicator is related to the comparison of environmental emissions by taking into account the 28 buses which have been equipped with soot filters and the 81 busses running with biodiesel.

- **Indicator 3** (Emissions of HC, CO, Nox and particulates at the level of the whole bus fleet)

  In order to have an overview of the overall environmental gains at the level of the whole bus fleet, it has to be underlined that the installation of soot filters and the launch of a biodiesel experimentation do not consist an isolated action but is a part of an integrated clean vehicles policy which is also considering the substitution of diesel buses with CNG buses (measure 5.1 of the CIVITAS MOBILIS project). The results which will be presented in relation to this indicators battery are the same as for the measure 5.1.

- **Indicator 4** (Fuel consumption costs)

  A comparison of fuel consumption costs will be realized between diesel buses and biodiesel buses.

  This indicator is not relevant for soot filters analysis.

- **Indicator 5** (Maintenance costs)

  A comparison of maintenance costs will be realized between diesel buses and biodiesel buses.

  This indicator is not relevant for soot filters analysis.

- **Indicator 6** (Overall operation costs)

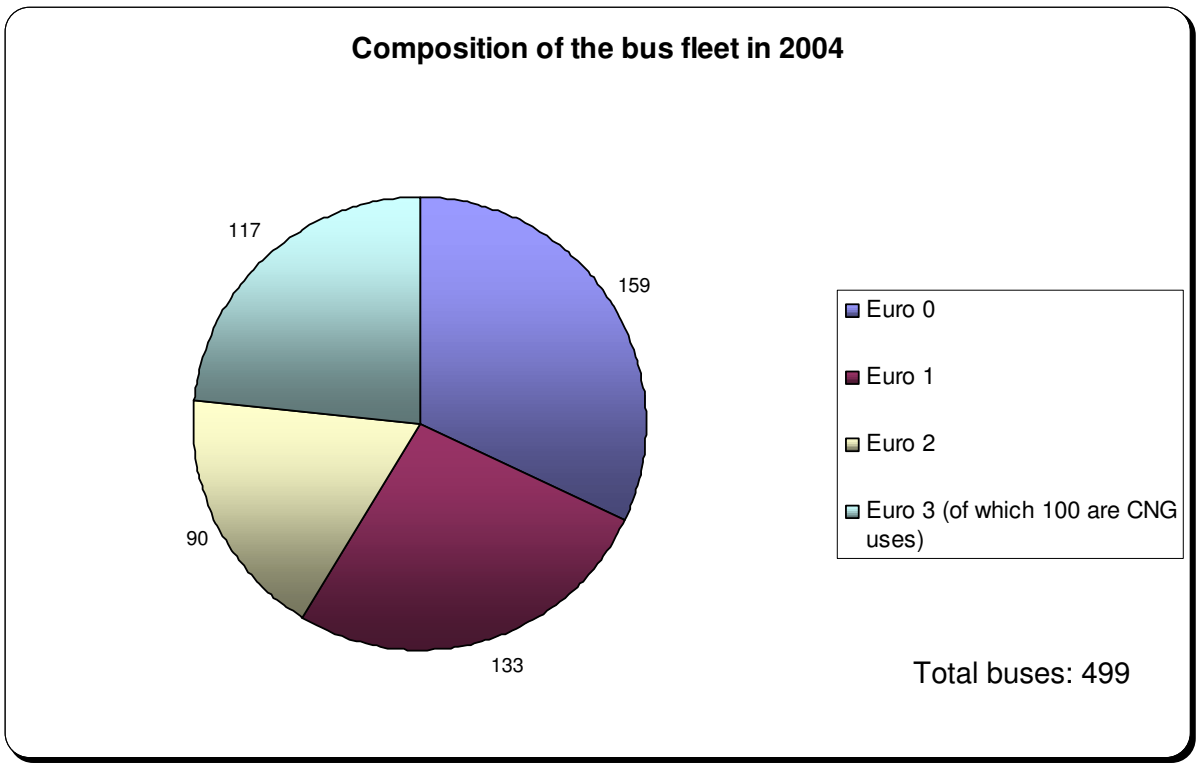
A comparison of overall operation costs will be realized between diesel buses and biodiesel buses by taking into account the whole set of parameter enabling a relevant comparison of operational costs.

- **Indicator 7** (Costs- Benefit Analysis)

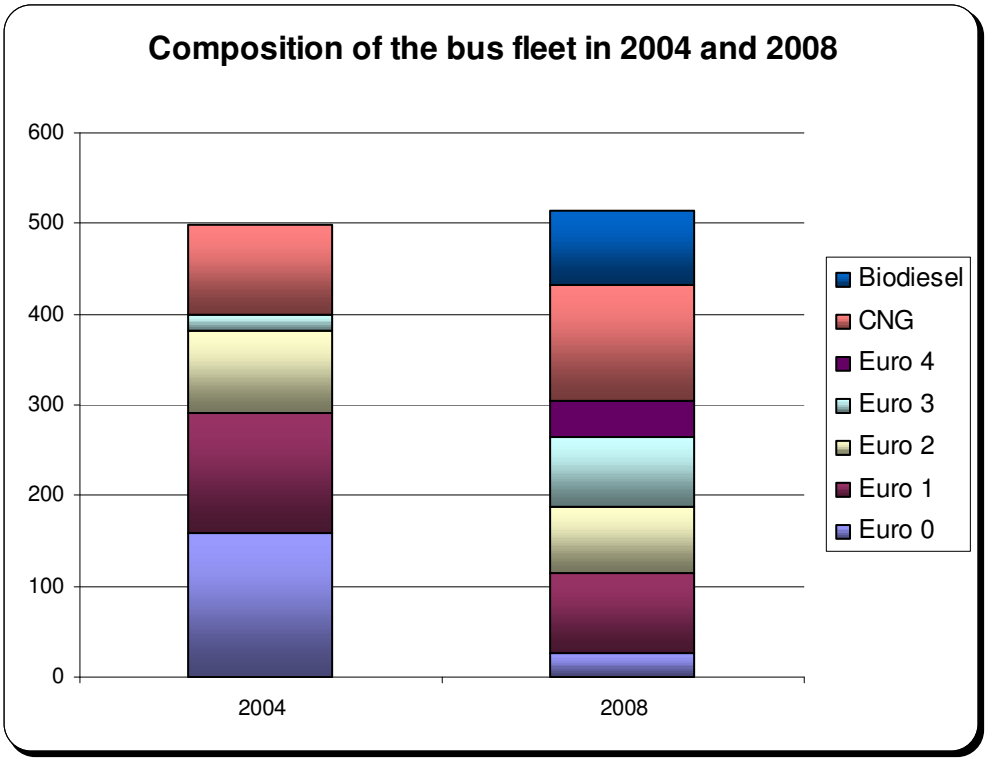
  A Costs- Benefit Analysis will be performed by taking into account both environmental and economical indicators both for installation of soot filters and biodiesel experimentation.

## C1.2 Establishing a baseline

The baseline refers to the composition of the bus fleet at the moment when the CIVITAS MOBILIS started (1st of February 2005).
At this period, the fleet was composed of 399 diesel buses and 100 CNG buses (see graph). None of the diesel buses was equipped with soot filters at this period.




The following graph and table show how the bus fleet has evolved throughout the project:




| | 2004 | 2008 |
|---|---|---|
| Euro 0 | 159 | 27 |
| Euro 1 | 133 | 88 |
| Euro 2 | 90 | 72 |
| Euro 3 | 17 | 77 |
| Euro 4 | 0 | 41 |
| CNG | 100 | 128 |
| Biodiesel | 0 | 81 |
| total | 499 | 514 |

## C1.3 Building the business-as-usual scenario

Soot filters:
Without MOBILIS, the diesel buses procured during the project lifetime would not have been equipped with soot filters. In parallel, the old diesel buses which were retrofitted with soot filters in the frame of the project would not have been retrofitted.

Biodiesel:
The 81 buses running on biodiesel in 2008 would have continued to run with regular diesel.

Biogas:
Not concerned. Tisséo only studied the possibility to run the bus fleet with biogas. Nevertheless and without MOBILIS, Tisséo would maybe not have yet started to think about using biogas for its bus fleet…

# C2 Measure results

## C2.1 Economy

Fuel consumption costs (only concerns biodiesel experimentation)

Over the first 6 months of the year 2008 (i.e. since the start of the biodiesel experiment), an internal report of the technical department reveals an additional fuel cost of 1.21 € of fuel per 100km.

With respect to the kilometer volume covered in 2007 (i.e. 4 572 956 kilometers) and corresponding to the kilometer volume foreseen for the 81 buses running on biodiesel in 2008, the additional cost reaches 55 332.77 € for the whole year 2008.

Maintenance costs (only concerns biodiesel experimentation)

Over the first 6 months of the year 2008 (i.e. since the start of the biodiesel experiment), an internal report of the technical department reveals an additional cost of 1.35 € for maintenance per 100km.

With respect to the kilometer volume covered in 2007 (i.e. 4 572 956 kilometers) and corresponding to the kilometer volume foreseen for the 81 buses running on biodiesel in 2008, the additional cost reaches 61 734.91 € for the whole year 2008.

Overall operation costs

Overall operation costs are being calculating by adding fuel costs, maintenance costs. Soot filters investments costs have been calculated according local depreciation rules.

| | Extra investment costs (€ / 100 km) | Extra fuel costs (€ / 100 km) | Extra maintenance costs (€ / 100 km) | Total extra costs (€ / 100 km) |
|---|---|---|---|---|
| Diesel bus with soot filters | 0,28 | NC | NC | **0,28** |
| Diesel bus running with biodiesel | NC | 1,21 | 1,35 | **2,56** |

With respect to the kilometer volume covered in 2007 (i.e. 4 572 956 kilometers) and corresponding to the kilometer volume foreseen for the 81 buses running on biodiesel in 2008, the total additional cost reaches 117 067.69 € for the whole year 2008.

With respect to the kilometer volume covered in 2007 (i.e. 1 195 690 kilometers) for the 28 buses fitted with particular filters, the additional cost reaches 3 347.93 € for the whole year 2008.

## C2.2 Energy

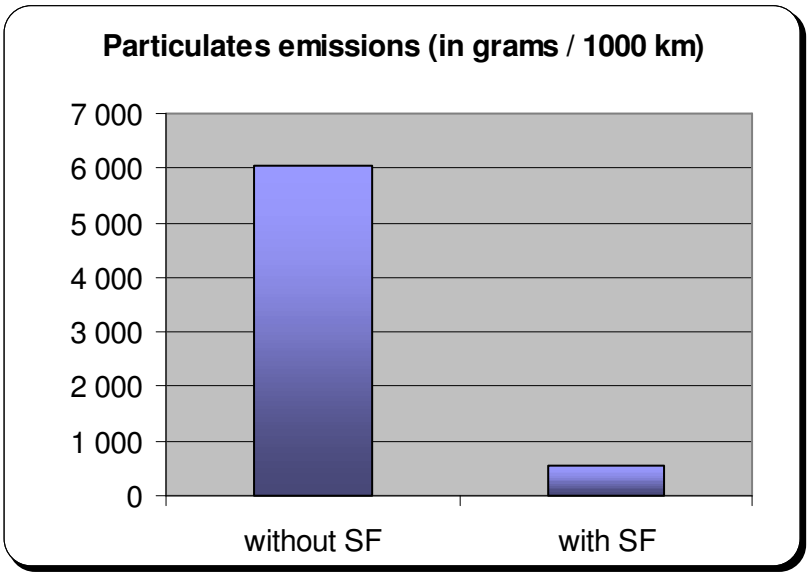
Energy related issues are indirectly being tackled in the “environment section”.

## C2.3 Environment

**C.2.3.1**: Emissions of HC, CO, Nox and particulates per 1000 km

- The following graph and table compare the emissions particulates per 1000 km between Euro 2 diesel buses and Euro 2 diesel buses with soot filters

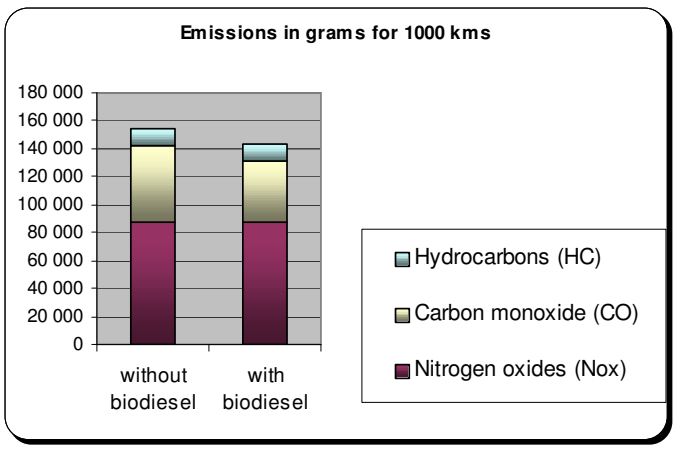
| **g / 1000kms of operation** | without SF | with SF |
|---|---|---|
| Particulates | 6 058 | 551 |

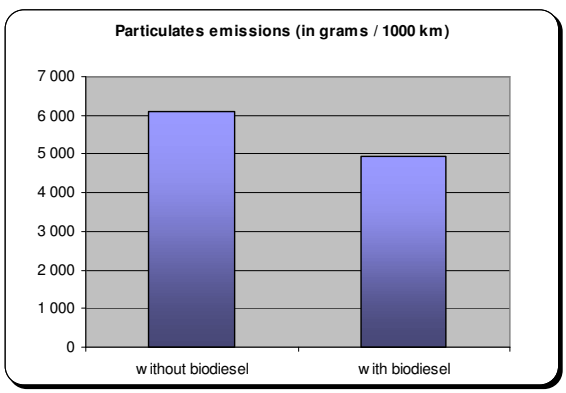



The buses fitted with particle filters emit much less particles than those that are not fitted with them (- 90.90%).

- The following graphs and tables compare the emissions of HC, CO, Nox and particulates per 1000 km between Euro 0 and Euro 1 diesel buses and Euro 0 and Euro 1 biodiesel buses.

| **g / 1000kms of operation** | without biodiesel | with biodiesel |
|---|---|---|
| Nitrogen oxides (Nox) | 87 920 | 87 920 |
| Carbon monoxide (CO) | 53 812 | 42 911 |
| Hydrocarbons (HC) | 12 780 | 12 780 |
| Particulates | 6 107 | 4 941 |



The comparison of emissions of Nox, CO, HC and particles put forward the following elements:

- the buses running on biodiesel emit exactly as much Nox as the buses running on conventional diesel,
- the buses running on biodiesel emit less CO than the buses running on conventional diesel (-20.3%);
- the buses running on biodiesel emit exactly as much HC as the buses running on conventional diesel,
- the buses running on biodiesel emit less particles than the buses running on conventional diesel (- 19.1%).

**C.2.3.2**: Emissions of HC, CO, Nox and particulates for the 27 soot filters buses and 81 biodiesel buses

The following table compares the emissions of HC, CO, Nox and particulates at the level of the 27 soot filters buses and 81 biodiesel buses for the year 2008.

The following data takes into account the production kilometric volume for the 28 buses with particle filters over the year 2007 (i.e. 1 003 526 kilometers) faced with an equivalent kilometric volume for 27 diesel buses. For the biodiesel buses, the kilometric volume is the production volume foreseen for the 81 biodiesel buses for the year 2008.
This data presents the emission in tons for the defined production volume.

| **Biodiesel** | | | |
|---|---|---|---|
| **emissions in tons in 2008** | without biodiesel | with biodiesel | gain |
| Carbon monoxide (CO) | 246,1 | 196,2 | 49,9 |
| Particulates | 27,9 | 22,6 | 5,3 |

| **Soot Filters** | | | |
|---|---|---|---|
| **emissions in tons in 2008** | without SF | with SF | gain |
| Particulates | 7,2 | 0,7 | 6,6 |

In 2008, the use of biodiesel on 81 buses instead of using conventional diesel on these buses should save emission of 49.9 tons of CO and 5.3 tons of particles.

The installation of particle filters on 28 diesel buses should save emission of 6.6 tons of particles.

**C.2.3.3**: Cost-benefit analysis for measure 5.2

In relation with the following table and the method for calculation of external costs resulting from the ExternE and Cleaner Drive projects (www.cleaner-drive.com), le cost-benefit analysis of the experiment gives the following results:

*Calculation of the external costs:*

| **emissions in tons in 2008** | **gain** | **value in €** |
|---|---|---|
| Carbon monoxide (CO) | 49,9 | 174,5 |
| Particulates | 11,9 | 1 512 218,6 |
| **total** | **61,8** | **1 512 393,1** |

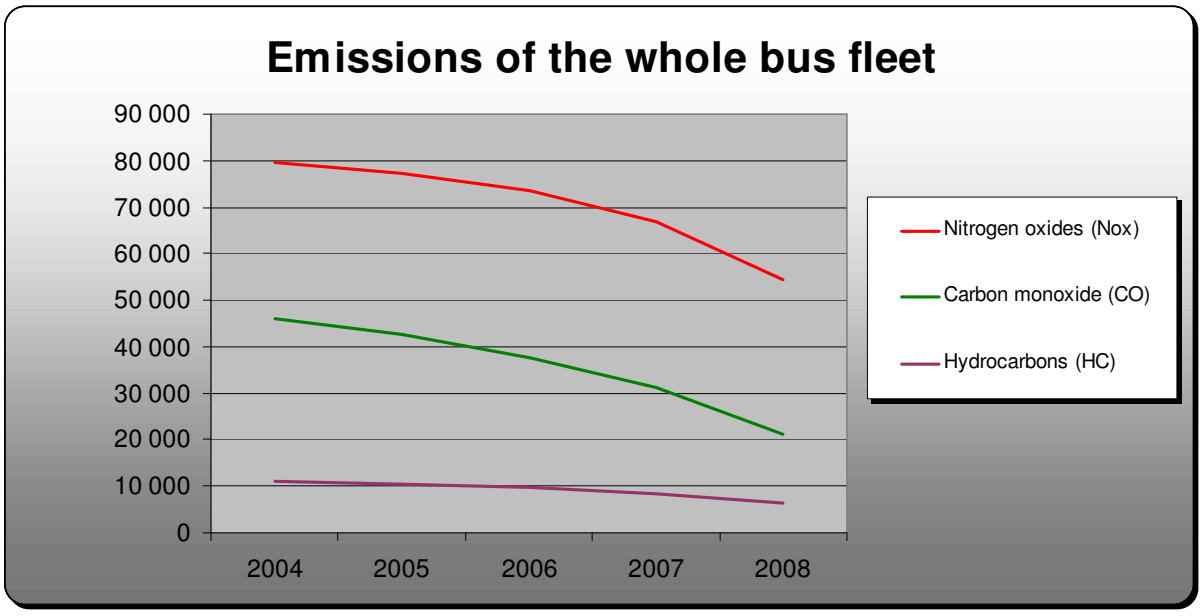
*Cost-benefit analysis:*

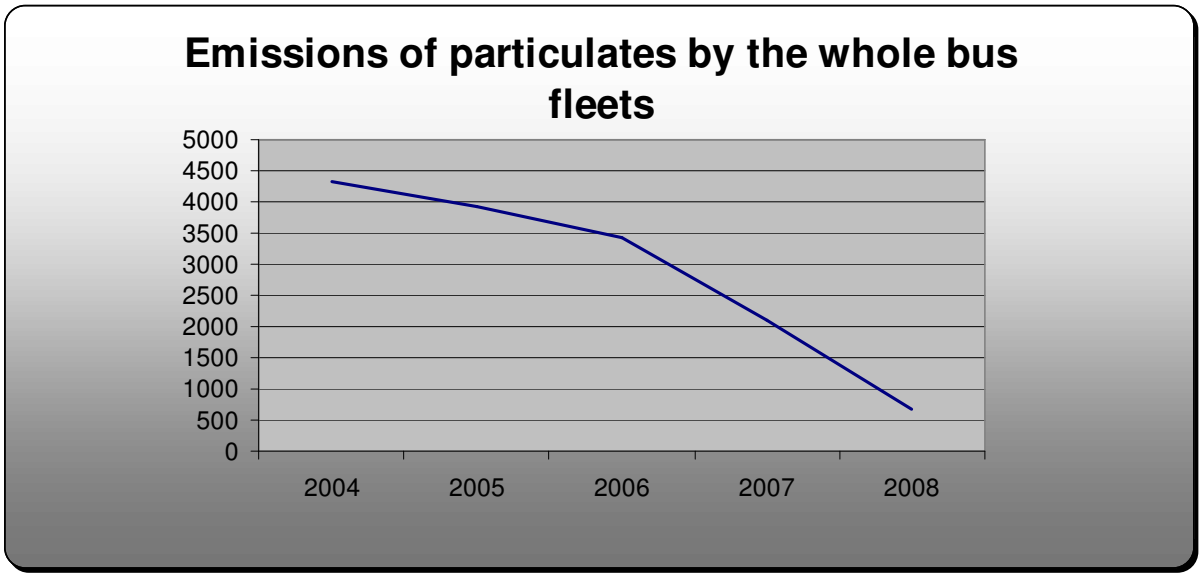
- Extra operation costs of using soot filters in 28 buses 2008 = 3.347,93€
- Extra operation costs of having 81 buses running with biodiesel instead of standard diesel in 2008 = 117.067,69 €
- Extra operation costs for measure 5.2 = 120.415,62€
- External costs to be deducted = 1.512.393,10€

- Final general extra costs = **- 1.391.977,52€.**

**C.2.3.4**: Evolution of emissions of HC, CO, Nox and particulates at the level of the whole bus fleet

The following graphics indicate how the emissions of NoX, CO, HC and particulates have evolved throughout the MOBILIS project. It has to be indicated that the evolution is not only due to the two MOBILIS measures but also to the actions which have not been integrated within the MOBILIS project (renewing of the diesel bus fleet with higher Euro standards levels).
Emissions are given in g/1000 km of operation.






Since the beginning of the MOBILIS project (between 2004 and 2008),

- the emissions of Nox have decreased by 31,9%,
- the emissions of CO have decreased by 54,2%;
- the emissions of HC have decreased by 42,8%,
- the emissions of particulates have decreased by 84,4%.

### C2.4 Transport

Not relevant

### C2.5 Society

The starting of a biodiesel experimentation by Tisséo corresponds to a political will to present the Toulouse common transport network as a clean network respectful of the environment. This experimentation also allows developing the number of captive fleets using biofuels, thus making the research work easier to arrive at second generation biofuels.

## C3 Achievement of quantifiable targets

| No. | Target | Rating |
|---|---|---|
| 1 | To assess the feasibility of use of bio diesel in the public transport fleet | ** |
| 2 | To contribute to a cross evaluation through the launch of a bio diesel experimentation | ** |
| 3 | To asses the feasibility of use of bio gas in the public transport fleet | ** |
| 4 | To develop an implementation plan for use of biogas in the public transport fleet | * |
| 5 | To install soot filters on old diesel buses and to get important cuts in terms of particulates emissions | ** |
| 6 | Procurement of diesel buses equipped with soot filters | ** |
| **NA = Not Assessed * = Partially achieved **= Achieved in full ***= Exceeded 0 = Not achieved** | | |

## C4 Up-scaling of results

Not relevant

## C5 Appraisal of evaluation approach

First of all, it must be noted, concerning the particle filter section, that only 28 buses fitted with particle filters in the course of the project were evaluated. The new buses acquired (also in the framework of MOBILIS) and fitted with particle filters from their construction (91 in all) were not taken into consideration since it is not possible to effectively measure the added value of the particle filter (in other words, the Tisséo bus fleet does not have a model for equivalent buses not fitted with particle filters). Thus the results presented in this sheet are only partial and are not representative of all the actions relative to particle filters for the Tisséo bus fleet.

Nevertheless and as for measurement 5.1 (GNV) the interest of the evaluations which were made is to show that, on the scale of the Tisséo bus fleet, there was a considerable decrease in the emission of polluting and greenhouse effect gases.

## C6 Summary of evaluation results

The key results are as follows:

- **Key result 1** – Launch of a bio diesel experimentation and assessment of economic, environmental gains.
- **Key result 2** – The CIVITAS MOBILIS project permitted to assess the feasibility of use of biogas and to start the development of an implementation plan (previous barriers have to be overcome in a first stage).
- **Key result 3** – The generalisation of soot filters within the diesel bus fleet permitted to have a major decrease in particulates emissions by the bus fleet of Tisséo.

# D Lessons learned

## D1 Barriers and drivers

### D1.1 Barriers

- **Barrier 1 (biodiesel)** – Several stakeholders; maintenance, direction, engineers posed several doubts on the viability, cost effectiveness and environmental performance of the use of biofuels.
- **Barrier 2 (biogas)** – Legislation does not allow biogas producers to inject biogas in the natural gas network. On the other side, transporting biogas by trucks has not been considered as a viable solution.

### D1.2 Drivers

- **Driver 1 (biodiesel and biogas)** – The production of an objective in-depth multi-criteria analysis of the different fuel options involving environmental, societal and cost-benefit assessments has been useful in order to go further with development of a clean public transport fleet.

- **Driver 2 (biodiesel)** – The organisation of several meetings with national and local experts in order to discuss the advantages and disadvantages of using biodiesel was very important in the decision to go ahead with the biodiesel experimentation.
- **Driver 3 (soot filters)** – A motivated workgroup that wanted to go ahead with the equipment of the program of soot filters installation.

## D2 Participation of stakeholders

- **Stakeholder 1 (biogas)** – Tisséo has involved the Urban Community of Lille (CIVITAS I city) as a third party partner in order to assess how biogas is being used in Lille and how it could be transferable to Toulouse.
- **Stakeholder 2 (biodiesel)** – Tisséo has met several stakeholders that are promoting biodiesel all over the national territory. The most involved stakeholder was "partenaires diester" (this is an association aiming to promote the use of biodiesel; this association gathers the different biodiesel users over the national territory).

## D3 Recommendations

- **Recommendation 1 (biogas and biodiesel)** – Realizing a complete in-depth multi-criteria analysis is absolutely necessary before taking any decision dealing with biofuels. This analysis facilitates the decision-making process by providing decision makers with tangible elements.

## D4 Future activities relating to the measure

Biodiesel
It has not been decided yet whether the biodiesel experimentation will continue after the MOBILIS project. Evaluation results will be analysed by directors and members of the political board in order to determine whether Tisséo wants to go further or not with biodiesel.
Anyway, Tisséo considers that using biodiesel is a way to promote biofuels research (in the view of the next generations of biofuels) and wants to develop its role in the transport R&D field.

Biogas
Tisséo is very interested in using biogas for its CNG buses. Nevertheless, Tisséo is facing a regulatory obstacle which is hard to overcome at the moment since it is not permitted yet to inject biogas within the natural gas network. For this, some works are being carried out at the national level but there are no specific outcomes yet.

Soot filters
When purchasing diesel buses, Tisséo will integrate soot filters as a necessity in the specifications of the call for tenders.