Dissemination of results

Conference papers and journal publications

Alternative Fuel Vehicles – the PROCURA project

Utrecht, 20 February 2009

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<th>Deliverable n.º</th>
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<td>Work Package</td>
<td>WP9: Cross-case analysis</td>
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THE PROCURA PROJECT AND THE SITUATION IN ITALY WITH RESPECT TO ALTERNATIVE FUEL VEHICLES

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ABSTRACT:
PROCURA is a General Action project of the Intelligent Energy for Europe programme of the Directorate General Transport and Energy. The project started the beginning of February 2006 and will last three years. PROCURA aims at contributing to the EU Objective of 20% substitution of oil-based motor fuels by 2020, by overcoming market barriers for large-scale procurement of Alternative Fuel Vehicles (AFVs).

ETA Florence-Renewable Energies is currently performing many activities in order to manage all the deliverables assigned such as interview potential end-users, apply the developed PROCURA tools and models, perform fleet scans among public and private fleet owners, propose and apply procurement models to fleet owners and groups of private car owners, create private-public partnerships on Flexi-fuel Vehicles introduction.

Keywords: Biofuels, Alternative Fuel Vehicles, substitution of oil-based motor fuels.

1 INTRODUCTION AND PROBLEM DEFINITION

Currently, Alternative Fuel Vehicles (AFVs) form a niche market.
Large-scale introduction is hampered by a number of structural market barriers:
• Lack of infrastructure (chicken-egg problem);
• Lack of maintenance and repair facilities;
• Lack of knowledge of fleet owners and consumers;
• Higher purchase costs;
• Lack of second-hand market.

PROCURA project aims at contributing to the EU objective of 20% substitution of oil-based motor fuels by 2020, by overcoming market barriers for large-scale procurement of Alternative Fuel Vehicles (AFVs).

PROCURA’s strategy consists of developing and testing models for centralised AFVs procurement.

The PROCURA approach is novel in involving private owners, emphasizing incentive systems, and contributing to Greenlease schemes, certification systems and second hand markets.

2 PROBLEMS AND PROPOSED SOLUTIONS

PROCURA’s strategy to overcome structural market barriers consists of developing models for large-scale procurement of AFVs by:
• developing of centralized buyer pools (permitting centralized infrastructure, and stronger purchase power);
• Assessing of incentive systems to compensate higher purchase prices;
• Set up of GreenLease schemes;
• Organizing of second-hand market development;
• Designing a certification system for Alternative Fuel Vehicles
• Extensive involvement of relevant target groups and end users
• Fleet scans to examine economic as well as environmental benefits possible through a vehicle exchange within an existing fleet to an alternative fuel fleet.

Furthermore, extensive dissemination activities are carried out in order to involve relevant target groups and end users.

3 WORK PROGRAMME, TARGET GROUPS AND DELIVERABLES

Overall coordination takes place in WP1.

The structure of the work plan is characterized by the following:
WP2 consists of a market analysis phase (technology-infrastructure, analysis of buyer pools and incentive systems).
The analysis phase provides the necessary input for the development of procurement models in the WP3.
Five pilot projects in five countries are organized in parallel work in WP4, WP5, WP6, WP7 and WP9.
WP9 consists of a cross-case evaluation of pilot cases, as well as an evaluation of the PROCURA project, leading to recommendations for ‘next steps’ at European levels.
Parallel to the analysis/synthesis/pilot/evaluation,
Dissemination activities are taking place in WP 10, to take advantage of lessons learnt and knowledge build-up to influence other sites.

Target groups for PROCURA include the following:
- Local authorities;
- European authorities;
- Private fleet owners
- Lease companies;
- Maintenance and repair shops;
- Infrastructure developers;
- Branch organisations (automotive);
- Automotive manufacturers.

Target groups are involved in this project towards interviews, workshop and seminars, newsletters and Website.

The pilot projects will deliver incentives to the market for AFVs, and provide contribution of achieving the long-term EU objectives of 20% in 2020.

For this reasons, project deliverables are:
- 150 public and private fleet owners for which fleet scans are carried out;
- 1500 public and private fleet owners, 200 local and regional authorities, 2000 supply chain members (suppliers, infrastructure developers, lease companies, rental companies, taxi companies) participating in workshops, conferences, seminars;
- 50 maintenance and repair shops having been trained in AFVs;
- 5000 interested stakeholders, with interest in keeping up to date through PROCURA newsletter;
- 35% Percentage of participants from private sector in workshops, conferences, seminars.

4 THE “AIM” OF THE PROJECT: THE FLEET SCAN TOOL

The software tool called “Economic and Environmental Tool” has been developed within the PROCURA project. This tool aims at allowing fleet owners to examine potential economic as well as environmental benefits and challenges possible through a vehicle exchange within an existing fleet.

The decisive factor in fleet procurement remains the financial benefit although environmental concerns increase to become significant decision factors. Hence, in order to gain the interest of a fleet owner to procure an alternatively fuelled fleet / vehicle in most cases, the user has to realize a financial benefit by this procurement. This tool offers the possibility to depict the economic consequences implied with a vehicle exchange towards green vehicles.

Apart from the economic considerations, fleet owners should also consider the environmental impact of the AFV acquisition. The importance of ecological profits for the fleet owners increases steadily. A decision towards the employment of alternative fuel vehicles may improve local air quality and moreover contributes to the overall environmental improvement and the reduction of the greenhouse effect. When thinking of ecological profits the fleet owner has to take into account the true environmental benefit (i.e. improved air) as well as the "soft" benefit factors (benefits that are not calculable in monetary terms) for his business, such as an improved company image.

The motivation to use this tool may differ from user to user as it supports in procurement decision in various aspects. They may:
- Look for a way to improve the performance of his fleet with respect to a specific emission rate ($CO_2$, $PM_{10}$, NOx);
- Try to present the fleet in a more modern and sustainable way;
- Try to align their fleet with a new policy;
- Investigate the options to decrease maintenance costs (such as fuel costs).

The environmental figures which are calculated in this tool include the $CO_2$ emission, $PM_{10}$ emission and NOx emission. The consideration of environmental aspects is not an established part of the traditional vehicle procurement in Europe. The PROCURA tool aims at supporting the integration of environmental issues in the overall large-scale vehicle procurement.

The purpose of the economic and environmental tool is to show a fleet owner the short term possibilities (available on local scale) to reduce the emissions of a fleet by changing to alternative fuels as well as the monetary impact of a vehicle exchange.

A brief overview about the structure of the tool is summarized below:

**INPUT**

Fleet data of existing fleet:
- Vehicle type
- Fuel Type
- Average Km / year
- Depreciation period
- Purchase date

**TOOL**

Customised vehicle database
Customised fleet characteristics
Calculation on:
- Economics
- $CO_2$ emissions
- Local emissions

**OUTPUT**

Results on:
- Annual Costs
- $PM_{10}$ Emission
- NOx Emission
- $CO_2$ Emission
Fleet scan reports with fleet owners were:

- performing many activities in order to manage all the ETA Florence - Renewable Energies is currently
- biological and potential solutions. Further, ETA Florence works for the application of the developed PROCURA tools and models to tackle these barriers, the performing of fleet scans among public and private fleet owners to determine both the cost aspects as well as the technical and non-technical barriers of Alternative Fuel Vehicles.

An important task is also related to propose and apply procurement models to fleet owners and groups of private car owners and to create private-public partnerships on Flexi-fuel Vehicles introduction.

Detailed deliverables for ETA Florence - Renewable Energies are:

- 3 workshops with local and regional fleet owners;
- 2 workshops with automotive supporting industry
- 11 Fleet Scan Reports with fleet owner (application of the Fleet Scan Tool);
- Increased activity on Alternative Fuels in 5 organizations/associations in the AFV-chain;
- 1 Report about Regional public private partnership on AFVs.

5 PROGRESS ON WORK PLAN AGAINST INITIAL OBJECTIVES

The main task for ETA Florence is to give a change in vehicle purchase behavior towards AFVs.

In order to accomplish this task, ETA acts towards:

- increasing in awareness among bus companies, fleet owners and vehicle users on AFVs options;
- developing experiences with the use of CNG in order to allow a more effective shift to the introduction of AFVs;
- giving special focus on economic and environmental impacts, barriers and possible solutions.

The activities carried out by ETA during the project period, that is from 1st January 2006 to 31st June 2008 were:

**Fleet scan reports with fleet owners**

- currently: 11 done
- plan: fleet scan reports by December 2008
- initial objective: >10 reports
- # of vehicles scanned: >1000

The scan has been directed towards the following fleet owners:

1. local public transport company;
2. italian bank in Florence;
3. volunteer emergency medical service Association;
4. local garbage removal service company;
5. local natural gas provider company;
6. provincial government of Pistoia (a city near Florence)
7. Rental car company
8. Rental car company
9. University of Florence (Polo Biomedico, Centro1, Scienze Sociali, CSIAF)
10. University of Florence (Polo Scientifico)
11. Municipality of Rovereto

The fleet scan analysis shows in general that the exchange of the fleet to CNG and E85 will generate a reduction in all the pollutants. While environmental benefits are important factors for fleet owner’s business in terms of improved company image, the financial impacts don’t seem to be a decisive factor in fleet procurement mostly because of the depreciation time of the current fleet. Only NGVs show financial benefits due to the price of CNG vehicles and to fuel costs and consumption. In order to propose procurement models to fleet owners and groups of private car owners, fleet scan reports will be carried out. Main contents of each reports will be:

1. Overall Objective of Fleet Scan Tool
2. Calculation Basis and underlying assumption
3. Reference scenario of existing fleet
4. Overview of Alternative Fuel scenario
4.1- Compressed Natural Gas (CNG) scenario
    - Economic benefits
    - Environmental benefits
4.2 - Bioethanol (E85) scenario
    - Economic benefits
    - Environmental benefits
4.3 - Biodiesel (B50) scenario
    - Economic benefits
    - Environmental benefits
5. Conclusions

**Workshops with local and regional fleet owners**

- initial objective: 3 workshops
- currently: 2 workshops done:
  - 16/4/2007, Florence - supported by the Municipality of Florence
  - 11/12/2007, Rovereto (North Italy) - with Technological District + Municipality Traffic & Environment Assessor + Environmental and Energy regional agencies
- plan: 1/10/2008 workshop in Florence supported by the Municipality of Florence
- Total # of participants: 40 (tot expected: 80)
- workshops audience:
  ✓ local fleet managers;
  ✓ local authorities;
  ✓ experts in the field of Mobility Management;
  ✓ regional agencies for the environment;
  ✓ car manufacturers
- main topics discussed:
  ✓ General overview about Biofuels;
  ✓ PROCURA and the BEST project;
  ✓ Financial aspects for biofuels in Italy;
  ✓ The Mobility Management;
  ✓ Successful experiences with CNG.

**Workshops with automotive supporting industry**

- initial objective: 2 workshops
- currently: 2 workshop done:
  - 4/12/2007 Rome - supported by ANIASA (National rental cars Association)
  - 4/4/2008 Bolzano- with FORD + Municipality & Environment Assessor
- Total # of participants: 50
• workshops audience:
  ✓ managers from important rental car companies;
  ✓ bioethanol producers association;
  ✓ mobility managers association;
  ✓ environmental and fleets magazine;
  ✓ environmental regional agency.
• main topics discussed:
  ✓ Rental car companies and environment;
  ✓ The PROCURA and the BEST project;
  ✓ Incentives for the use of bioethanol;
  ✓ Sustainable mobility in urban areas;
  ✓ The “carsharing” technique.
• Ford Motor Company experiences with FFV/E85
• Ford Flexi fuel vehicles

Increased activity on Alternative Fuels in at least 5 organizations/association in the AFVs chain
• currently: work in progress
• plan: 1 report
• initial objective: 1 report
• main activities carried out by ETA Florence:
  ✓ working with the Italian Minister of Environment in order to join the Sustainable Energy Europe Campaign partnership with the PROCURA project.
  ✓ ETA is in contact with ANIASA (National rental cars association): strong interest from fleet owners association in AFVs
  ✓ working with Assodistil (Italian bioethanol producers association) in order to lobby the government, to resolve the problem of the high taxation of alcohol.
  ✓ ETA is in contact with Peugeot Italia for the promotion of the fleet scan tool and for the possibility to install an E85 filling station at their plant in Milan
  ✓ ETA is associated with the National industry Confederation for the entire range of renewable energies including Sustainable Mobility and AFVs ;
  ✓ ETA is in contact with Euromobility, the National mobility managers Association, in order to extend the know how developed within the PROCURA in a broader context.

Regional Public-private partnership on AFVs
• currently: work in progress
• plan: 1 report
• initial objective: 1 report
• main activities carried out by ETA Florence:
  ✓ working with bioethanol producers and providers in relation to the installation of the bioethanol pump in the Municipality of La Spezia (connected with the BEST project);
  ✓ working with SCANIA and the Municipalities of Trento and Rovereto. This collaboration have led to the beginning of a network about AFVs.
  ✓ working with the municipalities of Florence. These contacts have led to the organization of the two workshops in Florence as deliverable 6.2.
✓ working with the Energy Department of the Province of Pistoia. These contacts have led to a fleet scan analysis.

6 CONCLUSIONS

During the project period, ETA Florence have had the opportunity to discuss with a number of fleetowners, local authorities, car dealers, etc., and many aspects about biofuels in Italy are arised:

- **BIOFUELS & SUSTAINABLE MOBILITY:** the introduction of AFVs into the fleets is an option BUT it should be inserted in a broader strategy for private/public mobility management such as:
  - planning of local transport services;
  - promotion of the “carsharing” and “carpooling” technique using AFVs.

- **SWEDISH BIOFUELS EXPERIENCE:** the successful Swedish experience demonstrates the need of clear national policies also in Italy, new codes, regulation, incentives, obligations and standards must be developed by public Italian authorities.

- **E85 DISTRIBUTION & COSTS:** serious lack of distribution infrastructure and higher price of E85 compare to petrol price:
  - other E85 filling stations are required (only 1 installed in La Spezia);
  - strong excise reduction is needed for E85 to convince people in the use of this alternative fuel.

- **FOOD FOR FUEL DEBATE:** This is a strong argument against the developing of alternative fuels in Italy, public opinion is afraid of the bad consequences of biofuels.
  - Second generation biofuels will do away with the counterarguments?
  - Hydrogen or hybrid vehicles for PROCURA2?

- **BIOFUELS MARKET IN ITALY & EUROPE**
  A strong effort must be developed not only in Italy but also in all the EU in order to get the 10% binding minimum target for the share of biofuels in overall EU petrol and diesel consumption by 2020:

<table>
<thead>
<tr>
<th></th>
<th>total final consumption of petrol and diesel for transport (ktoe)</th>
<th>% of biofuels in total final consumption of petrol and diesel for transport (ktoe)</th>
<th>Bio fuels ktoe</th>
<th>Bio ethanol ktoe</th>
<th>Bio diesel ktoe</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td>25</td>
<td>1,1%</td>
<td>3211</td>
<td>690</td>
<td>2508</td>
</tr>
<tr>
<td>Italy</td>
<td>37258</td>
<td>0,4%</td>
<td>162</td>
<td>n.a.</td>
<td>162</td>
</tr>
</tbody>
</table>

SOURCE: Eurostat, december 2007

- **CNG VEHICLES**
  - Italian fleet includes about 400,000 natural gas vehicles. There is a network of 500 refuelling stations across the country, and the number of NGVs and filling stations keeps increasing.
The production and the upgrading of biogas for vehicles could represent an important new perspective.

A common conclusion has been achieved during the period project: in order to get Large-Scale Alternative Fuel Vehicles market, new codes, regulation, incentives, obligations and standards must be developed by Public Italian authorities. They can offer incentives to accelerate the introduction of biofuels giving a long-term perspective for the community and the country.
Green Fleet Procurement Models for the Introduction of Alternative Fuel Vehicles in Portugal

by
Ana Isabel Cardoso¹, Lara Moura¹, Gonçalo Gonçalves¹, Tiago Farias¹ and Luís Alves¹

ABSTRACT:

The European Union is aiming at a 20% substitution of oil-based motor fuels by 2020. Many alternatives seem very promising, as biofuels, natural gas and, in a long term perspective, hydrogen. The replacement of the conventional fuels by alternatives poses a lot of major challenges that encloses many different types of issues, such as, the easy use, safety and reliability to the car owners at reasonable prices, the environmental impact of this alternatives has to be lower than the one caused by the current fuels, the level of energy efficiency has to be the same, and the last, but one of the most important, the levels of investment in infrastructure and equipment, so that can be a high penetration in the market.

The PROCURA project – Green Fleet Procurement Models aims at facilitating large-scale procurement of alternative fuel vehicles (for example, natural gas vehicles and biofuels) by assessing and lowering traditional market barriers for large-scale procurement of Alternative Fuel Vehicles (AFVs). Currently, AFVs form a niche market. Large-scale introduction is hampered by a number of structural market barriers. Earlier EU programmes found that market barriers for AFVs include (1) lack of appropriate infrastructure (chicken-egg problem); (2) lack of maintenance and repair facilities; (3) lack of knowledge of fleet owners and consumers; and (4) lack of second-handed market.

The strategy to overcome these barriers consists of developing models for large-scale procurement of Alternative Fuel Vehicles. There will be developed models with a focus on centralized buyer pools (e.g. private and public fleets, rental agencies), permitting centralized infrastructure, maintenance and repair, and stronger purchase power (lower costs). It will be analyzed and develop incentive systems to compensate for higher purchase prices. PROCURA will set up novel ways of facilitating green fleet procurement via Green Lease schemes, organizing second-hand market development, and designing a certification system for Alternative Fuel Vehicles.

The intensification of the use of biofuels is an important aspect of the current Portuguese strategy to reduce the dependence on oil products imports. There exists already an increased activity in Portugal, particularly in Lisbon and its surrounding municipalities on the theme of biofuel introduction, both biodiesel and bio-ethanol. Local authorities are not only concerned with the profitability of the introduction of AFVs, as well with the non-commercial aspects, as image of the city, public perception of the new fuel, impacts on health and local labour, indirect impacts on local trade, among other.

The PROCURA project is setting a pilot case study for AFV procurement in the Lisbon region, as an opportunity to explore the design of a geographical approach in the concept of “buyer pool”, also concerned with the management of a considerable fleet (public transportation, transport of goods and equipments, urban waste removal, etc.). Involvement of these end users from the beginning will take a central place in order to assess end needs and provide inputs for the development of realistic and useful solutions.

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Green Fleet Procurement Models for the Introduction of Alternative Fuel Vehicles (AFV) in Portugal

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ABSTRACT

The European Union funded “PROCURA project – Green Fleet Procurement Models” † aims at facilitating large-scale procurement of alternative fuel vehicles (for example, natural gas vehicles and biofuels) by assessing and lowering traditional market barriers for large-scale procurement of Alternative Fuel Vehicles (AFVs). Currently, AFVs form a niche market. Large-scale introduction is hampered by a number of structural market barriers. Earlier EU programmes found that market barriers for AFVs include: (1) lack of appropriate infrastructure (chicken-egg problem); (2) lack of maintenance and repair facilities; (3) lack of knowledge of fleet owners and consumers; and (4) lack of second-handed market.

The Instituto Superior Técnico of Lisbon (IST) is one the participant institution in the project. IST participation will contribute to set a pilot case study for AFV procurement in Portugal (Lisbon region), as an opportunity to explore the design of a geographical approach in the concept of “buyer pool”, also concerned with the management of a considerable fleet (public transportation, transport of goods and equipments, urban waste removal, etc.). Involvement of these end users from the beginning will take a central place in order to assess end needs and provide inputs for the development of realistic and useful solutions.

INTRODUCTION

The European Union is aiming at a 20% substitution of oil-based motor fuels by 2020. Many alternatives seem very promising, as biofuels, natural gas and, in a long term perspective, hydrogen. The replacement of the conventional fuels by alternatives poses a lot of major challenges that encloses many different types of issues, such as, the easy use, safety and reliability to the car owners at reasonable prices, the environmental impact of this alternatives has to be lower than the one caused by the current fuels, the level of energy efficiency has to be the same, and the last, but one of the most important, the levels of investment in infrastructure and equipment, so that can be a high penetration in the market.

* Corresponding author, telephone: +351 218417372.
† The project is funded by the Intelligent Energy for Europe Programme of the European Commission, its consortium is made of 11 institutions from 6 EU Member States, and co-ordinated by the ECOFYS b.v. (The Netherlands).
The PROCURA Project was designed to facilitate the large-scale procurement of Alternative Fuel Vehicles (AFVs) by identifying traditional market barriers and furthermore, promoting guidance for their mitigation. In addition, PROCURA also aims to contribute to intermediate EU goals to substitute 2% of conventional fuels by Biofuels in 2005, and 5.75% in 2010, by providing guidance to potential clients that are willing to adopt AVFs to their fleets.

The action major objectives will contribute to overcome major barriers to AFVs by developing models for large-scale procurement of AFVs. Procurement models will be developed with a focus on centralised buyer pools (e.g. private and public fleets, rental agencies), permitting centralised infrastructure, maintenance and repair, and stronger purchase power (lower costs). The action strategy consists of developing and testing models for centralized AFV-procurement via:

a) buyer pools (permitting centralized infrastructure and servicing),
b) focus on private fleet owners (e.g. Greenlease), and
c) start-up development of second hand markets and certification systems for AFVs.

The project will assess and develop incentive systems to compensate for higher purchase prices, and will set up novel ways of facilitating green fleet procurement via GreenLease schemes, organising second-hand market development, and designing a certification system for AFVs.

MARKET BARRIERS FOR LARGE-SCALE AFV PROCUREMENT

Market barriers can be linked to the following key aspects: fuel to be adopted, infrastructure required, vehicle technology required, as well as performance, maintenance, reliability and autonomy of the vehicles, where availability, cost, regulations, tax incentives and public acceptance were fundamental issues.

These main barriers were analysed in the scope of the project, concerning each specific fuel, the infrastructure required and the vehicle technology. In addition, the major constraints as perceived by the target groups for AFVs, as well as opportunities and decision factor related to adoption these new solutions were also addressed.

From the study performed, it can be concluded that one of the main barriers encountered is closely related to the lack of strong political willingness in different member states to commit to a long term perspective in terms of implementing alternative fuels in the market. This situation brings other consequences related with the vehicles and fuels available for the user and also the prices necessary to be applied.

Some of the other main barriers identified were:

a) The availability and the cost of the fuel is a major factor when evaluating the purchase of an AFV. All AFVs will require additional or completely new fuelling infrastructures. Most of the AFV fuels will have either a separate fuel station at a fleet operator’s location or can be incorporated into a traditional gasoline/diesel fuelling station. The degree to which the new fuels can be incorporated into the existing structure varies according to the fuel, but in all cases the various fuel suppliers normally play a strong role in making their fuels accessible for the public. Some municipalities and governments support the development of new fuelling infrastructures and partnering with different commercial
entities to install the required fuelling systems, since it is generally the environmental advantages of increased use of AFV that are a driving concern of governments;

Table 1. Barriers related to fuel

<table>
<thead>
<tr>
<th></th>
<th>Biodiesel</th>
<th>Ethanol</th>
<th>CNG</th>
</tr>
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<tbody>
<tr>
<td><strong>Fuel availability</strong></td>
<td>Limited production capacity prevents widespread use</td>
<td>Limited production capacity prevents widespread use</td>
<td>Gas network covers most of Europe. All major population centres are covered. Supply is not a problem</td>
</tr>
<tr>
<td><strong>Fuel Quality and Certification</strong></td>
<td>Quality can vary considerably depending on type of feedstock</td>
<td>Contamination with water. Requires control of storage and distribution procedure</td>
<td>Obstacles only when Biogas/ Bio Methane</td>
</tr>
<tr>
<td><strong>Fuel cost</strong></td>
<td>Current costs at the pump compares favourably with conventional Diesel, but taxes can be a problem. Fleet owners can negotiate prices with suppliers. Private owners depend on market price. Taxation can change this situation</td>
<td>Current cost at the pump compares favourably with conventional gasoline, but taxes can be a problem. Taxation can change this situation</td>
<td>Current cost at the pump compares favourably with conventional fuels, but taxes can be a problem. Fleet owners can negotiate prices with suppliers. Taxation can change this situation</td>
</tr>
</tbody>
</table>

b) The cost of AFV due to the fact that they are new technologies normally produced and supplied in much smaller quantities than gasoline or diesel vehicles. Since governments are sometimes anxious to help develop the market for new, cleaner vehicles, there are frequently national or local financial incentives to help offset the higher first cost of vehicles through vehicle tax reduction, exemption from congestion charges or tolls, or reduction of the fuel tax. Concerns about additional maintenance or operational costs have been an issue. Owners of ‘first generation’ AFV may experience problems that are solved later in subsequent models of the same AFV. So it is important not to base judgments about AFV usage upon a first experience if that vehicle is an early generation AFV. (The same holds true for gasoline and diesel vehicles, which are subject to annual recalls for a variety of things that must be corrected by the OEM).
Table 2. Barriers related to infrastructures and operation and maintenance

<table>
<thead>
<tr>
<th></th>
<th>Biodiesel</th>
<th>Ethanol</th>
<th>CNG</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Filling station availability</strong></td>
<td>Dedicated biodiesel filling stations are not common. As vehicles can use either biodiesel or conventional Diesel this is not a problem</td>
<td>Dedicated Ethanol filling stations are not common. Due to interchange ability with conventional gasoline (if flex fuel vehicle is used) this is not a problem</td>
<td>Limited number of filling stations. Low coverage. Not a problem for multifuel vehicles. Heavy duty fleet operators usually have their own filling station, but radius of action of the vehicles is still limited. Possibility of home fuelling</td>
</tr>
<tr>
<td><strong>Filling station cost</strong></td>
<td>Same as conventional station if using mixed fuel, extra cost (tanks and filling islands) if pure biodiesel is to be available</td>
<td>Same as conventional station if using mixed fuel, extra cost (tanks and filling islands) if pure Ethanol is to be available</td>
<td>Filling stations are very expensive and that limits their widespread use. Captive fleets owners usually build their own filling station</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>Some attention to fuel system as some older rubbers used can be sensitive to the fuel. Fuel filter might need replacement (once) due to clogging</td>
<td>Attention to fuel system as rubber is sensitive to the fuel</td>
<td>Dedicated maintenance staff is required, again not a problem for fleet operators. For light duty vehicles, factory converted vehicles have factory support</td>
</tr>
<tr>
<td><strong>Fuel consumption</strong></td>
<td>In most cases slightly higher than using regular diesel</td>
<td>Lower energy content of Ethanol (21.1MJ/l vs 31.7MJ/l for gasoline) increases fuel consumption (depending on Ethanol content). E85 fuel consumption (volume) ~30% higher</td>
<td>Lower autonomy than with conventional Diesel or gasoline</td>
</tr>
<tr>
<td><strong>Performance</strong></td>
<td>No significant change</td>
<td>Small increase in performance (power) with increase in Ethanol percentage</td>
<td>If CNG is replacing Diesel (e.g. urban bus) lower noise, for light duty vehicles no change in noise between Gasoline and CNG</td>
</tr>
<tr>
<td><strong>Reliability</strong></td>
<td>No problems if correct parts are used</td>
<td>No problems if correct parts are used</td>
<td>No problems</td>
</tr>
</tbody>
</table>

c) The availability of the vehicles is also a major concern, as increasingly more AFV are coming into the market but are not always distributed in every location in every country. The downstream distribution and service system of a vehicle manufacturer will be a consideration in the purchase of new AFV. Typically, the more vehicles that are purchased the more encouraged the OEMs will be to make new AFVs available in more and more locations.
Table 3. Barriers related to vehicle availability and costs

<table>
<thead>
<tr>
<th></th>
<th>Biodiesel</th>
<th>Ethanol</th>
<th>CNG</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vehicle availability</strong></td>
<td>Although regular vehicles (light and heavy duty) can use biodiesel with no alterations, manufacturers limit the mixture to 5% Biodiesel in order not to lose guarantee</td>
<td>Lower concentrations (up to 20-25% Ethanol) can be used by any SI vehicle. For higher concentrations dedicated vehicles (flex fuel) are needed. Most large manufacturers make them for South America, but availability in Europe is still limited</td>
<td>Significant vehicle changes limit the supply of light and heavy duty vehicles. Some suppliers offer factory prepared vehicles. Aftermarket changes are also possible but not very common. Light duty vehicles are usually multifuel (CNG and gasoline)</td>
</tr>
<tr>
<td><strong>Vehicle cost</strong></td>
<td>Some fuel circuit elements might need changes, but only on older vehicles. Fuel filter might become clogged after switch to biodiesel. Basic vehicle cost remains the same</td>
<td>Higher concentrations require dedicated or flex fuel vehicles. In Brazil these vehicles replaced conventional ones at the same price. Taxation can change this</td>
<td>Costs are higher than conventional vehicles due to fuel system. For urban buses expect increase of 10-20%. Taxation can change this</td>
</tr>
</tbody>
</table>

**MANUAL FOR AFV INFRASTRUCTURE DEVELOPMENT**

The PROCURA project also includes the development of manuals and guidelines for the introduction of these new technologies and fuels. The manual is particularly directed to Private and Public Fleet Owners who can get an overview of the different technologies that can be adopted by their fleets and the necessary supporting infrastructure to implement. However, it can be also used by Maintenance and Repair Shops with current limited experience on this type of vehicles. The Manual contains a brief description of biodiesel, ethanol and natural gas main characteristics, and the infrastructure requirements, such as tanks and storage, pipelines, dispensers and refuelling station. The document tackles safety and regulations of storage tanks, fuelling practices, fire practices, accidental release practices and hazards as well as the costs and feasibility, including fuel and station costs.

Physically, biodiesel is very similar to diesel fuel. There is no evidence that any of the metals currently used in the distribution, storage, dispensing, or onboard fuel systems for diesel fuel would not be compatible with biodiesel. The main difference between diesel and biodiesel is that the last one is more aggressive to the elastomers that may be used in pumps and meters. Therefore, the existent filling stations and tanks can be used for biodiesel with only small modifications. In this sense, the cleaning of a conventional diesel tank may be sufficient to be safely used by biodiesel.

On the other hand, ethanol requires proper fuel handling techniques to prevent fuel contamination. Attention must be paid when selecting materials, as some materials can be incompatible with alcohols. When these materials (such as aluminium) enter in contact with ethanol, they may dissolve in the fuel, which can damage engine-parts and result in poor vehicle driveability. The costs of ethanol facilities will, of course, vary depending on the circumstances that apply to each particular establishment.
Installing a CNG fuelling system generally is a more complex process and a number of important factors need to be considered, such as the equipment size, the installation requirements, the site preparation, the regulations and permits (these may be national or local), the fleet fuelling profile (fuel quantity required, time of day needs, etc.) and the operation costs (gas and electric costs, maintenance requirements, etc.). The size of a CNG refuelling station has strong influence on the economics of the station. A small station has a higher investment cost per Nm³ of CNG than a large station. However, the station can only be economic if there is a maximum use of the station (over 80%).

In a selection process, all the presented characteristics must be considered, in order to achieve a maximum efficiency at the fuelling station and of course in the vehicle operation.

PILOT STUDY FOR BIOFUELS INTRODUCTION IN PORTUGAL

Pilot case studies in Netherlands, Italy, Portugal, Poland and Spain, will be developed in the frame of PROCURA.

In Portugal, the transport sector represented 25% of the total pollutant emissions for 2002. Between 1990 and 2002 transport emissions increased approximately 92%, due to a massive increase in the number of vehicles and road traffic. To tackle this problem and to achieve Portuguese Kyoto Protocol commitments, the National Programme for the Climate Change (PNAC) identified actions to promote the development of the biofuels market and to implement tax incentives in this matter. This led to the publication of several Laws related with the use of biofuels and other alternative fuels in the transport sector, and to petrol and energy products taxes as main incentives for the increase the use of biofuels.

To increase the use of biofuels is an important aspect of the current Portuguese strategy to reduce the dependence on oil products imports, which can be observed by the large investments that are being made in the country over the last two years. Many national industries are investing in the production of biodiesel, not only from seed and mineral oil imported, but also from used cooking oils. It can be observed an increased activity in Lisbon and its surrounding municipalities on this theme, mostly on biodiesel and in particular cases compressed natural gas, not very well spread around the country due to the lack of specific supporting infrastructure. Many local authorities are not only concerned with the profitability of the introduction of alternative fuel vehicles, but also on the non-commercial aspects, as image of the city, public perception of the new fuel, impacts on the health and local labour, indirect impacts on the local trade, among other.

The intensification of the use of biofuels is an important aspect of the current Portuguese strategy to reduce the dependence on oil products imports. There exists already an increased activity in Portugal, particularly in Lisbon and its surrounding municipalities on the theme of biofuel introduction, namely biodiesel, and natural gas. Local authorities are not only concerned with the profitability of the introduction of AFVs, as well with the non-commercial aspects, as image of the city, public perception of the new fuel, impacts on health and local labour, indirect impacts on local trade, among other.

The pilot study for Lisbon will involve the following fleets for evaluation of introduction of AFV: Lisbon Municipality Fleet comprising 1049 vehicles, (253 heavy duty; 896 light duty
vehicles); three transit urban buses fleets (Rodoviária de Lisboa – 378 diesel buses, Vimeca – 244 Diesel buses and Carris 785 buses comprising 40 CNG buses). Environmental and economical impacts of a progressive introduction of AFV will be also analysed.

The Metropolitan Area of Lisbon has a total area of about 2,963 km² and approximately 2,660 million inhabitants (in 2001), being the largest urban agglomeration in Portugal. The population density (in 2001) was around 900 inhabitants per km², and this region is divided into 18 municipalities (Figure 1). The Municipality of Lisbon is also included in the metropolitan area, and is represented in Figure 1 with an orange circle. Due to its particular characteristics and to the city’s energy and environmental strategy recently defined, the municipal fleet of Lisbon is an excellent pilot study for the procurement of alternative fuel vehicles.

The Municipality of Lisbon fleet is quite diversified and comprises around 1,149 vehicles. Table 4 represents the number of vehicles and the annual fuel consumption (divided by category) of this fleet.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of vehicles</th>
<th>Annual consumption [L] (diesel)</th>
<th>Annual consumption [L] (gasoline)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passengers</td>
<td>567</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light Duty</td>
<td>329</td>
<td>3,160,650</td>
<td>300,896</td>
</tr>
<tr>
<td>Heavy Duty</td>
<td>242</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buses</td>
<td>11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The fleet is constituted by 768 diesel vehicles and 381 gasoline vehicles, as a result the major fuel consumption is due to diesel vehicles, although gasoline represents an important share. The biggest share of fuel consumption is related with the heavy duty vehicles with 66%. These vehicles are most of them for waste collection and street cleanness in the Lisbon municipality. The variety of vehicles and fuels existent in this fleet, and the different types of solutions performed by each are an opportunity for a wide variety of alternative vehicles solutions.
In order to achieve a large scale introduction of alternative fuel vehicles for the fleet of the municipality of Lisbon, it is necessary to develop a number of activities:

a) Assessment on existing fleet and identification of the number of vehicles that can be adapted to new fuel, the cost of fleet adaptation, fuel mix options, consumer acceptance issues, considering the characterization of the fleet renovation municipal strategy;

b) Analysis on the necessary purchase of auxiliary support infrastructure and training (considering the different alternative fuels options), to identify the minimum critical mass necessary to achieve sustainability of the AFV use for the municipality. Some activities that could be performed include workshops and interviews with relevant target groups for the intended fuel switch, in order to better understand the necessary changes and options available for the fleet;

c) Identification of the profile and key characteristics of the target region, such as technological and infrastructure focus and opportunities, market barriers and conditions, incentive systems and current procurement experiences, to serve as a base for the introduction of the alternative fuels in the area;

d) Identification of the approach to procure alternative fuel vehicles considering the management of the main packages of services required for the integration of the alternative fuels considered in the fleet;

e) Identification of particular market barriers for large-scale procurement of AFVs in this city/region, which could also be present in other places/cities;

f) Assessment of the indirect gains envisaged when to pursue the incorporation of an alternative fuel vehicle in the fleet. The non-financial gains, like environmental, and how much this would be considered in the process to decide towards the AFV.

CONCLUSION

Transport fuels account for 32% of total European Union energy consumption and road traffic is forecast to increase massively – so increased use of alternative fuels is vital to achieve targets for renewable energy sources. Transport overall produces 298% of Europe’s CO₂ emissions and road transport will account for 90% of the growth in these emissions until 2010. As a consequence, implementing alternative fuel vehicles is crucial to achieve European Union Kyoto Protocol commitments.

The European Union biofuels directive is one of the most important components of the Community energy policy. This policy seeks to optimise energy use by safeguarding the energy supplies needed to fuel Europe’s socioeconomic growth and to promote sustainable development. The biofuels directive concerns energy used for transport.

PROCURA is an European project aimed at facilitating large-scale procurement of Alternative Fuel Vehicles (e.g. natural gas vehicles, biofuels) by lowering traditional market barriers. The results of PROCURA will contribute to the EU objectives related to reducing greenhouse gas emissions and increasing energy security through achieving a 20%
substitution of conventional fuels by alternatives in 2020. Furthermore PROCURA contributes to intermediate EU goals to substitute 2% of conventional fuels by biofuels in 2005, and 5.75% in 2010.

Procurement models will be developed with a focus on centralised buyer pools (e.g. private and public fleets, rental agencies), permitting centralised infrastructure, maintenance and repair, and stronger purchase power (lower costs). PROCURA will assess and develop incentive systems to compensate for higher purchase prices. Lastly, PROCURA will set up novel ways of facilitating green fleet procurement via GreenLease schemes, organising second-hand market development, and designing a certification system for Alternative Fuel Vehicles.

The project is particularly directed to Private and Public Fleet Owners who can get an overview of the different technologies that can be adopted by their fleets and the necessary supporting infrastructure. These target groups can have a unique role during the development of this primary stage of the procurement activity.

The project presents an analysis on the AFV availability in the market and an explanation on the main decision factors for choosing these types of solutions. Additionally, a description of the main challenges and barriers encountered in different European countries, to the procurement of alternative fuel vehicles, is also considered. PROCURA will demonstrate novel ways of procuring Alternative Fuel Vehicles on a large scale through the extensive involvement of relevant target groups and end users. Building on the extensive dissemination activities related to the developed manuals and models, the project will facilitate large-scale green fleet procurement in the EU in the immediate future.

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7. PROCURA project, Pilot Study for the introduction of Biofuels in Lisbon Area (Portugal), Moura, L. (co-ordination), IST, January 2006.
The European Union has set itself the objective of a 20% substitution of traditional fuels in the road transport sector (gasoline and conventional diesel) by alternative fuels before the year 2020. Many alternatives seem very promising, as biofuels, natural gas or in long term perspective hydrogen. The replacement of the conventional fuels by alternatives poses a lot of major challenges that encloses many different types of issues, such as, the easy use, safety and reliability to the car owners at reasonable prices, the environmental impact of this alternatives has to lower than the one caused by the current fuels, the level of energy efficiency has to be the same, and the last, but one of the most important the levels of investment in infrastructure and equipment, so that can be a high penetration in the market.

The PROCURA Project is a General Action project of the Intelligent Energy for Europe programme of the Directorate General Transport and Energy. It aims at contributing to the EU objective of 20% substitution of oil-based motor fuels by 2020, by overcoming market barriers for large-scale procurement of Alternative Fuel Vehicles (AFVs).

Currently, Alternative Fuel Vehicles form a niche market. The large-scale introduction is hampered by a number of structural market barriers, as founded in earlier EU programs. These market barriers for Alternative Fuel Vehicles include: lack of infrastructure (chicken-egg problem), (lack of maintenance and repair facilities, lack of knowledge of fleet owners and consumers, higher purchase costs, and lack of second-hand market.

The strategy to overcome these barriers consists of developing models for large-scale procurement of Alternative Fuel Vehicles. There will be developed models with a focus on centralized buyer pools (e.g. private and public fleets, rental agencies), permitting centralized infrastructure, maintenance and repair, and stronger purchase power (lower costs). It will be analyzed and develop incentive systems to compensate for higher purchase prices. PROCURA will set up novel ways of facilitating green fleet procurement via Green Lease schemes, organizing second-hand market development, and designing a certification system for Alternative Fuel Vehicles.

An extensive involvement of relevant target groups and end users is required, in order to achieve better results among the project. These target groups include the following: local authorities, private fleet owners, regional and national agencies, maintenance and repair shops, infrastructure developers, automotive developers and branch organisations especially from the automotive industry. The target groups will be involved along the project by many
different ways, so that the results resemble the most with the reality practised in the real world.

Building on the extensive dissemination activities related to the developed manuals and models, PROCURA aims to facilitate large-scale green fleet procurement in the EU in the immediate future.
The PROCURA Project and the Situation in Italy with respect to Alternative Fuel Vehicles (AFVs)

**Project and Objective**

PROCURA is a General Action project of the Intelligent Energy for Europe programme of the Directorate General Transport and Energy. The project started the beginning of February 2006 and will last three years. PROCURA aims at contributing to the EU Objective of 20% substitution of oil-based motor fuels by 2020, by overcoming market barriers for large-scale procurement of Alternative Fuel Vehicles (AFVs).

**The Problem**

Facilitating Large-Scale Procurement of AFVs by lowering traditional market barriers. Large-scale introduction is hampered by a number of structural barriers:

- Lack of infrastructure (chicken-egg problem),
- Lack of maintenance and repair facilities,
- Lack of knowledge of fleet owners and consumers,
- Higher purchase costs,
- Lack of second-hand market.

**Target Groups and Key Actors**

- Local authorities;
- European authorities;
- Private fleet owners;
- Lease companies;
- Maintenance and repair shops;
- Branch organisations (automotive);
- Automotive manufacturers.

Target groups will be involved in this project towards interviews, workshop and seminars, newsletters and Website.

**The Solutions**

PROCURA’s strategy to overcome these barriers consists of developing models for large-scale procurement of AFVs by:

- Developing of centralized buyer pools (permitting centralized infrastructure, and stronger purchase power);
- Assessing of incentive systems to compensate higher purchase prices;
- Set up of GreenLease schemes;
- Organizing of second-hand market development;
- Designing a certification system for Alternative Fuel Vehicles
- Extensive involvement of relevant target groups and end users
- Fleet scans to examine economic as well as environmental benefits possible through a vehicle exchange within an existing fleet to an alternative fuel fleet

**Target Groups**

- Automotive manufacturers.
- Branch organisations (automotive);
- Infrastructure developers;
- Maintenance and repair shops;
- Lease companies;
- Private fleet owners;
- European authorities;
- Local authorities;
- Automotive manufacturers.

**Total Deliverables**

- 150 public and private fleet owners for which fleet scans are carried out
- 1500 public and private fleet owners, 200 local and regional authorities, 2000 supply chain members (suppliers, infrastructure developers, lease companies, rental companies, taxi companies) participating in workshops, conferences, seminars
- 50 maintenance and repair shops having been trained in AFVs
- 5000 interested stakeholders, with interest in keeping up to date through PROCURA newsletter
- 35% Percentage of participants from private sector in workshops, conferences, seminars

**Eta Florence Deliverables in Italy:**

- 3 workshops with local and regional fleet owners (50 participants)
- 2 workshops with automotive supporting industry (40 participants)
- 11 Fleet Scan Reports with fleet owner (application of the Fleet Scan Tool)
- Increased activity on Alternative Fuels in 6 organizations/associations in the AFV-chain
- 1 Report about Regional public private partnership on AFVs

**The Aim of the Project: The PROCURA Fleet Scan Tool**

Tool for cost-benefit analyses of using biofuels. The tool creates four alternative fuel scenarios to benchmark consequences in economic and environmental figures through a vehicle exchange within an existing fleet. Overall these scenarios are:

1) **Base case** scenario (existing fleet used with gasoline/diesel fuel);
2) **Compressed Natural Gas (CNG)** scenario;
3) **Bio-ethanol (E85; 85% ethanol + 15% gasoline)** scenario;
4) **Bio-diesel (800; 50% biodiesel, 50% normal diesel)** scenario.

**INPUT**

- Fleet data of existing fleets
  - Vehicle type
  - Fuel type
  - Average Kms/Year
  - Depreciation period
  - Purchase date

**DATABASE**

- AFVs Selection
  - Bioethanol (FFVs)
  - Biodiesel (Vehicle Modifications Required)
  - CNG
- Data crossing
  - Emissions
  - Tax
  - Incentives
  - Purchase tax
  - Insurance
  - Fuel price

**OUTPUT**

- Environmental & Economical Results
  - CO2/year
  - PM10/year
  - NOx/year
  - Total Costs
  - Saving, loss

**Deliverables**

- 1 Report about Regional public private partnership on AFVs
- 11 Fleet Scan Reports with fleet owner (application of the Fleet Scan Tool)
- Increased activity on Alternative Fuels in 6 organizations/associations in the AFV-chain
- 3 workshops with local and regional fleet owners (50 participants)
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**AFVs Selection**

- Bioethanol (FFVs)
- Biodiesel (Vehicle Modifications Required)
- CNG

**Data crossing**

- Emissions
- Tax
- Incentives
- Purchase tax
- Insurance
- Fuel price

**Analyse results & implement them**

**Coordinating partners**

- PROCURA Project and Objective
- The Problem
- Target Groups and Key Actors
- The Solutions
- Total Deliverables
- Eta Florence Deliverables in Italy
- The Aim of the Project: The PROCURA Fleet Scan Tool

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**Website**

- www.procura-fleets.eu
- www.procura-fleets.eu
Models for Large-Scale Procurement of Alternative Fuel Vehicles (AFVs)

The PROCURA Project

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The Project

PROCURA is a General Action project of the Intelligent Energy for Europe Programme of the Directorate General Transport and Energy.

Starting date: February 2006
Duration: 3 years.
Total budget: Euro 1,748,546.00.

The Objective

PROCURA aims at contributing to the EU objective of 20% substitution of oil-based motor fuels by 2020, by overcoming market barriers for large-scale procurement of Alternative Fuel Vehicles (AFVs).

The Problem

• infrastructure (chicken-egg problem);
• maintenance and repair facilities;
• knowledge of fleet owners and consumers;
• economic viability;
• second-hand market.

The Solution

PROCURA’s strategy consists of developing and testing models for centralised AFV procurement via:

• Buyers’ pools (permitting centralised infrastructure and servicing);
• A focus on private fleet owners (e.g. Greenlease);
• The start-up development of second hand markets;
• Certification systems for AFVs.

The Lisbon Case Study

Portugal has a great potential for producing Biodiesel, bioethanol from forest residues and Bio Gas from waste. These solutions would contribute to the road transport sector decarbonisation and consequently to the GHG emission drop, helping to accomplish the Portuguese International commitments.

Objectives for Lisbon WP 5

• Fleet Scan;
• Study and develop 2 case studies for procurement models for Alternative Fuel Vehicles (AFVs);
• Present solutions for the barriers identified:
  - Fiscal and economical incentives
  - Solutions for infrastructure
  - Financing

The DTEA/IST team is committed to the successful development of 2 case studies:

• implementation of a CNG fleet, and respective infrastructure,
• development of a business model for biodiesel production from used cooking oil.

Partners

Ecofys b.v. (Coordinator)
FAST Federazione delle associazioni scientifiche e tecniche
Municipality of Nijmegen
Terberg Leasing b.v.
European Natural Gas Vehicle Association
ETA Renewable Energies
Krajowa Agencja Poszanowania Energii S.A.

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