

WP 4

Results from case studies/feasibility studies – gas vehicles and gas car expansion plans

D.4.4

Summary of Deliverables (D.4.3.1. – 4.3.13)

This publication is a result of
the project Madegascar, EIE/07/180/S12.466795
supported by

Intelligent Energy  Europe

Disclaimer:

The sole responsibility for the content of this WP 5 publication lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that maybe made of the information contained therein.

Intelligent Energy  Europe



GAS FILLING STATIONS

COUNTRY OVERVIEW

Sweden (SEA and ESS) carried out a case study of one of three newly opened gas filling stations in the region. This was initiated and carried out under Madegascar and is intended to be used as a marketing tool

Sweden (Malarnet) carried out 5 case studies of existing gas filling stations to make a comparison of different types of ownership:

- owned by the municipality,
- owned by a gas company and operated by a petrol filling station owner,
- owned jointly by the municipality, local waste company, local energy and a group of local farmers
- owned by a company owned by the municipality
- owned by gas company with co-operation from the municipality

Austria (GEA and ST GW) carried out 8 feasibility studies and reported on one. This was chosen for economic reasons, and was carried out for a particular company. It would have taken place without Madegascar but Madegascar's contribution was to increase the networking and raise awareness of CNG filling stations to potential customers

Austria (AEA) carried out 17 case studies regarding CNG filling stations and reported on one which served as a model. The filling stations would have been established without Madegascar, since some gas utilities had already decided to put substantial effort in increasing the number of CNG filling stations in the region. AEA therefore concentrated on marketing activities aimed at final customers

UK (OPL) carried out a feasibility study to be used as a marketing tool, particularly as feasibility studies are often thought to be too expensive, and this one is to show the sort of information that can be expected to result from a feasibility study. This would not have taken place without Madegascar and was carried out under the project

Germany (BEA) carried out a study of home refuelling appliances, interviewing 277 households and working closely with GASAG for whom the study was carried out as a marketing tool

Spain (San Valero) carried out a feasibility which resulted from the active regional network of partners created under Madegascar. it will be used as a marketing tool by members of the regional network. The study would not have gone ahead without Madegascar.

Slovenia (Energap) carried out a feasibility study with co-operation from the Slovene association of natural gas suppliers and will be used by the association. Madegascar's contribution was crucial as there was no knowledge of using either CNG or biomethane as a vehicle fuel in the country before Madegascar

Czech Republic (SEVEN) A case study was carried out relating to a new filling station which opened in May 2009 as the third publicly accessible CNG filling station in Prague. and the largest capacity one in the Czech Republic. The study would not have gone ahead without Madegascar and was chosen to exemplify the far sighted strategy of Prazske Sluby in converting their fleet of refuse lorries, vans for street cleaning and other utility vehicles to CNG. It will be used as a marketing tool.

Lithuania (LEI) carried out 2 case studies and one feasibility study and one of the case studies was report on in WP4.3. This was carried out as a marketing tool for Klapieda's public transport company.

Poland (IEO) carried out a case study for the main Polish gas company with the aim of accelerating the plans for new gas filling stations

Poland (PAE) carried out a feasibility study as a marketing tool

Bulgaria (Boraem) carried out a feasibility study to survey the potential for expanding the supply of biogas in Bulgaria, to identify the constraints and to define measures for overcoming these constraints. This was initiated under Madegascar as a marketing tool and includes SWOT analyses

BARRIERS AND SOLUTIONS

Barriers

Most of the feasibility studies and case studies highlighted the same barriers

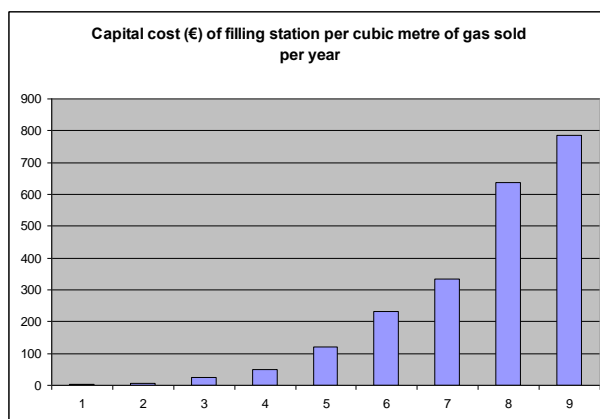
- High investment cost
- Lack of information
- Consumer acceptance
- Permit procedure and legal regulation
- Unreliable technically
- Insufficient number of vehicles

In particular the permit procedure and legal regulation was the most serious problem in Slovenia as the lack of regulation meant that it was illegal for vehicles to be fuelled by natural gas.

Solutions

High Investment cost

The feasibility studies were mostly prepared as marketing tools which show that although the investment costs can be high, if enough vehicles use the filling stations they can be profitable. The costs varied in the different studies from €1.5million in Poland to €30,000 in Bulgaria. The most usual price was between €200,000 and €500,000. Analysing the figures provided in the feasibility studies shows that the capital cost of the filling station in relation to the cubic metres of gas sold varies from €7 per cubic metre, to €785 per cubic metre. This is symptomatic of an emerging market.



Lack of information

This is the barrier that the feasibility/case studies have done most to overcome. In most cases the studies are being used as marketing tools to provide information and to raise customer awareness. They illustrate best practice and also raise the profile of these stakeholders such as the gas companies who have been involved with the studies. For many municipalities the fact that they have contributed to the studies has raised their own awareness of the benefits of CNG and biomethane as vehicle fuels. In addition to the feasibility/case studies, nearly all activities undertaken by the partners in WP4 have contributed to the dissemination of information about CNG and biomethane to the relevant market players.

Consumer acceptance

Where the above section concentrated on informing the stakeholders such as the gas companies and the filling stations owners, it was also generally accepted that there was insufficient knowledge about CNG and biomethane as vehicle fuels amongst potential customers. A large part of the Madegascar project has been involved in educating potential customers, whether they be taxi drivers or private vehicle owners. In Germany where the feasibility study concentrated on home refuelling units, the emphasis was aimed particularly at customers.

Permit procedure and legal regulation

The three countries where this was most a problem are the UK, Lithuania and Slovenia, although the slow and complicated permit procedure was cited as a serious barrier in Austria and Poland. Much of the work generally under Madegascar for UK, Lithuania and Slovenia has been concentrated on talking with governments at both a national and local level, with a view to overcoming this. This has proved successful with new legislation planned in all these countries. The feasibility studies generally do not specifically address these problems, but what they do show is that there is a market for CNG filling stations and so it is worth governments investing the time to simplify the regulations. Where municipalities have been involved with the feasibility studies, then obviously they have been able to add their support to the simplification of the regulations.

Technical reliability

For those that identified technical reliability as a problem this has largely been overcome demonstrating modern current best practice where the filling stations are largely reliable. Again, the general activities undertaken by the partners in WP4 will have helped to overcome this problem

Insufficient number of vehicles

This was overcome by the marketing activities of the partners under Madegascar. In Prague for example the increase of the number of heavy duty vehicles led to the establishment of a new filling station

COMPARISON OF MEASURES TO EXPAND NUMBER OF GAS FILLING STATIONS

As explained above, the principle means by which partners have encouraged the expansion of the gas supply has been to provide information and to educate the relevant stakeholders. This has been done through a wide variety of activities

- Workshops
- Visits to filling stations
- Seminars and conferences
- Individual meetings with stakeholders
- Opening filling stations

For most partners the target audience has been:

- Municipalities
- fleet managers
- gas companies
- national government
- equipment suppliers
- general public

These have generally been very successful. In countries where there was little knowledge of CNG and biomethane as vehicles fuels, most of the activity has been at a national level, raising the awareness of government ministers. This has been successful in the UK, Slovenia and Lithuania where government policy will soon be changed to recognise CNG and biomethane as vehicle fuels and to provide the necessary incentives. In the participating regions in countries such as Sweden and Austria where there was already a good network of filling stations the activities have further encouraged more filling stations and in particular the end consumers have been encouraged. In Bulgaria and where there is a very positive attitude to CNG, the activities have been at a more general level, raising awareness amongst the general public as well as amongst the stakeholders. In Germany the emphasis on home refuelling units was in direct response to the cost of public filling stations, and the inconvenience of having to travel too far to reach them. In Poland, IEO have concentrated particularly on the municipality and a taxi company with great success. In the Czech Republic the activities included persuading the Prague City Administration to subsidise the procurement of CNG heavy duty vehicles, in order to make the CNG filling stations viable.

EXECUTED EXPANSION OF GAS FILLING STATIONS

The number of new gas filling stations directly as a result of Madegascar has not been as high as originally anticipated. Whereas some partners have exceeded their targets, some have not. In Styria in Austria, GEA and StGW have had great success: where the target was 10 new filling stations, 18 have already been opened and 3 more are planned. In Berlin/Brandenburg there were 13 public filling stations at the start of the project, and no home fuelling stations. By the end of the project there were 2 new public filling station and 50 new home fuelling stations.

However this is not the full story. The number of planned filling stations in some cases far exceeds the original target. For example in Slovenia one new filling station was the target, whereas 10 are now planned.

Region	Target	Increase	Planned
Mälardalen - Sweden	3	1	3
South Sweden	15	13	>15
Styria - Austria	10	18	2-3
Lower Austria	27 ¹	16	About 10
Aragon, La Rioja, Castilla y Leon - Spain	10	1	1
Podravje - Slovenia	1	0	10 ²
Vilnius, Kaunas, Klaipeda - Lithuania	5	1	4
Podkarpacka, Malopolskie - Poland	3	0	1
Mazowsze	2	1	0
Bourgas - Bulgaria	1	2	1
Somerset - UK	2	1	3
Berlin, Brandenburg - Germany	6	2 public / 50 home fuelling stations	13 public / 0 home fuelling stations
City of Prague, South Bohemia and Pardubice – Czech	15	3	6

¹ The given target refers to four Austrian federal provinces (Vienna, Lower Austria, Upper Austria and Salzburg), which were originally considered target regions for the project activities. After consultation with relevant market actors of these provinces it was decided to limit the regional activities to the province of Lower Austria, which is the largest of Austria's provinces with one fourth of Austria's residents. The mentioned increase in filling stations (+17) refers to the province of Lower Austria.

² Plans for all Slovenia

Republic			
----------	--	--	--

CONCLUSIONS AND RECOMMENDATIONS

The over-riding conclusion of this part of the project is that there is an appetite for gas filling stations and they can be profitable, but they take a long time to plan. In countries where there was little or no knowledge about CNG or biomethane as vehicle fuels, it has been possible to introduce the concept and to raise awareness to a level where gas filling stations have been built or are now being planned. The feasibility studies and case studies have contributed to the project by illustrating that filling stations can be profitable if enough vehicles (in some cases heavy duty vehicles) use them, and if the capital cost is reasonable.

BIOGAS PLANTS

COUNTRY OVERVIEW

Sweden (SEA and ESS) carried out a feasibility study to ascertain whether there was enough substrate for the municipality to have their own biogas plant rather than importing biomethane from neighbouring municipalities. The study would have gone ahead without Madegascar but the municipality invited the partner to contribute their knowledge of biogas to the study. The study was made for a particular municipality.

Sweden (Malarnet) carried out a study as a marketing tool for an interesting consortium of a municipality, a local waste company, a local energy company and 17 local farmers who are running a biogas plant together

Austria (GEA and ST GW) carried out a feasibility study to investigate the economic case for a biogas plant, the availability of substrate and the closeness of a grid connection. This study was commissioned before the start of Madegascar

Austria (AEA) did not carry out any feasibility studies during the Madegascar project period, but had already performed three such studies before the start of Madegascar. Two biogas and biomethane upgrading plants have been established as a result of these feasibility studies and AEA was consulting the involved project clients during the entire project period

UK (OPL) carried out a feasibility study to be used as a marketing tool to plan the parameters for a real feasibility study which would be used to show potential plant owners the sort of study that it was necessary to carry out before planning a plant

Germany (BEA) carried out a case study on the new plant at Rathenow which, unlike most plants in Germany, is producing biomethane for vehicles

Spain (San Valero) carried out a feasibility study looking at agricultural residues for generating energy. It was initiated by the regional government of Aragon, one of the regional network partners within Madegascar, and will be used as a marketing tool for the government

Slovenia (Energap) carried out a feasibility study to introduce the concept of biomethane to Slovenia. It was carried out by specialist consultants for a gas company after an introduction by the Madegascar partner

Czech Republic (SEVEN) Several case studies and feasibility studies were carried out. One was as part of a grant application and was initiated by the partner under Madegascar and resulted in a lower project capital cost. The study will be used by the investor. Another gave the partner the opportunity to look at the economics of producing biomethane rather than biogas for electricity, another looked at the economics and other benefits of a very small project at Prague Zoo. Although the latter would not be profitable, it would serve to demonstrate using waste to generate electricity which could be used to drive electric vehicles on the zoo site.

Lithuania (LEI) carried out a feasibility study looking at regional coverage and environmental problems with waste and to investigate upgrading biogas to biomethane as a vehicle fuel, rather than using biogas to generate electricity. It will be used as a marketing tool

Poland (IEO) did not carry out a feasibility study specifically on a biogas plant

Poland (PAE) carried out several case studies for a municipality with whom the partner has a long term relationship. The studies were initiated under Madegascar and will be used as marketing tools

Bulgaria (Boraem) carried out a feasibility study as there is no working biogas plant in the Bourgas area yet. The study concentrated on the quantities of municipal waste that

would be available as a feedstock for a biogas plant. The study was not initiated under Madagascar.

BARRIERS AND SOLUTIONS

Barriers

As with the filling stations most of the feasibility studies and case studies highlighted some of the same barriers:

- Cost of infrastructure for biogas plants and particularly for upgrading, making the risk too great
- Permit procedure and regulation
- Government support uncertain and difficult to access
- Availability of waste, volatile grain prices
- Competition with natural gas and LPG, and with incentives to generate electricity
- Lack of information

Solutions

Cost and risk

This barrier has not been overcome, however the feasibility and case studies mean that the information on which the risk is calculated is sounder. Some of the partners developed tools for calculating the capital expenditure and income that can be expected from a biogas plant producing biomethane. The work with the fleets and the gas filling stations will help to create more of a market for biomethane which should contribute to reducing the price

Permit procedure and regulation, and government support

Slovenia, UK and Lithuania concentrated on discussions at a national level to introduce the government to the environmental and economic advantages of biomethane with a view to introducing financial incentives for the production of biomethane.

Availability of waste and high grain prices

The feasibility studies addressed these problems in many instances and provided reliable information on which potential biogas plant owners could base their plans

Competition with natural gas and LPG, and electricity

The environmental and economic benefits of biomethane were presented to interested parties.

Lack of information

As with the gas filling stations this is the area where the partners were able to contribute most under the Madagascar project. Information was provided for the feasibility/case studies, and the studies themselves will become means of dissemination information about waste streams, costs, government support and particularly the environmental and economic advantages of biomethane.

EXECUTED EXPANSION OF BIOGAS PLANTS

The number of new biogas plants directly as a result of Madagascar is more or less what is to be expected. Planning and funding a biogas plant is a big undertaking and takes a long time, so even where the target number of plants has not yet been commissioned, the number planned fits in well with the targets. Of particular note is the

activity in Sweden where there is more reliance on biogas plants as a source of gas. Malarnet have encouraged the planning of 6 plants, greatly exceeding the target of one new plant. SEA and ESS have contributed to an increase of 9 plants almost reaching their targets of 12.

CONCLUSIONS AND RECOMMENDATIONS

As with the filling stations, the length of time from first concept to commissioning a plant is often several years. Under the Madagascar project the feasibility studies carried out by the partners have provided much of the knowledge needed for this vital step in planning a new biogas plant to produce biomethane. Of particular interest in the feasibility studies was the amount of gas produced from different waste streams. This information is notoriously unreliable, so these studies will contribute to the body of knowledge on which further studies can be based in the future.

A sample of waste streams shows:

Partner	Waste stream	Cubic metres biogas produced per tonne treated
SEA/ESS	municipal waste, food industry waste, cattle slurry	8 to 28
GEA/St GW	municipal waste, biowaste, brewery waste	100 to 115
OPL	cattle slurry, cheese processing waste	68
BEA	cattle and pig slurry and primary products	206
San Valero	liquid manure	30
Energap	municipal waste	
Seven	maize, grass silage, pig slurry	182
LEI	pig manure, municipal waste	20 to 60
PAE	waste water	2.24
Boraem	municipal waste	1,389
Malarnet	municipal waste, crops, household waste	68
AEA	maize, sunflower, grass	167

The wide range of biogas production probably raises more questions than it answers, but will form a useful contribution to the base of knowledge.

Some of the barriers have not been resolved. The capital cost of a plant is high, the cost of upgrading equipment is high, the price of the crops is volatile for those plants using crops rather than waste as a feedstock, government support for biomethane is not yet wholehearted in any of the partner countries. The work of the partners under Madagascar, and particularly the feasibility studies and case studies has provided a solid basis for resolving these barriers.