

## CURRENT STATUS OF BIOGAS PRODUCTION, UPGRADING POTENTIAL AND IMPACT OF BIOMETHANE USE FOR TRANSPORT IN ITALY

Maurizio Cocchi, Stefano Capaccioli, Francesco Bazzoffi, Angela Grassi  
ETA, Energia, Trasporti, Agricoltura srl, Piazza Savonarola 10, 50132, Florence, Italy  
Fabio Sagnelli, Barbara La Licata  
Environment Park S.p.A., Galleria San Federico 54 c/o Finpiemonte spa, 1012, Torino, Italy  
Tytti Laitinen,  
Jyväskylä Innovation Ltd., JI, P.O. Box 27, 40101 Jyväskylä, Finland

**ABSTRACT:** This report is set in the framework of the Intelligent Energy for Europe program project called “GasHighway”, launched in 2009 with the purpose of the promotion of the “Uptake of Gaseous Vehicle Fuels, Biogas and Natural Gas, in Europe”.

The project has started in May 2009 and will run for 3 years under the coordination of Jyväskylä Innovation, (Finland) and the participation of 14 other partners from Italy, Sweden, Estonia, Poland, Czech Republic, Germany, Austria, Spain, Latvia, and Lithuania.

Biogas production has been found to be among the most environmentally benign and energy efficient means of producing vehicle biofuel from waste resources, whereas the use of natural gas as vehicle fuel also decreases the carbon dioxide emissions of vehicles by about one fourth compared to those of traditional petrol fuelled cars.

The production of biogas as a sustainable alternative for methane fuel is getting large consideration in Italy. One of the possibilities, in addition to the power generation sector, is the upgrading of biogas to the quality of natural gas for a subsequent injection into the grid.

**Keywords:** biogas, transport, biomethane.

### 1 INTRODUCTION

The European Union (EU) has set the target of increasing the share of biofuels and so-called alternative fuels, including natural gas, in traffic to 10 and 20%, respectively, by 2020. EU defines the second generation biofuels as biofuels with a high level of greenhouse gas emission savings produced from materials not intended for human or animal consumption, i.e. cellulosic biomass feedstock, wastes and by-products from industry, agriculture and municipalities. The gaseous vehicle fuels, namely upgraded biogas (biomethane) and compressed natural gas (CNG), offer an environmentally friendly alternative to the other vehicle fuels in use today: In several life cycle assessments, biogas production has been found to be among the most environmentally benign and energy efficient means of producing vehicle biofuel from waste resources, whereas the use of natural gas as vehicle fuel also decreases the carbon dioxide emissions of vehicles by about one fourth compared to those of traditional petrol fuelled cars. Also the emissions of particles and several gaseous compounds of highest concern in terms of city air quality are very low in gas fuelled vehicles compared to those using petrol or diesel. The range of feedstocks that can be used for production of biomethane through anaerobic digestion is vast: virtually any anaerobically degradable biomass without high lignin content can be digested by optimising the process conditions. Hence, biomethane fulfils the requirements set by the definition of second generation biofuels (Figure 1).

Biomethane and CNG can be used in the same vehicles, and in the same storage, transfer and fuelling systems, and hence their use and supply support each other. Availability of biomethane filling stations brings a very environmentally friendly alternative at hand for the users of gas vehicles. The expansion of the network of CNG filling stations and increase in the number of gas vehicles creates new markets for the potential producers of biogas, especially in areas outside the reach of the natural gas pipeline, where filling stations for biomethane

expand the operating span of gas fuelled vehicles. At the same time, CNG functions as an important backup solution for biomethane during market build-up and in the event of production failures.

### 2 POTENTIAL FOR SUSTAINABLE BIOGAS AND BIOMETHANE PRODUCTION UNTIL 2020

The interest in biogas investments has recently risen among the major national energetic groups because of the favorable legislative framework and high feed in tariffs for renewable power production.

Investors in biogas plants come from different sectors; they can operate in association in private limited company or as investors in bio-energy collective investment schemes.

In the European Union the biogas production estimated for 2007 was about 5901.2 kTOE with 50% coming from urban waste tips. In Italy biogas production in 2007 was estimated to 406.2 kTOE (about 4.7 TWh) with about 80% coming from MSW landfills.

In 2008 GSE (the National Energy Service Operator) qualified 360 plants (about 345 MWe), including 141 biogas plants from MSW landfills producing about 210 MWe.

Most of biogas produced is obtained from organic wastes in landfills, from anaerobic digestion of crops and agro-industrial waste, and for a small part by sludge and animal wastes.

A total of 1.300.000 m<sup>3</sup> of biogas/day can be produced only from livestock effluents that could result in a total biomethane production of 237.000.000 m<sup>3</sup>/year which is about 10 times more than the actual need of methane used for transports. Very positive signals come from the Northern Italy (Lombardia, Emilia Romagna and Piemonte), affected by the presence of several intensive breeding farms.

### 3 POTENTIAL IN BIOMETHANE PRODUCTION FOR TRANSPORT

The production of biogas as a sustainable alternative for methane fuel is getting large consideration in Italy. One of the possibilities, in addition to the power generation sector, is the upgrading of biogas to the quality of natural gas for a subsequent injection into the grid.

Despite the highest number within Europe of gas powered vehicles (650,000) as well as the most extended gas distribution grid, Italy is not a leader in the upgrading and use of biomethane for transport. However, the high potential for biomethane to become an effective renewable fuel for transport is supported by many encouraging facts:

- the methane grid in Italy is very well developed;
- biomethane as vehicle fuel requires the same engine and vehicle configuration as natural gas;
- environmental benefits of biomethane compared to gasoline and diesel are relevant;
- biomethane is a sustainable fuel that can be manufactured from local resources.

### 4 IMPACT OF BIOMETHANE USE FOR TRANSPORT

Biogas can be easily used in vehicle engines and there are today many cases across Europe where vehicles are already running on biogas. Italy has seen a rise in the natural gas vehicles numbers in the past couple of years and the potential of the Italian biogas production is so large that it could replace 12 to 20% of the natural gas consumption.

Due to the increase in the price of natural gas, a growing number of stakeholders are now interested in producing biomethane in order to inject it into their natural gas networks or to use it as fuel for gas-powered vehicles.

### 5 CONCLUSIONS

There are now 10 million gas driven vehicles operating mainly on CNG worldwide, whereas the use of biomethane as vehicle fuel is still relatively new. There are currently several non-technological barriers, gaps and challenges retarding the widespread use of biomethane and CNG in vehicles in Europe. Particularly for biomethane as a transport fuel there are unfavourable and/or inadequate policies, standards and regulations in most European countries.

Biomethane use for electricity generation is in most countries incentivised through the issue of green certificates and other tradable allowances, while no direct incentives exist for biomethane used as a transport fuel (with the exception of EU targets for biofuels and national laws ratifying these).

Other challenges to the market expansion of natural gas and biomethane are the chicken-and-egg problem of vehicle adoption and infrastructure build-up (the limited number of filling stations), and there are also issues with fleet operator attitudes, general unawareness and preferences towards alternatively fuelled vehicles (various studies have documented that private fleet operators are reluctant to adopt these vehicles for various

reasons, including perceived lower reliability, need for specific training of staff for their operation and maintenance, and the absence of an established second-hand market).

Another major market barrier to be overcome is political, convincing critics about the synergistic market effect of a mixed supply of natural gas and biomethane. Especially larger fleets along with heavy vehicles and municipal services and utilities should be addressed in the near future as there is a great and unused potential.

This paper analyzes the many aspects related to the development of biomethane for transport in Italy such as the current status of biogas production in Italy, the potential for further biogas production until 2020, upgrading potential of biogas for transport use and injection into the national grid.

This paper provides an overview of the current Italian context for biomethane production, and illustrates the role and the contribution that biomethane could play in the framework of the National Renewable Energy Action Plan (now under development), to help meet the mandatory target of 20% renewables and 10% alternative fuels in transports by 2020 as demanded by the EC regulation 28/2009.

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