Biomethane as a substitute for Natural Gas

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ABSTRACT

The world's energy consumption keeps its tendency to increase, and the natural gas stands out as one of fuels where this trend is more significant. The environmental benefits in the use of natural gas in certain other fossil fuels, as well as the economic reasons justify this same increase. However, as with any other form of fossil energy, reserves of natural gas have a finite life, which calls into question whether the security of supplies and energy independence.

The biomethane is obtained by biomass, and it's in everything is similar to natural gas, with the advantage of being a product from renewable sources, and can replace natural gas in all its various applications. The biomethane could play an important role either in the possibility of reducing energy dependence, or as a factor in reducing emissions of greenhouse gases, existing in Europe a high potential for its production and use. In this work, will be assessed the potential of producing biomethane through the quantification of available biomass.

Keywords: Biomethane, natural gas, potential.

1 INTRODUCTION

World consumption of energy has been observing an annual growth of around 2.5%, to highlight the year 2005 as the year with greater increase over the previous period (3%). In 2008 the increase in consumption was approximately 1.72%, corresponding to a total of 11 billion toe. The EU was responsible for 15.3% of consumption with a total of about 1 700 Mtoe's (Graf 1).

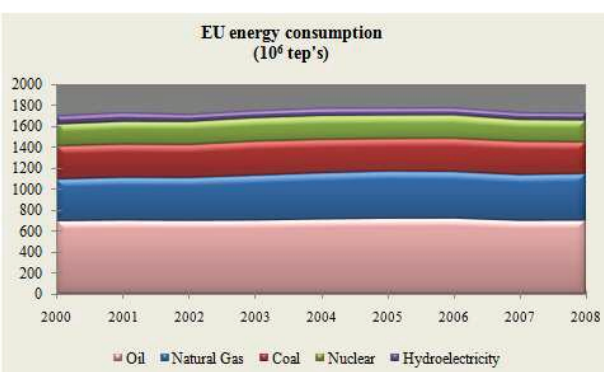

Figure 1 – EU energy consumption [1].

The increase in consumption in the EU is much less significant than its global growth, revealing, for the period under study, an average increase of 0.19% per annum.

The years of 2007 and 2008 show a decrease in consumption, respectively, 2.3 and 0.23% compared to previous years.

The trends of fuel consumption (Graf 2) show negative trends in terms of consumption of coal and nuclear power respectively, - 0.54 and -0.04% per year.

The oil consumption show positive values with an average of 0.11% per year, having recorded a significant drop between 2004 and 2007.

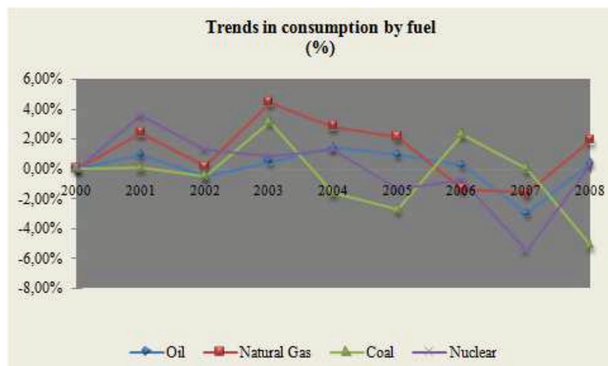

Figure 2 – Trends in consumption by fuel.

Natural gas is the fuel that has a higher increase in consumption, with an average increase per year of 1.37% and an increase between 2000 and 2008 was 11%.

The natural gas consumption in the EU in 2008 was 441 Mtoe, and the UK, Germany and Italy stand out as the biggest consumers, with respectively 84.5, 73.8 and 69.9 Mtoe (Graf 3).

As shown by the analysis of Graf 3, the general trend in several EU countries is the increase in consumption of natural gas. The high oil prices, along with the environmental benefits of natural gas reasons this is happening even increase.

The increased consumption of natural gas, despite the undeniable environmental benefits when it replaces other forms of fossil energy, also leads to a dependence on energy and the same problem of security of supply. The natural gas reserves are estimated [2] in about 64 years, and although it represents a lifetime much greater than estimated for the petroleum, is also a form of finite energy.

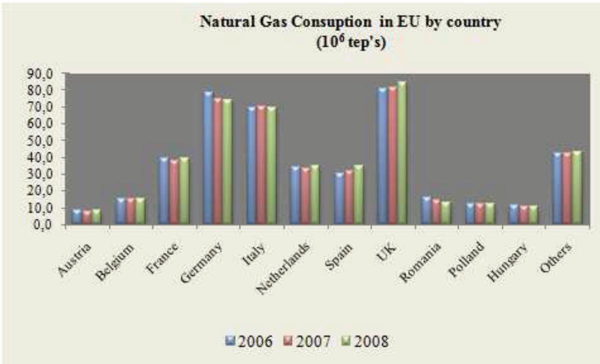

Figure 3 – Natural gas consumption in EU by country.

2 BIOMETHANE

The biomethane (Substitute Natural Gas, Natural Gas Resources not Conventional - GNRNC), is a gas produced by biomass, that is able to meet the specifications of natural gas. For this reason, it can be transported by the existing infrastructure, replacing natural gas in all applications.

A natural gas market competitive and free, allows a greater ease of injection of biometano in natural gas networks, allowing access to all individuals to enjoy a source of clean energy. If there is a European production of biomethane, that production will reduce energy dependence, and allow security of supply, a key objective of EU.

Their possible participation in order to decrease greenhouse gas emissions is also significant. Since this is a biofuels (obtained from renewable sources) is regarded as neutral with respect to CO2 emissions.

Biomethane, can be used in vehicles, applying domestic, industrial application, or (as with natural gas) be used in the production of electricity and heat.

The biomethane, is well appreciated, both by the possibility of a reduction in energy dependence, either as a relevant factor in the reduction of emissions of greenhouse gases.

Table 1 – Typical Composition of Syngas and Biogas, and their calorific values.

Parameters	Syngas[3]		Biogas[4]
	Initial Characteristics	After methanisation	
CH_4 (% vol.)	1,7	54,8	65
CO_2 (% vol.)	7,3	43,3	35
CO (% vol.)	37,2	0,2	--
H_2 (% vol.)	50,2	1,6	--
H2S (ppm)	--	-	<500
LHV (MJ/Nm3)	10,769	19,814	23,0

Biomethane is obtained through two gases: biogas and syngas. Biogas, in is turn is obtained by anaerobic digestion of waste, and its composition is mainly CH_4 and CO_2 (Table 1). The upgrading to biomethane is done through the disposal of hazardous compounds and the removal of carbon dioxide.

The syngas, which is obtained by gasification of solid biomass waste, is upgraded to biomethane by the increasing on the content of methane, since the initial gas has low levels of methane, and CO and H2 with high concentration (Table 1), so being reformed into methane with catalyst, aware of what happens into the biogas, by the removal of carbon dioxide present.

Raw materials, biomass, used in the production of both gases are measured in Graf 4. The values are obtained in base of production data in 2000 and trends of increase.

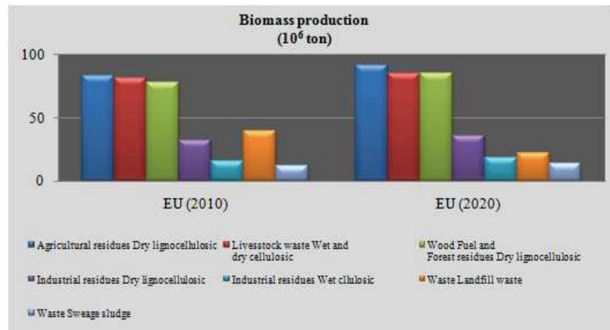

Figure 4 – Biomass production in EU in 2000, and estimated production in the years 2010 and 2020 [2].

Considering the values of Graf 4, and the ratios of conversion indicated in Table 2, we can calculate the potential for producing syngas and biogas for the years 2010 and 2020.

Table 2– Sector, resource and description of biomass and conversion ratios

Sector	Resource	Description	Conversion technologies	Conversion ratios (m^3/tones)
Agriculture	Agricultural residues	Dry lignocellulosic	Gasificaction	1 560[5]
	Livestock waste	Wet cellulosic	Digestion	20[7]
		Dry lignocellulosic	Gasificaction	1 560[5]
	Energy crops	Dry lignocellulosic	Gasificaction	1 560[5]
Forestry	Wood fuel	Dry lignocellulosic	Gasificaction	1 560[5]
	Forest residues	Dry lignocellulosic	Gasificaction	1 560[5]
Industry	Industrial residues and waste	Dry lignocellulosic	Gasificaction	1 560[5]
		Wet cellulosic	Digestion	400[6]
		Landfill waste	Digestion	450[6]
		Sweage sludge	Digestion	400[6]

Biogas has a conversion ratio of 65% [7] in biomethane and Syngas of 22% [3]. Thus, based on the values of Table 1 and in the quantities of biomass produced in each sector and each technology (Graf 4), we can estimated the production potential of biomethane in Europe in the years 2010 and 2020 (Table 3).

Table 3 – Potential production of biomethane in Europe in 2010 and 2020.

		Potential ($10^9 Nm^3$)	Efficiency (%)	LHV (MJ/Nm^3)	Potential Biomethane	
					10^9MJ	10^6tep
2010	Biogas	31	65%	23	458	10,942
	Syngas	303	22%	11	718	17,137
				Total	1.176	28,080
2020	Biogas	25	65%	23	373	8,910
	Syngas	330	22%	11	783	18,695
				Total	1.156	27,605

3 CONCLUSIONS

Europe, has a high dependence on energy this situation is not sustainable, either for environmental or security of supply and even economically. Thus arises the need for sustainable alternatives, by taking measures and policies for energy. The biomethane is part of the measures and policies adopted and proved to be a solution that can have a major contribution in reducing the consumption of fossil fuels and to replace these sources of renewable energy.

Europe has a high potential for biomass production, which should be explored. By quantifying the biomass, which can be converted into biomethane, was reached a potential of 1.176 billion MJ (28 million toe) for 2001's and 1.156 billion MJ (27, 6 million toe) in 2020's of biomethane. The value is a theoretical value, being impractical, for logistical and economic reasons, the exploitation of all biomass quantified, however the value obtained reflects the high potential level.

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