

Supply and utilisation of biogas and natural gas in the Mazowieckie voivodeship region, POLAND

- An overview of the present situation, norms & legislation and available vehicles

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Introduction

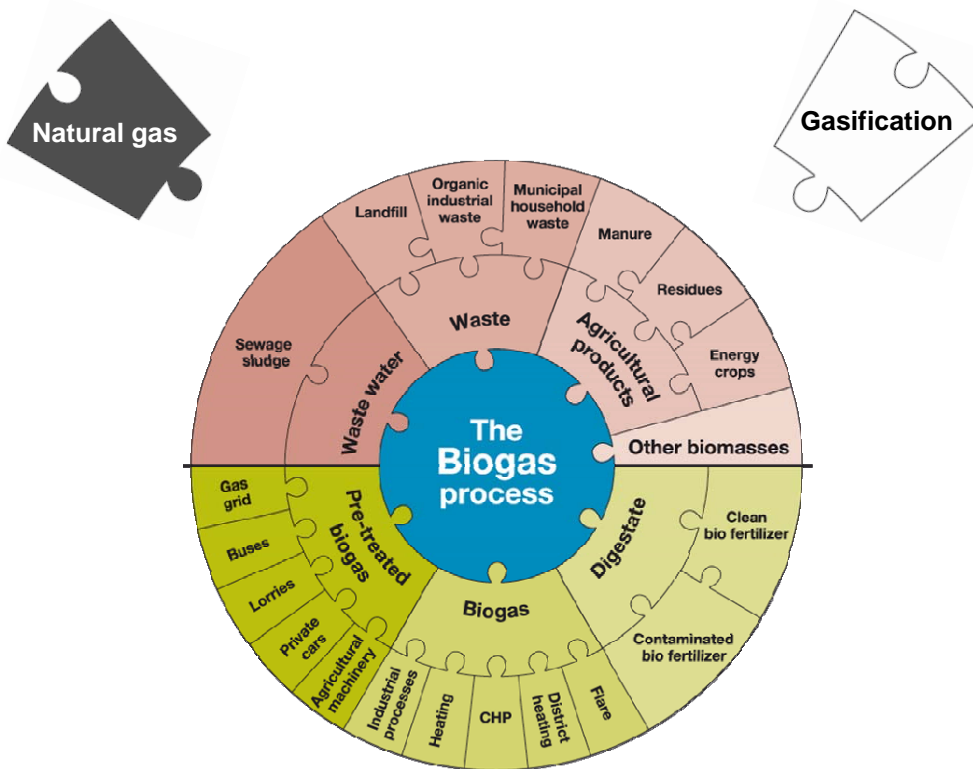
Biogas and natural gas are very clean energy sources, due to lower amount of particles, NO_x, CO etc. than most other fuels. Biogas is also a renewable fuel. If petrol or diesel are replaced with biogas produced from manure, the CO₂ emissions can be reduced by up to 180% . The MADEGASCAR project aims to improve the framework conditions for a growing market for gas driven cars and light transport vehicles and also to increase the supply of biogas and natural gas for these vehicles.

To expand the market for supply and use of gas as a fuel for vehicles it is of high importance to understand the present situation of use and supply of natural gas. This text sums up the present situation of supply, treatment & distribution and the final use of biogas and natural gas in the region.

Chapter summarises presents legal environment -norms and legislation around biogas production plants, distribution of biogas and natural gas, and the use of gas in vehicles. The current management control measures that are used in the region to support gas vehicles are also summed up in this chapter.

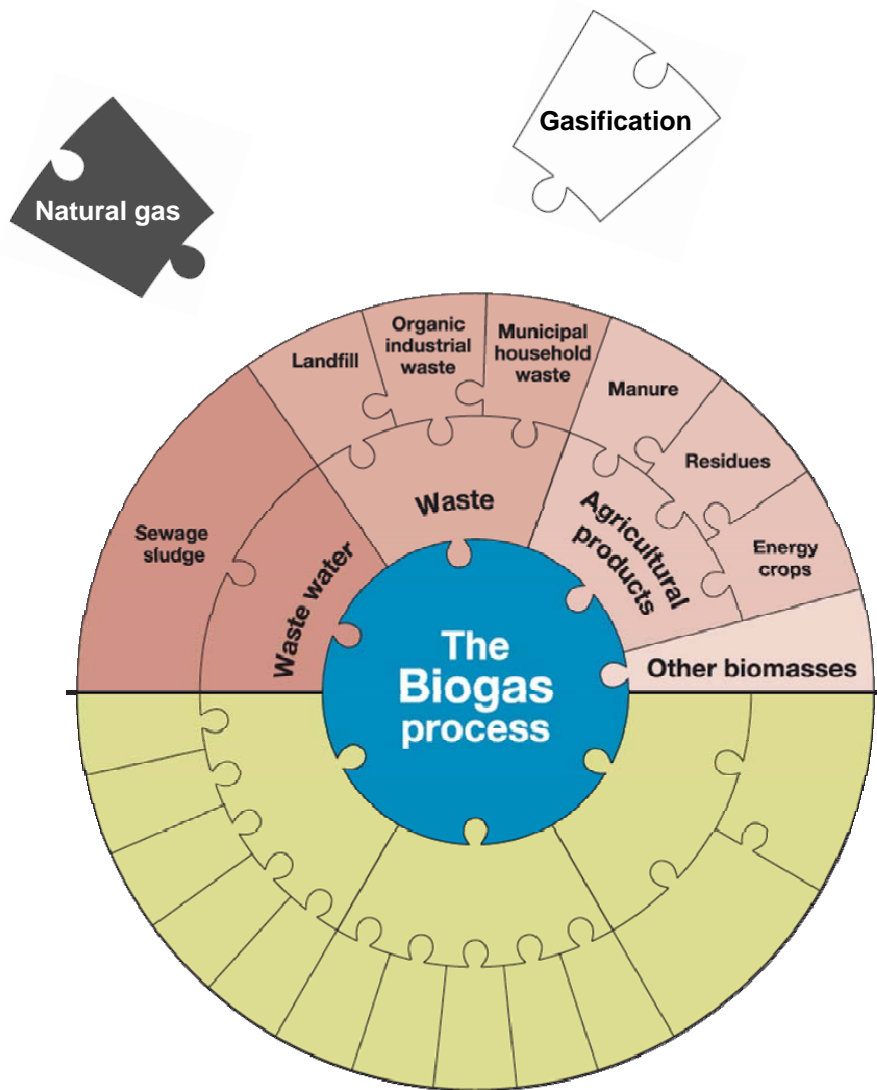
The use of LPG as vehicle fuel is also of interest for the MADEGASCAR project because of the possibility to convert these vehicles to methane.

This text also contains an overview of the range of available gas driven personal cars and light transport vehicles in the region.



Supply

This section handles the present supply situation of biogas, natural gas and bio methane (gasification) in the region.



Biogas production plants

Background

The potential of biogas production in Poland is significant. Abundant potential sources of biomass exist, from dedicated crops and agricultural residues to organic industrial and urban waste. To date, this potential has been under-exploited, mainly due to low awareness of renewable energy in general, the absence of a legal framework for optimal biogas production and use, and also lack of financial support incentives.

In Poland, biogas from landfills and wastewater treatment plants is mostly flared. If biogas is retrieved, it is usually used to produce electric and thermal energy. Electrical energy gained from landfills: 113,7 GWh/year, from wastewater treatment plants: 79,5 GWh/year

Three agricultural biogas plants are operating in Poland. The oldest is "Pawłówko" (completed in 2005), followed by a "Płaszcyca" and "Kujanki". All biogas plants are operated by a big Danish meat producer POLDANOR S.A. The company has got plans to build 9 more within the next few years, however, it depends on public subsidies. Substrates for fermentation are livestock wastes, glycerine, slaughter wastes and corn silage depending on the plant and availability. Substrates are dosed manually without fixed proportion. In Pawłówko, Płaszcyca biogas is used for cogeneration and power introduced to gas grid. Different situation occurs in the "Kujanki" biogas plant - biogas is used to only for heating of farm buildings. Total energy production from agricultural biogas plants: 2,1 GWh/year

Parameters of agricultural biogas plants:

Pawłówko- substrates are: manure, glycerine, slaughterwater wastes, corn silage. Installation has got hygieniser for treatment slaughterwater wastes.

Power: 730kW_{el}

Heat: 818kW_{th}

Płaszcyca - main substrates:livestock manure and glycerine. Process is carried solely on lagunes. First one operate as pre tank, second degester, following 3 are proper lagunes.

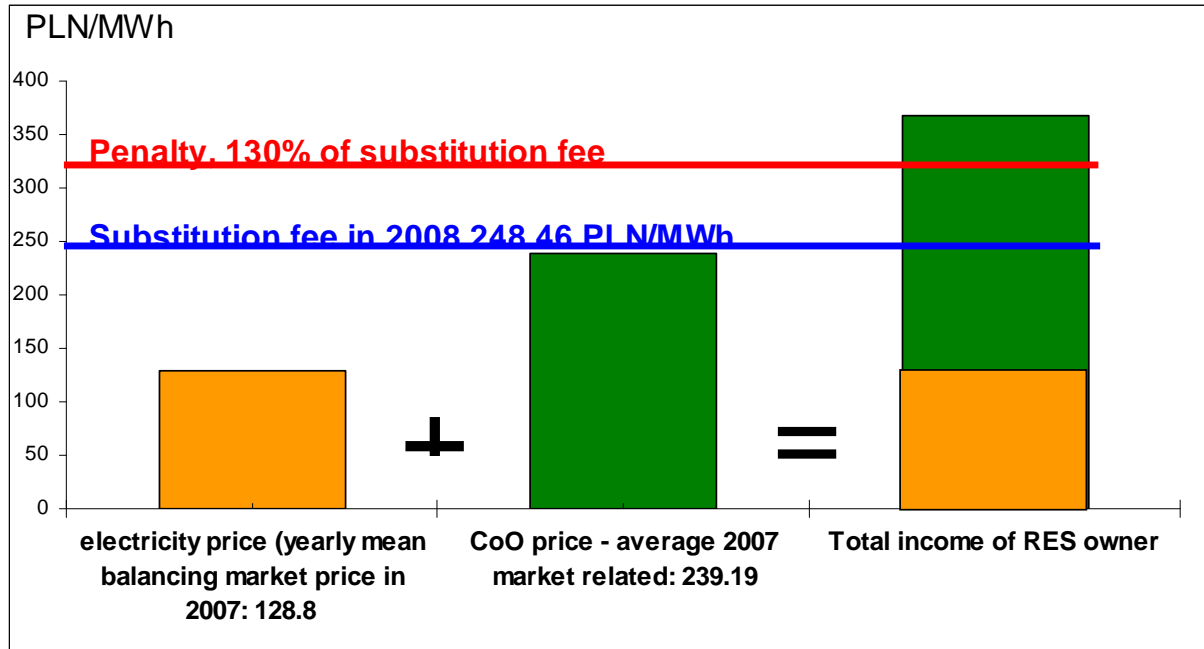
Power: 625kW_{el}

Heat: 7350 kW_{th}

Kujanki- main substrates are manure and glycerine. Solely heat for heating farm building is produced (cogeneration planned)

Heat: 320kW_{th}

The company receives “green certificates” for energy fed to the grid. The certificates are sold, which makes additional profits.



Biogas could be also be produced from sludge and wastewater treatment plants, organic parts of urban wastes, industrial effluents and wastes from livestock. The main production of biogas comes from degassing dumps of urban wastes and from wastewater treatment plants.

Present situation¹

Waste Water (sewage gas)

- 79.5 GWh in total biogas production at waste water plants

Agricultural products

- 3 biogas plants
- 2.1 GWh per year

Landfills

- 168 with storage system of biogas
- 9 landfills where biogas is flared
- 32 installations with biogas energy production
- 113.6 GWh in total production per year

Future perspectives

- Improvement of efficiency of biogas production
- Development of substrates to optimise digestion process
- Development of systems for the injection of the biogas in the natural gas grid
- Improvement of efficiency of engines
- Implementation of policy supported by country “biogas plant in every village”, which supports the idea to establish one agro biogas plant in every agricultural living area.

¹ Nationwide data

Bio methane (gasification)

Background

In Poland we use English phrase “gasification” for producing synthesis gas out of wood, wood chips and similar biological fuels.

Biomass pyrolytic gasifier – gas from gasification process is used for thermal energy production. Heat could be used for drying wood, crops or crops. In Poland biomass pyrolytic gasifiers are used to dry wood in wood industry and agriculture (crops drying).

Present situation

74 biomass pyrolytic gasifiers have been implemented. Main producers are Grupa Majchrzaka (68 implementations) and ZAMER (6 implementations).

Future perspectives

- Research for cogeneration heat and power for industry – expected maximum power of installation is 100MWe
- Research on micro cogeneration (heat and power production)

Research on removal of dust from condensation of hydrocarbons (wood tar)

Natural gas

Background

Natural gas widely used in Poland by industry and final customers. 60% of natural gas is imported from Russian Federation. 10% is imported from Turkmenistan, Uzbekistan and Germany. Total import is 9.3 milliards m³ Only 30% is produced in Poland (4.3 milliards m³).

Present situation (2007)

- 2 gas companies delivers natural gas within the region
- The Energy value of the gas is 10.5 kWh per Nm³
- The total number of costumers in the region is 1 094,000
- The amount of sold/used gas is ~12,557 mln m³

Use of natural gas in Mazowieckie voivodeship[TJ]

Total use - 90,515

Power plants - 642

Thermal power stations - 1,115

Refineries - 28,987

Industry and building industry - 13,520

Transport - 12,688

Small companies sector - 33,563

Households - 25,180

Other - 8,383²

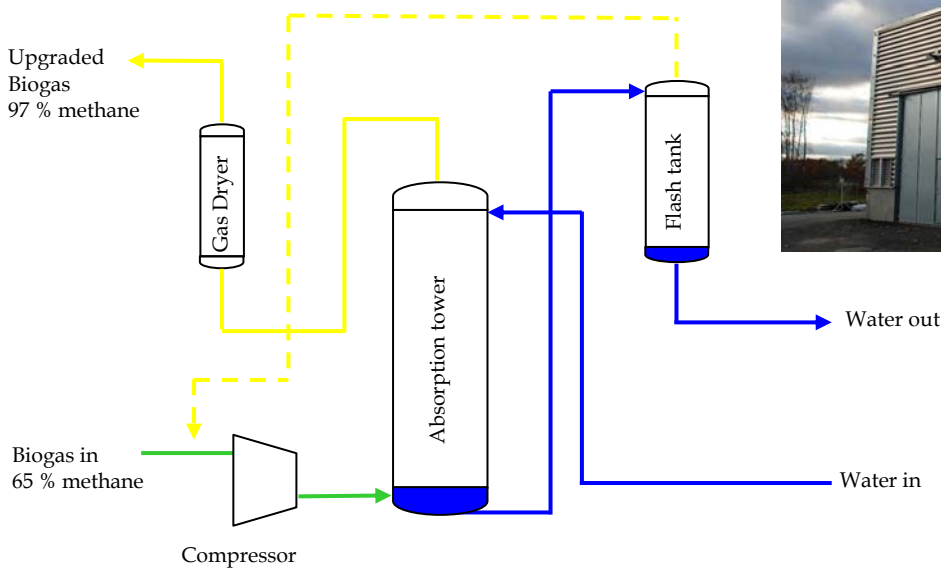
Future perspectives

- The government plans to build a seaport in Szczecin, which would be used to import LNG. Costs are estimated at 350 million euro, however, investments are in the planning phase.

² http://www.stat.gov.pl/cps/rde/xbcr/gus/PUBL_pbi_zuzycie_paliw_nosnikow_energii_2007.pdf

Treatment and distribution

This section handles the present situation of biogas treatment plants and distribution systems for biogas and natural gas in the region. The number of gas fuelling stations will also be found in this section.



Treatment of biogas (upgrading)

Background

Could be approached in different ways:

- injection of bio methane into natural gas grid
- filling stations next to biogas plants or transport to filling stations by tank lorries

No biogas upgrading plants are so far available in Poland

Present situation

Upgrading plants unavailable

Future perspectives

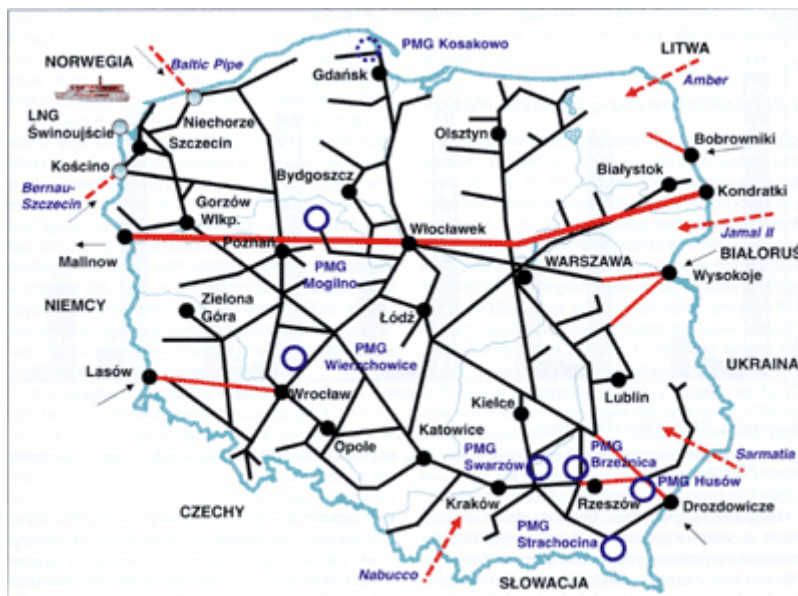
Identification best locations for biogas plants – possibly closest to natural gas grid or regions with significant share of NGV's

Gas grid

Background

Poland imports natural gas from Russia (67%), Central Asia - Turkmenistan and Uzbekistan (24.6%) and Germany (8.4%). On the territory Mazowieckie viovodeship the Mazovian Gas Distributing Company operates the grid. The Mazovian Gas Distribution Company is owned by PGNiG. PGNiG is an umbrella organization which controls 98% of the natural gas market.

The grid is can be described in the following 2 categories:
 -the gas quality (high vs. low energy content): H-gas, L-gas
 - he pressure level: high, medium, or low pressure grid



Graph: National Gas Grid system in Poland

Present situation

Poland is an important transit country of natural gas, which is distributed from Jamal peninsula to Germany and other EU countries. The total length of pipelines is over 4,000 kilometers (Polish section has length of 682km). Two companies deliver gas in the Mazowieckie region: PGNiG Capital Group and CP Energia.

Future perspectives

- Local gas grids should be established in order to diversify the energy supplies

Non grid transportation

Background

Existing filling stations are connected to the national gas grid. Natural gas is transported by national gas grid, however, one company delivers also LNG (CP Energia).

Present situation

1 company delivers LNG to final customers

Future perspectives

Expand of LNG transported by lorries is expected at remote areas where gas grid is unavailable.

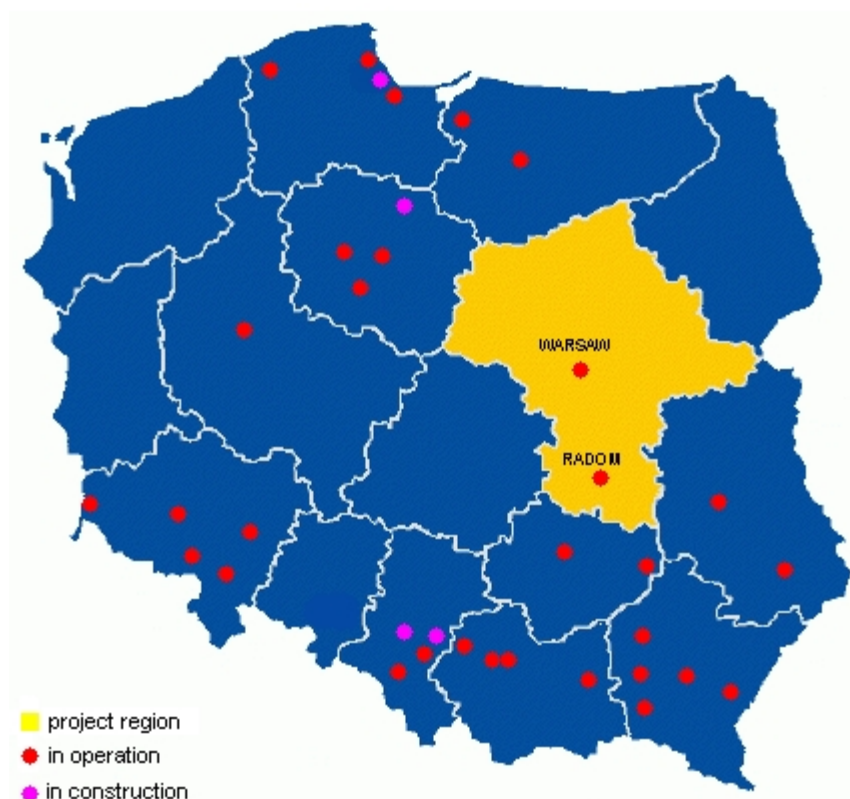
Gas filling stations

Background

Very initial phase of gas filling stations infrastructure. Only two public gas filling stations in Mazowieckie voivodeship are available (Warsaw and Radom). CNG filling station in Warsaw has got 6 fast filling points. It is stand alone station. Main users are fleet cars and taxis (around 200). It is open from 6AM to 10PM 7 days per week. Unfortunately only cash is accepted.

CNG filling station in Radom has got one distributor integrated with standard diesel/petrol station. Station is open 24 hours per day, 7 days per week. Only cash is accepted. Main users are private cars.

Last station is for non-public use owned by Municipal Bus Fleet Company of Radom. In Poland there are thirty CNG filling station in total. Most of them are located in the south-east of Poland – Podkarpackie and Małopolskie voivodeship.



Present situation

- 2 private gas filling stations in the Mazowieckie region
- 0 filling stations are provided with 100% biogas.
- 0 home filling stations

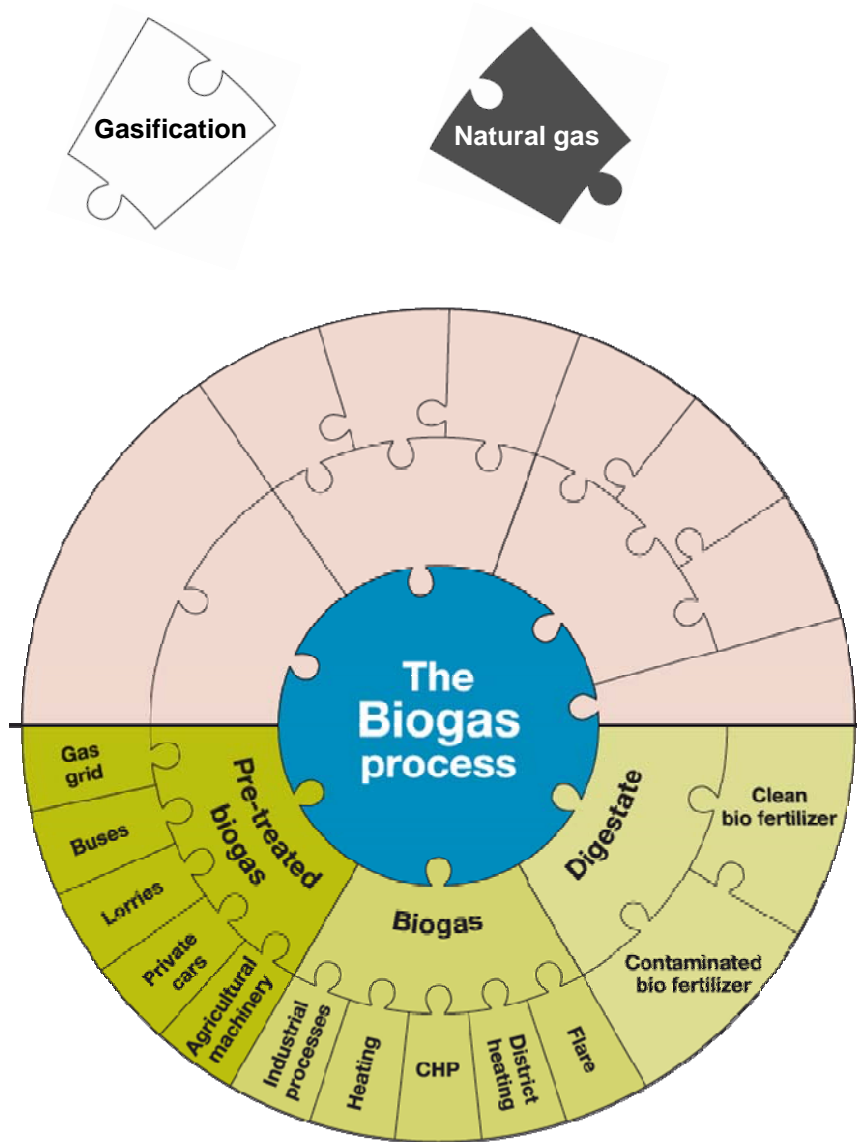
Future perspectives

Activities planned in the near future:

- The Mazovian Gas Distributing Company is planning to move its gas filling station in Warsaw from Kasprzeka St. to Prądzyńskiego St., however, it has been in the project phase for around 3 years- currently all building permits are ready.
- Within the MADEGASCAR project envisaged to promote NGV cars, the use of home filling stations, and feeding of bio methane into local gas grid has been planned. Due to low petrol and oil prices (prices in 2008 dropped around 30% in comparison to 2007) goals would be connected to infrastructure development would be hard to achieve.
- 2 petrol filling stations Łukoil and Shell declared to increase number of stations which would offered CNG besides of diesel and petrol.

Utilisation of biogas and natural gas

This section sums the use of biogas and natural gas in the region. The focus lays on use of gas for vehicles, but the use in fixed applications as heating and CHP will also be ventilated to get a better overview of the entire gas market.



Utilisation of upgraded biogas and natural gas in vehicles

Background

The biggest CNG fleet in Warsaw belongs to WAWA TAXI (around 160 cars). It is so far the only CNG taxi fleet in Warsaw. Wawa Taxi has been present on the market for 15 years in Warsaw, for some 4 years it has been using CNG vehicles – Seat Altea and Seat Altea XL, Seat Toledo. Wawa Taxi co-operates closely with SEAT, so all taxi cars are provided and serviced by SEAT. Total number of vehicles driven under WAWA TAXI brand are 500, now 160 cars are fueled by CNG. All CNG installations are assembled by SEAT and provided as brand new cars. In the future the company is planning to buy solely cars fueled by CNG. All SEATs are dual-fuel cars: CNG-petrol.

Besides of WAWA taxi drivers, some taxi drivers with their own cars use CNG as fuel. Popular car is Mercedes E class (engine version NGT). Furthermore, some trucks owned by Dar Natury a company, which produce and deliver mineral water to consumers in prefilled containers. Most of personal cars fuelled by CNG are from re-sales and private import.

Present situation

- ~ 220 personal cars in Mazowieckie voivodeship
- 26 buses
- ~10 heavy duty vehicles

Around 1,500 NGV's in Poland – most of them buses and fleet cars.

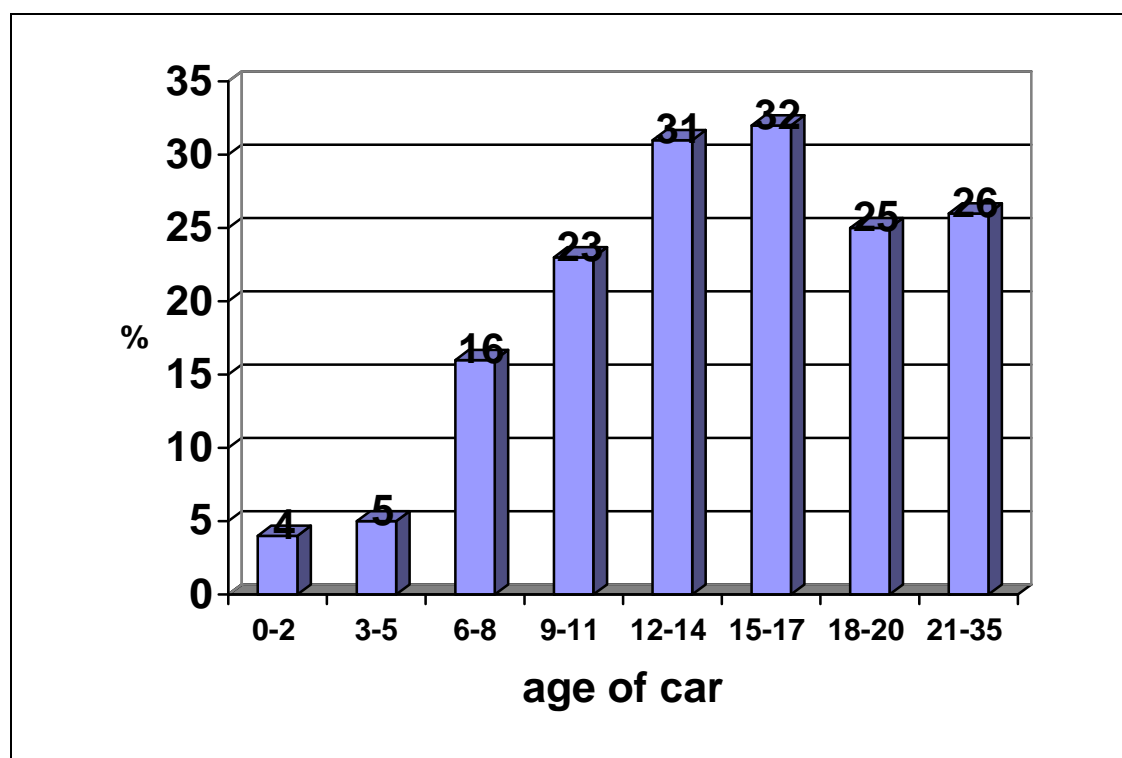
Future perspectives

The further development of CNG cars in Warsaw is hindered by the insufficient number of CNG filling stations. At least 2 new stations, located in different areas of the city would be enough to raise interest in this technology in both private consumers and car fleets. The only gas filling station in Warsaw is located at Kasprzaka Street owned by PGNiG. The filling station is located in the center of Warsaw- disadvantageous is difficult access due to traffic jams but cars coming from downtown areas can be fueled, which is an advantage. The further development is hampered by the lack of will to build other filling stations- the operator has a strategic plan but so far only in writing. So far there are plans to close the existing filling station and open up a new modern one on the other side of the same street.

LPG

Background

The LPG infrastructure is well developed within the region. Main oil companies offer LPG as well as oil and petrol their own stations. Well developed infrastructure and quite attractive price is in favor to LPG cars owners. Installations for new cars (multi-point injection) are expensive, thus brand new cars with mounted installations are not popular. Profits from LPG cars increases with mileage. LPG cars most profitable as fleet cars like taxi cabs and couriers.



Graph: Use of Liquid Petroleum Gas (%) in relation to age of car in 2007 (Source: Polish Organisation of Liquid Gas – Annual Report)

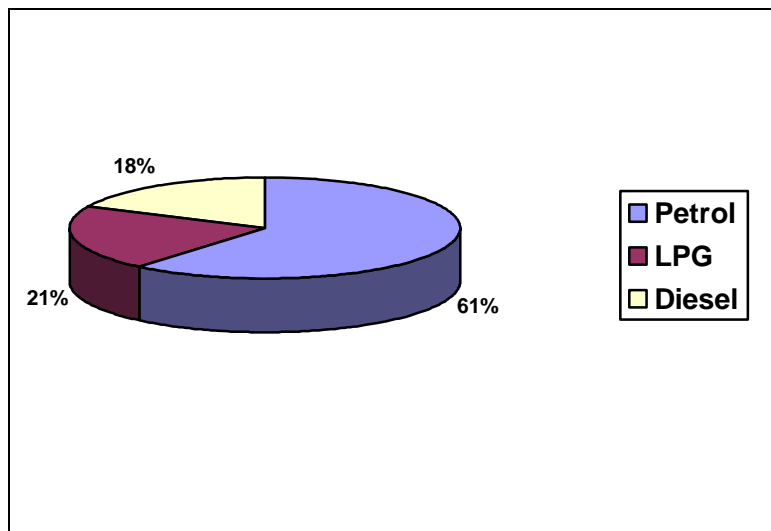
Present situation

Supply of LPG

- 1,050 filling stations for LPG in the region³

Utilisation of LPG

- 449,726 vehicles running on LPG in the region⁴
- 1,472.9 tons/year utilised



Graph: Percentage share of fuels in regards to private cars owners in 2007 (Source: Polish Organisation of Liquid Gas – Annual Report).

Future perspectives

- further perspectives strongly depend on excise duty on LPG and petrol/diesel: LPG price ratio
- smaller consumption of fuels of modern cars makes adaptation to LPG less profitable.

³ Polish LPG Association 2008

⁴ Central Statistical Office 2007

Norms and Legislation

Policy/Norm	Explanation
10 kwietnia 1997 Prawo energetyczne	Definition of RES and biogas
art. 13 ust. 1 pkt 2 lit. c ustawy z dnia 17 listopada 1984 r. o podatku rolnym	Tax relief for land tax payers for building biogas installations
rozporządzenie Ministra Środowiska z dnia 16 stycznia 2008 r. w sprawie szczegółowych warunków udzielania pomocy publicznej na przedsięwzięcia będące inwestycjami związanymi z odnawialnymi źródłami energii	States that government can subsidize investments for energy production from biogas
rozporządzenie Ministra Gospodarki, Pracy i Polityki Społecznej z dnia 30 maja 2003 r. w sprawie szczegółowego zakresu obowiązku zakupu energii elektrycznej i ciepła z odnawialnych źródeł energii oraz energii elektrycznej wytwarzanej w skojarzeniu z wytwarzaniem ciepła	Definition of biogas
rozporządzenie Ministra Środowiska z dnia 22 grudnia 2004 r	Definition of biogas
Dyrektywa 2001/77/EC w sprawie promocji na rynku wewnętrznym energii elektrycznej produkowanej z odnawialnych źródeł energii	Definition of RES, definition of biogas
Dyrektywa 2003/30/UE Parlamentu Europejskiego i Rady	Bio fuels promotion, definition of biogas
Dyrektywa Parlamentu Europejskiego i Rady 2003/54/WE	Rules of internal UE market
Rozporządzenie Ministra Rolnictwa i Gospodarki Żywnościowej z dnia 7 października 1997 r. w sprawie warunków technicznych, jakim powinny odpowiadać budowle rolnicze i ich usytuowanie	Definition of agricultural biogas plant
Rozporządzenie Ministra Środowiska z dnia 14 listopada 2007 r., w sprawie procesu odzysku R10	Definition of waste, norms of soil fertilization by sludge.
PN-C-04752:2002	Quality of natural gas in distribution grid
PN-C-04753:2002	Quality of gas provided to final customers

Utilisation of biogas and natural gas

Are there any control measures that are used to enhance the utilisation of biogas and natural gas for vehicles?

- Car owners who mounted CNG installation can get vouchers for CNG – local incentive. In Podkarpackie voivodeship local Gas Distribution Company enhance final customers to use CNG in that way.
- No excise duty for natural gas for transport use to 2013
- No excise duty for biogas

Available vehicles

Personal cars



Citroen Berlingo 1,4 Multispace

Cylinder capacity	1.360 ccm
Power	50KW (68 PS)
Fuel capacity CNG	14 kg
Fuel capacity petrol	55 l
Range CNG	220 km
Total Range	930 km
CO2 Emissions	146g/km



Citroen C3 STYYLE 1,4 bivalent

Cylinder capacity	1.360 ccm
Power	49 KW (67PS)
Fuel capacity CNG	9 kg
Fuel capacity petrol	45 l
Range CNG	180 km
Total Range	872 km
CO2 Emissions	146g/cm3



Fiat Multipla Bipower

Cylinder capacity	1.596 ccm
Power	68kW (92 PS)
Fuel capacity CNG	26,5 kg
Fuel capacity petrol	38 l
Range CNG	420 km
Total Range	840 km
CO2 Emissions	161 g/km



Fiat Doblo 1,6 16V Natural Power

Cylinder capacity	1.595 ccm
Power	68 kW (92 PS)
Fuel capacity CNG	22 kg
Fuel capacity petrol	60 l
Range CNG	350 km
Total Range	1000 km
CO2 Emissions	161 g/km



Fiat Panda Natural Power

Cylinder capacity	1.242 ccm
Power	38 kW (52 PS)
Fuel capacity CNG	13 kg
Fuel capacity petrol	30 l
Range CNG	300 km
Total Range	780 km
CO2 Emissions	114 g/km



Fiat Punto Natural Power

Cylinder capacity	1.242 ccm
Power	38kW (52 PS)
Fuel capacity CNG	11 kg
Fuel capacity petrol	47 l
Range CNG	250
Total Range	950
CO2 Emissions	119 g/km



Ford Focus CNG

Cylinder capacity	1.999 ccm
Power	93 kW (126 PS)
Fuel capacity CNG	18 kg
Fuel capacity petrol	55 l
Range CNG	300 km
Total Range	1070 km
CO2 Emissions	151 g/km



Mercedes - Benz E 200 NGT

Cylinder capacity	1.796 ccm
Power	120 kW (163 PS)
Fuel capacity CNG	18 kg
Fuel capacity petrol	62l
Range CNG	300
Total Range	1000
CO2 Emissions	168 g/km



Opel Combo 1,6 CNG monovalent plus

Cylinder capacity	1.598 ccm
Power	69 kW (92 PS)
Fuel capacity CNG	19 kg
Fuel capacity petrol	14 l
Range CNG	350 km
Total Range	515 km
CO2 Emissions	133g/km



Opel Zafira 1,6 CNG monovalent plus
 Cylinder capacity 1.598 ccm
 Power 69 kW (94PS)
 Fuel capacity CNG 21 kg
 Fuel capacity petrol 14l
 Range CNG 380 km
 Total Range 530 km
 CO2 Emissions 138 g/km



VW Caddy Life EcoFuel
 Cylinder capacity 1.984 ccm
 Power 80 kW (109 PS)
 Fuel capacity CNG 26 kg
 Fuel capacity petrol 13 l
 Range CNG 440 km
 Total Range 590 km
 CO2 Emissions 157 g/km



VW Touran EcoFuel
 Cylinder capacity 1.984 ccm
 Power 80 kW (109 PS)
 Fuel capacity CNG 18 kg
 Fuel capacity petrol 13 l
 Range CNG 310 km
 Total Range 440 km
 CO2 Emissions 155 g/km



VW Passat TSI Eco Fuel
 Cylinder capacity 1.400 ccm
 Power 110 kW (150 PS)
 Fuel capacity CNG 22 kg
 Fuel capacity petrol 31 l
 Range CNG 420 km
 Total Range 820 km
 CO2 Emissions ?

Light transport vehicles



Fiat Doblo Natural Power
 Cylinder capacity 1.596 ccm
 Power 68 kW (92 PS)
 Fuel capacity CNG 22 kg
 Fuel capacity petrol 30 l
 Range CNG 300 km
 Total Range 620 km
 CO2 Emissions 161 g/km

List of major fleet owners

Fleet owner name	Number of vehicles	Best description of fleet
WAWA Taxi	160	Warsaw domiciled company. Company plans are to increase number of CNG fuelled cars. Cars used: Seat Altea , Seat Altea XL and Seat Toledo - bivalent cars
Mazovian Gas Distribution Company (PGNiG Capital Group)	35	Peugeot, Renault and Fiat - bivalent cars
Municipal Bus fleet company in Radom	26	Municipal Buss fleet company. Plans for increasing total number of buses to 40. Solaris Urbino 12 CNG, Jelcz 120M CNG and Man NL313-15 CNG available.