

# **Supply and utilisation of biogas and natural gas in Berlin - Brandenburg**

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

Deliverable 2.2.11

Berliner Energieagentur GmbH  
Patrick Lamers

April 2008

## Summary of the present situation – facts & figures

### Supply

#### Biogas production - Germany

- Traditional focus: power production
- In 2007: > 3,700 biogas digestion plants with > 1,200 MW<sub>el</sub>
- In 2006: final energy production from
  - Biogas: 5,400 GWh
  - Landfill gas: 1,050 GWh
  - Sewage sludge gas: 888 GWh

#### Gasification - Germany

- no significant production loads yet

#### Natural gas

- Around 16 gas companies are registered with the local grid operator in Berlin-Brandenburg
- Around 5-6 offer the supply of natural gas currently in the region
- Energy value of the gas is around 11.06 kWh per Nm<sup>3</sup>
- The total number of costumers in the region exceeds 3 million
- The amount of sold/used gas in the region exceeds 23,000 GWh/a

### Treatment and distribution

#### Upgrading plants

- Around 10-14 expected to be up and running at the end of 2008 in Germany
- 3 planned in Brandenburg
- Used techniques are (pressure) water scrubbing and PSA
- Average upgrading capacity is around 500 Nm<sup>3</sup>/h

#### Local (biogas) grid

- No local biogas grid in the region yet
- Several examples in Germany exist

#### Natural gas grid

- High, medium, and low pressure grids
- Around 700 grid operators in the whole of Germany

#### Non Grid Transportation

- Only 1 filling station nationwide directly providing biogas produced onsite: Jameln (Lower Saxony)

- No plans for such usage in region yet
- Focus lies on injection into the natural gas grid

#### Gas filling stations

- 14 filling stations in Berlin, 42 in Brandenburg
- Market introduction of home re-fuelling stations planned for 2008

### Utilisation

#### Biogas & Natural gas in vehicles

- 54,000 NGV (incl. personal cars, buses, etc.) at the end of 2007 in Germany
- Berlin-Brandenburg accounts for more than 3,000 vehicles running on CNG: 68 million kWh of natural gas were sold in 2007 for transport use
- 2 locations offering biomethane for transport in Germany: Jameln (1), Munich (7 stations); none in the region yet

#### Biogas for non transport applications in 2006

- ~ 1 GW<sub>el</sub> installed CHP capacity
- 310-360 GWh heat production
- 4,170 GWh power generation

#### Natural gas for non transport applications

- 633.74 TWh in 2006
- Largest applications: Households & service sector (space heating), industry (process heat, CHP)

### LPG

#### Utilisation in vehicles

- LPG used as vehicle fuel in the region
- 34 LPG filling stations in Berlin, 118 in Brandenburg

### Available Vehicles (NGV) in Germany

- 18 available models of personal cars
- 9 available models of light transport vehicles

# Contents

<b>Summary of the present situation – facts &amp; figures .....</b>	<b>1</b>
<b>Introduction .....</b>	<b>3</b>
<b>Supply side .....</b>	<b>4</b>
Biogas production plants .....	5
Natural gas .....	7
<b>Treatment and distribution .....</b>	<b>8</b>
Biogas upgrading technology .....	8
Treatment of biogas (upgrading) .....	9
Gas grid .....	11
Non grid transportation / direct use .....	13
Gas filling stations .....	14
<b>Utilisation of biogas and natural gas .....</b>	<b>16</b>
Utilisation of upgraded biogas and natural gas in vehicles .....	17
Biogas for non transport applications .....	19
Natural gas for non transport applications .....	20
<b>LPG .....</b>	<b>22</b>
<b>Norms and Legislations .....</b>	<b>23</b>
Biogas production / usage .....	23
Natural gas transportation and connection .....	23
Transport .....	24
<b>Available vehicles .....</b>	<b>25</b>
Passenger cars and light transport vehicles .....	25

## Introduction

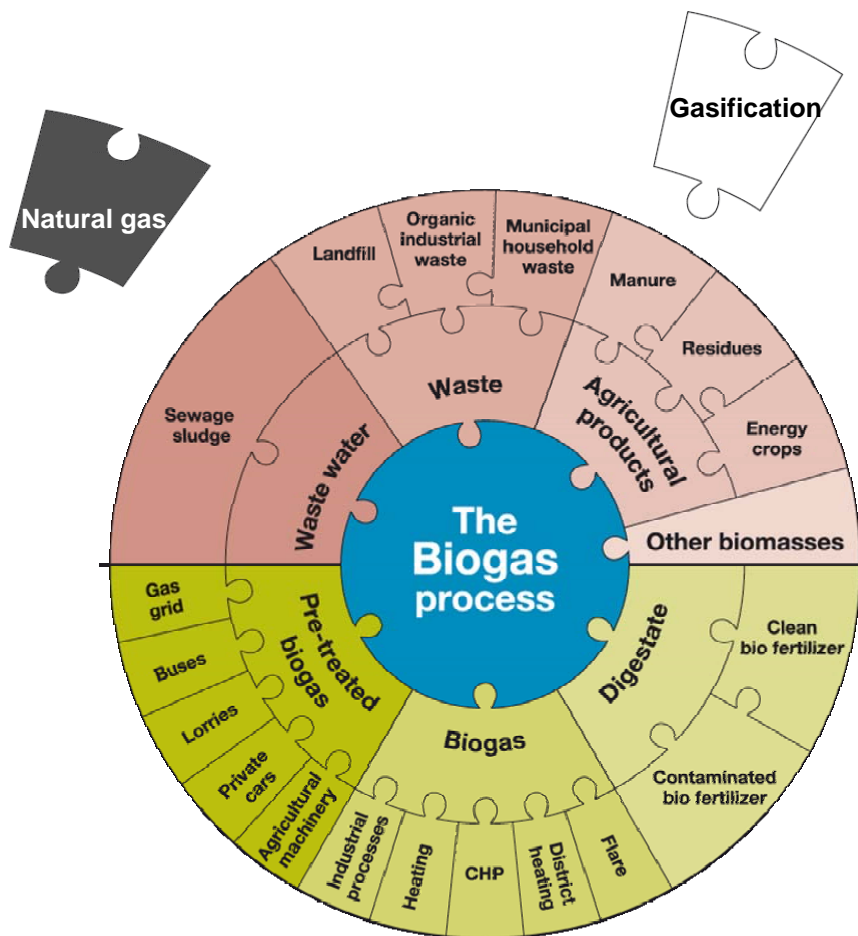
Biogas and natural gas are very clean energy sources, when combusted the amount of particles, NO<sub>x</sub>, CO etc are lower than most other fuels. Biogas is also a renewable fuel. If petrol or diesel is replaced with biogas produced from manure, the CO<sub>2</sub> emissions can be reduced with up to 180 %. The MADEGASCAR project aims at improving the conditions for a growing market for gas driven cars and light transport vehicles and also 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 gas. This text sums the present situation of supply, treatment & distribution and the final use of biogas and natural gas in the region.

One chapter deals with 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 in this chapter.

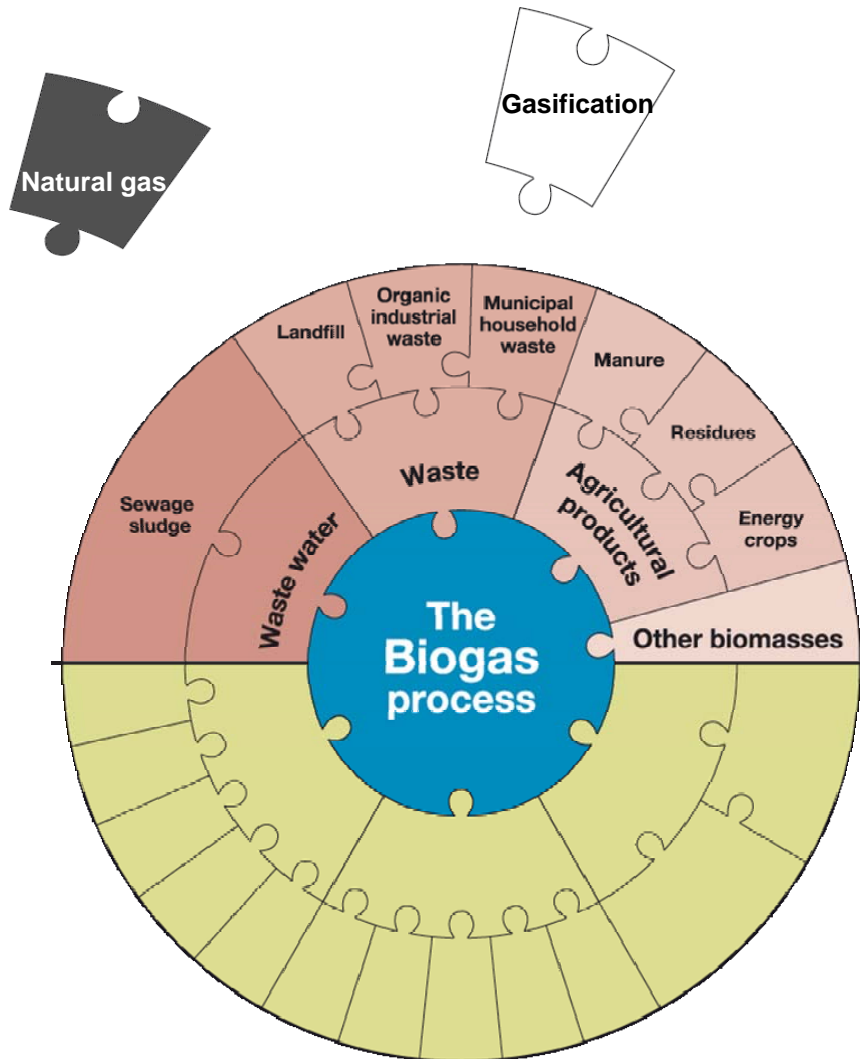
The use of LPG as vehicle fuel is also of interest for the MADEGASCAR project because of the possibility to convert these vehicles to propulsion with methane.

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



## Supply side

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



## Biogas production plants

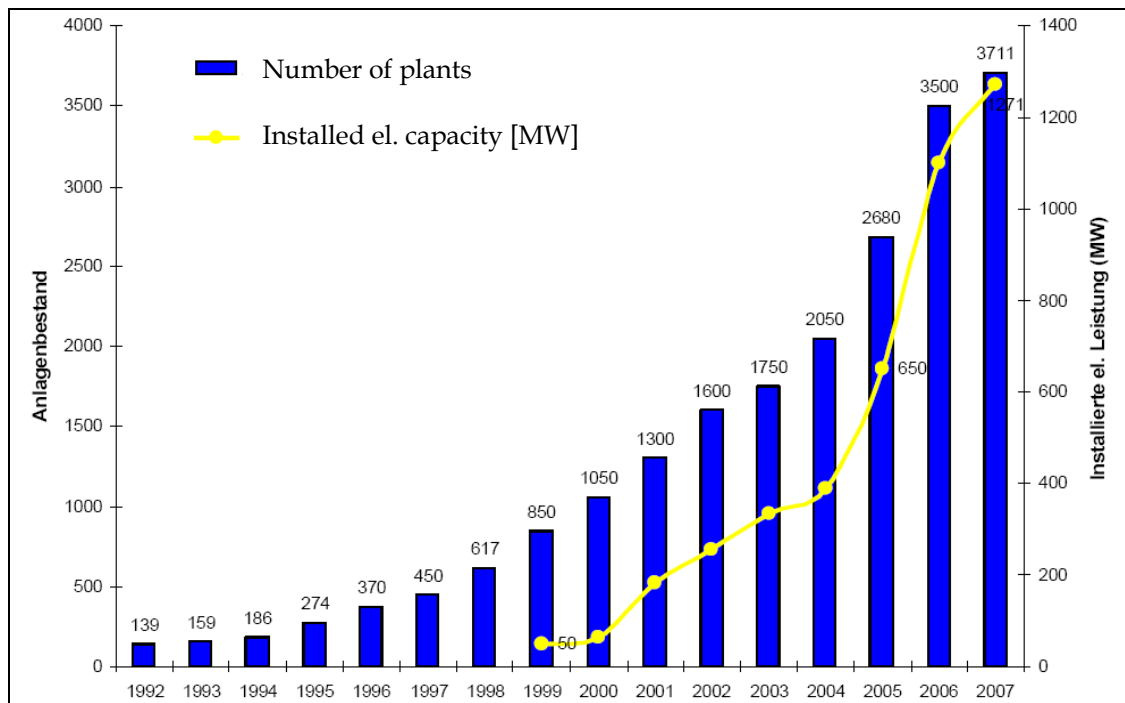
### Background

In the region of Berlin-Brandenburg, obviously all farm based biogas production plants from agricultural material are found in Brandenburg. A recent study, financed by the BGW & DVGW<sup>1</sup> estimated the technical biogas production potential in Germany to be around 70 million MWh (currently around 7 % of the total natural gas demand). While Brandenburg shows a potential of 4 million MWh – mainly based on farm residues, energy crops, and organic waste products; Berlin only has a potential of 0.194 million MWh – based on organic waste. As of March 2008, there were 118 biogas plants in Brandenburg with an installed capacity of 118.43 MW<sub>el</sub> and 141 MW<sub>th</sub>.<sup>2</sup>

The current biogas production in Brandenburg reflects the situation on national level. Through the framework of the renewable energy feed-in system (EEG)<sup>3</sup>, the production has so far been to burn the produced biogas directly onsite in CHP plants for the production of electricity. This way the biogas producers get a pre-defined amount of remuneration per kWh fed into the power grid (paid by the end consumer). Thus contributing to the cost balance of their biogas plant. Over the years the plants have increased significantly in size, hence raising their demand for feedstock. More than three quarter of all plants use a mixture of silage products and manure.

The focus in biogas production has not yet been on the usage of heat or on the upgrading of the biogas for the injection into the natural gas grid. This however is likely to change due to the upcoming amendment of the EEG in 2008. Current movements on national level show increasing interest for biomethane i.e. upgraded biogas injected into the natural gas grid. Also, there is strong interest to make use of organic and other waste (including sewage sludge) within the city boundaries of Berlin.

### Present German situation



Graph. Number of biogas plants and installed electrical capacity (Fachverband Biogas, 2007. [www.biogas.org](http://www.biogas.org))

<sup>1</sup> BGW & DVGW, 2007. Analyse und Bewertung der Nutzungsmöglichkeiten von Biomasse. Download: [http://www.wupperinst.org/de/projekte/proj/uploads/tx\\_wiprojekt/1110-report.pdf](http://www.wupperinst.org/de/projekte/proj/uploads/tx_wiprojekt/1110-report.pdf) [30.05.2008]

<sup>2</sup> ETI Brandenburg. Personal Communication in May 2008.

<sup>3</sup> Erneuerbare Energien Gesetz [Renewable Energy Law]. Put in place in 1991 (StrEG) and amended twice - in 2000 and 2004.

## Future perspectives

The techniques around farm based small, medium, and large sized biogas plants as well as waste water sludge are well proven. There is a critical need to raise the number of plants making use of the excess heat produced during power production – currently this share among all biogas plants is around 50 – 60 %.<sup>4</sup> This and other future perspectives are currently debated for the amendment of the EEG. At the moment, it seems that – among others – there will be the following amendments:

- Introduction of a bonus for the usage of manure to increase the share of manure in the biogas production process
- Introduction of a “positive list” for organic waste material from production processes
- Requirement for sustainable agricultural practice in the production of feedstock (e.g. crop rotation patterns) as well as the production of biogas (ceiling of digestate storage)
- Introduction of a bonus for the upgrading of biogas to biomethane
- Phase-out of various former boni to increase the necessity to make use of the excess heat produced during CHP for the economic efficiency of the biogas production
- Promotion of micro-biogas grids for the connection of biogas production facilities and larger end-users (CHP) where the heat could be used or fed into a district heating grid

---

<sup>4</sup> BMU, 2007. Erfahrungsbericht 2007 zum Erneuerbare Energien Gesetz (EEG). Download: <http://www.erneuerbare-energien.de/inhalt/40342/> [30.05.2008]

## Natural gas

### Background

Germany has been a large user of natural gas for a long time. Currently, natural is the largest share in the primary energy demand (as of 2006) – even (slightly) larger than crude oil. Since it is mainly used for space heating purposes in private households and process heat in industry, its share in the primary energy demand varies depending on the climatic conditions in the heating period from year to year.

### Present situation

Even though Germany exploits natural gas in several regions, around 84 % of the annual natural gas available is imported. Distracting the exported share of natural gas, the share of import rises up to 97 %. Main import countries are Norway, Russia, the Netherlands, Great Britain, Denmark and others.<sup>5</sup>

The local grid operator Netzverbund Berlin Brandenburg gas registered 16 different gas supply companies. Around 5-6 of those are actually offering the supply of natural gas currently in the region. The supplied natural gas has a high energetic value (H-Gas) of around 11.06 kWh per Nm<sup>3</sup>.

The total number of costumers in the region exceeds 3 million, and the overall amount of sold/used gas exceeds 23,000 GWh/year.<sup>6</sup>

### Future perspectives

Among others, the import dependency of Germany in regards to natural gas has pushed the debate for the replacement with biomethane. Since natural gas is mainly sold to private households, local gas supply companies are already looking into selling biomethane as an additional service. Also, the usage of natural gas combined with solar heating systems is promoted.

---

<sup>5</sup> AGEB, 2008. Erdgas in Deutschland 2007 – Erste Ergebnisse. Download: <http://www.bgw.de/files/Erdgas%20in%20Deutschland%202007.pdf> [30.05.2008]

<sup>6</sup> GASAG, 2008. Geschäftsbericht 2007. Available under: <http://www.gasag.de>

## Treatment and distribution

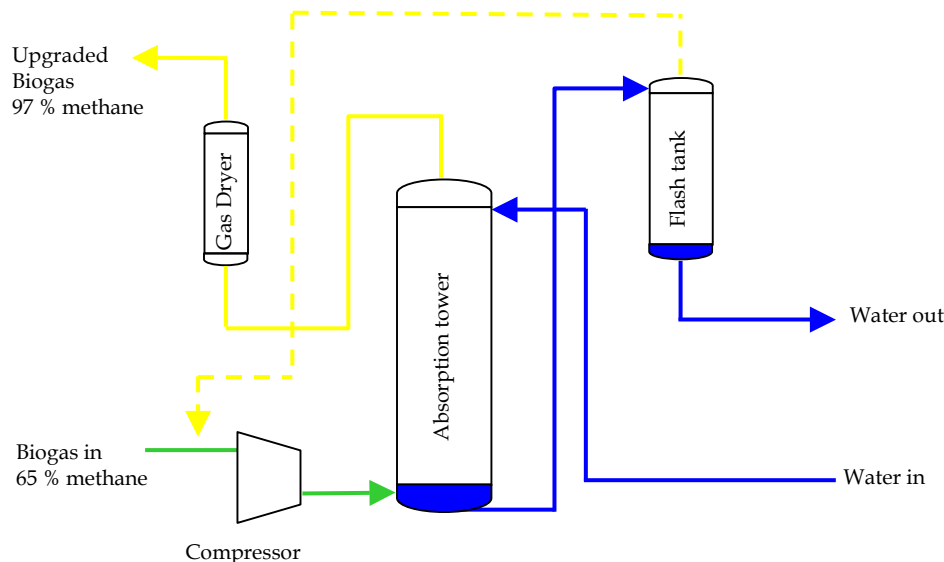
This section describes the present situation of biogas treatment technologies and distribution systems for biogas as well as natural gas in Germany. Also, the number of gas fuelling stations is listed in this section.

### Biogas upgrading technology

Several techniques are available in Germany for upgrading biogas to biomethane.<sup>7</sup> The two most common include:

1. Druckwechseladsorption: Pressure Swing Adsorption (PSA)
2. Druckwasserwäsche (DWW): Pressure water scrubbing (see picture)

Among the two, PSA is with around 50 % the most applied technology in Germany at the moment (see also table next page).



Graph: Layout pressure water scrubbing (DWW)

<sup>7</sup> For more information see: FNR & BMELV, 2006. Einspeisung von Biogas in das Erdgasnetz. Download: <http://www.fnr-server.de/cms35/Biogas.982.0.html> [30.05.2008]

## Treatment of biogas (upgrading)

### Background

The German government passed the Integrated Climate and Energy Program (ICEP) in December 2007 in which it states the goal to replace 6 % of the natural gas used in 2020 by biomethane, rising this share up to 10 % in 2030. The agricultural potential for the production of this share has been proven in several studies up-front.

Following this pathway a number of companies are currently investigating the German biogas market for the building of new biogas production facilities that include the upgrading step and finally the injection into the natural gas grid. The table below gives an indication of the current state.

6 % in 2020 will reflect an energy demand of around 60 million MWh. In order to supply this, it is estimated that around 1,200 - 1,600 plants of medium size will have to produce biogas specifically aimed at upgrading and injecting biomethane into the grid. This results in an increase of 120 plants per annum and a total of around 10-12 billion € investment volume - without the costs for grid connection.

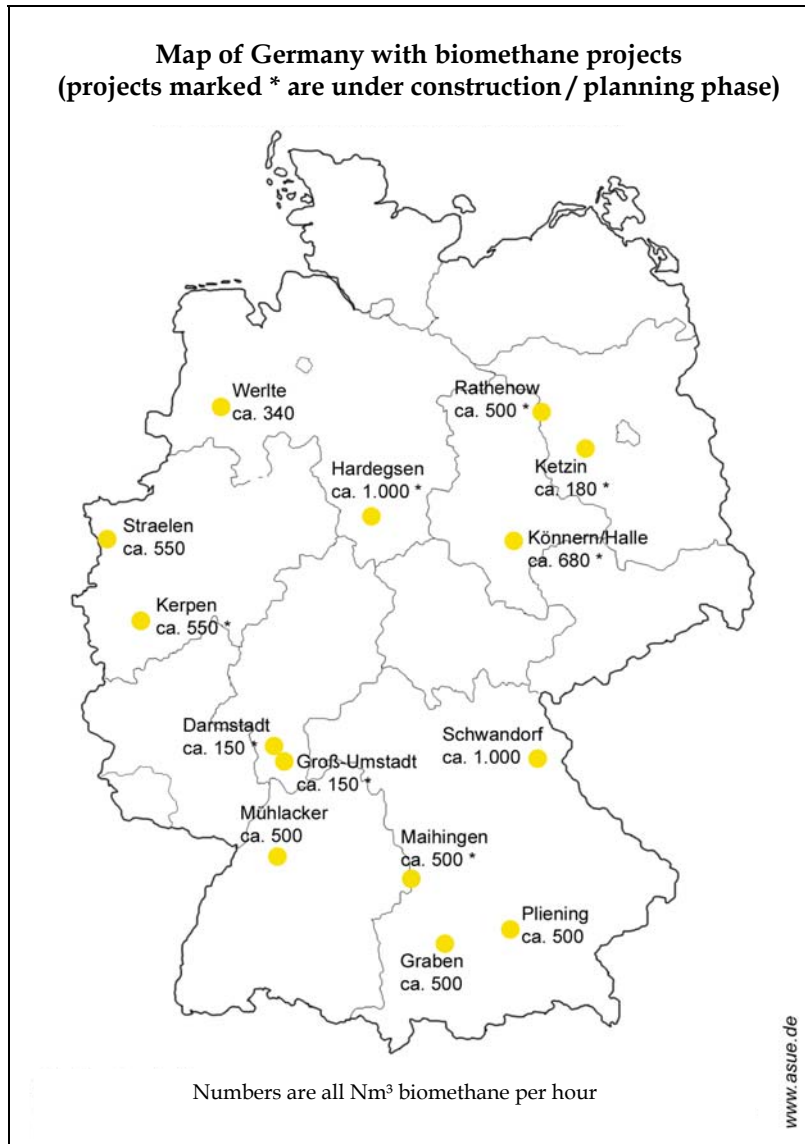
The biomethane is aimed to be used in buildings mainly - so far. However, in a notification in April 2008, the Federal German Ministry of the Environment, Nature Protection and Nuclear Safety strongly supports the promotion and usage of biomethane in NGV in order to fulfil the EU biofuels quota.

### Present situation

Table. List of biogas upgrading plants and project in Germany as of April 2008

	Location	Owner	Operator	Injection since	Raw material	Upgrading techn.
1	Jameln	RWG Jameln		12/05	Silage	Air-desorption
2	Pliening	Aufwind Schmack		12/06	Silage	PSA
3	Straelen	Stawag Energie GmbH	Stadtwerke Aachen	12/06	Silage	PSA
4	Werlte	EWE		08/07	Manure, slaughter waste	PSA
5	Mühlacker	Biomethananlage Mühlacker	n/a	12/07	Silage	PSA
6	Könnern	Agricapital		12/07	Silage	DWW
7	Schwandorf	Feldgas Energiezentrum	Schmack Energie Holding	02/08	Silage	PSA
8	Wixhausen / Darmstadt	HEAG		04/08	Silage, manure	DWW
9	Ketzin	Edis Natur			n/a	n/a
10	Elmenhorst	n/a	Gut Lanken		n/a	n/a
11	Burgfrieden	Bioenergie Laupheim		03/08	Silage	PSA
12	Graben / Augsburg	Biokraftwerk Lechfeld		04/08	Silage	PSA
13	Godenstedt Zeven	MT Energie		09/08	Silage	Amine-washing
14	Güstrow	IGB Nawaro Bioenergie		End of 2008	Silage	DWW
15	Passendorf / Köln	RWE Innogy		End of 2008	Silage	n/a
16	Jüterborg	Conergy		End of 2008	Silage	Amine-washing
17	Hardeggen	Hardeggen Energie C4	C4 Energie	03/09	Silage	n/a
18	Rathenow	GreenGas		05/09	Silage, manure	PSA
19	Borken	Borken Energie C4	C4 Energie	Middle of 2009	Silage	Amine-washing

The average upgrading capacity of the plants is around 500 Nm<sup>3</sup>/h. The only plant that significantly differs here is the one in Güstrow, which reaches an upgrading size of 5,750 Nm<sup>3</sup>/h.



Graph. Map of project locations for upgrading biogas in Germany as of April 2008 ([www.asue.de](http://www.asue.de))

### Future perspectives

The pilot plants have shown to run successfully, the commercial status of biogas upgrading is not reached yet. The amendment of the feed-in law will most likely support and boost the upgrading momentum in Germany. Also customer interest will further stimulate the market - comparably to the green power market. Biomethane is said to be twice as expensive as natural gas for gas supplying companies. The further development of the market will show how and if this price difference will / can be passed on to the consumers.

## Gas grid

### Background

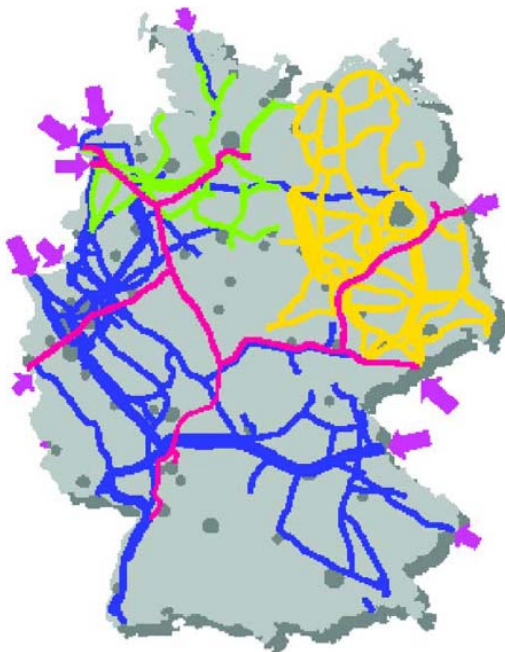
Situated in the heart of Europe, Germany is well integrated in the overall natural gas grid.



Graph: European map with gas distribution grid<sup>8</sup>

More than 700 natural gas grid operators exist in Germany. The grid can be distinguished between:

1. the gas quality (high vs. low energy content): H-gas, L-gas
2. the pressure level: high, medium, or low pressure grid



Graph: Long distance gas grid including injection points<sup>9</sup>

<sup>8</sup> IE Leipzig & Öko Institut, 2007. Möglichkeiten einer europäischen Biogaseinspeisungsstrategie. Download: [http://www.oeko.de/service/bio/dateien/ie2007biogas\\_osteuropa\\_teilbericht\\_1.pdf](http://www.oeko.de/service/bio/dateien/ie2007biogas_osteuropa_teilbericht_1.pdf)

<sup>9</sup> BMELV & FNR, 2006. Einspeisung von Biogas in das Erdgasnetz. Download: [http://www.fnr-server.de/ftp/pdf/literatur/pdf\\_211pdf\\_211\\_einspeisestudie\\_endfassung.pdf](http://www.fnr-server.de/ftp/pdf/literatur/pdf_211pdf_211_einspeisestudie_endfassung.pdf)

## Present situation

### Local Biogas grid

With the introduction of investment support through the market incentive program in 2008 for the set-up of local micro gas grids, more and more biogas producers are bundling their production and make use of micro grids for the transportation of the often cleaned but not upgraded biogas. The gas is burned in specifically located CHP blocks close or at district heating networks. This development however is only in a very early stage at the moment. More developments and an increase in local gas networks is expected after the amendment of the feed-in tariff law in 2009.

### Natural gas grid

The injection of biomethane into the natural gas grid in Germany was made possible by the amendment of the gas grid connection ordinance (Gasnetzzugangsverordnung – GasNZV). The GasNZV clearly outlines the responsibilities for the two parties of the biogas producer and the gas grid operator.

The main elements are:

- A requirement for connection
- 50/50 cost share for pipeline construction between biogas producer and network operator
- Biogas producer has to bare the costs for biogas production, cleaning and upgrading
- Network operator has to care for the maintenance of the grid connection including the pressure increase, measure and metering equipment as well as the odoring

## Future perspectives

The future perspectives will lie with the enforcement of the new GasNZV and the amendment of the feed-in tariff system. The political will for the market introduction of biogas into the natural gas grid is strong and the framework will be completely set until the end of 2008. Then it is up to the market to respond.

## Non grid transportation / direct use

### Present situation

The early mover in Germany regarding the usage of biogas as a vehicle fuel, RWG Jameln, set up a filling station on site. Around 10 % of the biogas produced is upgraded and used as vehicle fuel. The biomethane is offered at the same rate as compressed natural gas (CNG). 90 % of the biogas production is not upgraded but transported via a local / micro biogas grid to a nearby CHP block whose power production is fed into the electricity grid.

### Future perspectives

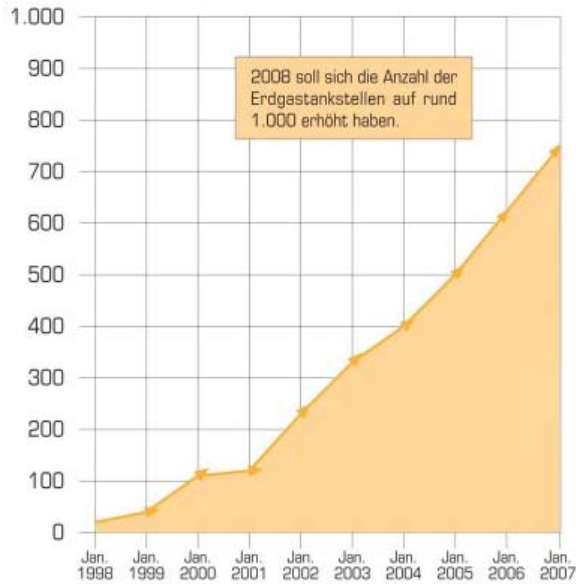
Making use of biogas as a vehicle fuel is not at an advanced stage in Germany. CNG and NGV are still only a niche market. With the new framework setting and the market incentive program (MAP), the amendment of the feed-in tariff system (EEG) and the policy package of the Integrated Climate and Energy Program (ICEP) this might change. Also the possibility to use biomethane in NGV as a share to reach the EU set biofuels quota in 2010 will act as a driver for a development of the market. However, as said before, it is far more likely that the upgraded biogas will be injected into the natural gas grid and not used directly onsite.

In the region of Berlin-Brandenburg, waste management companies are currently looking into setting up biogas plants on their facilities, to use the upgraded biogas in their vehicles.

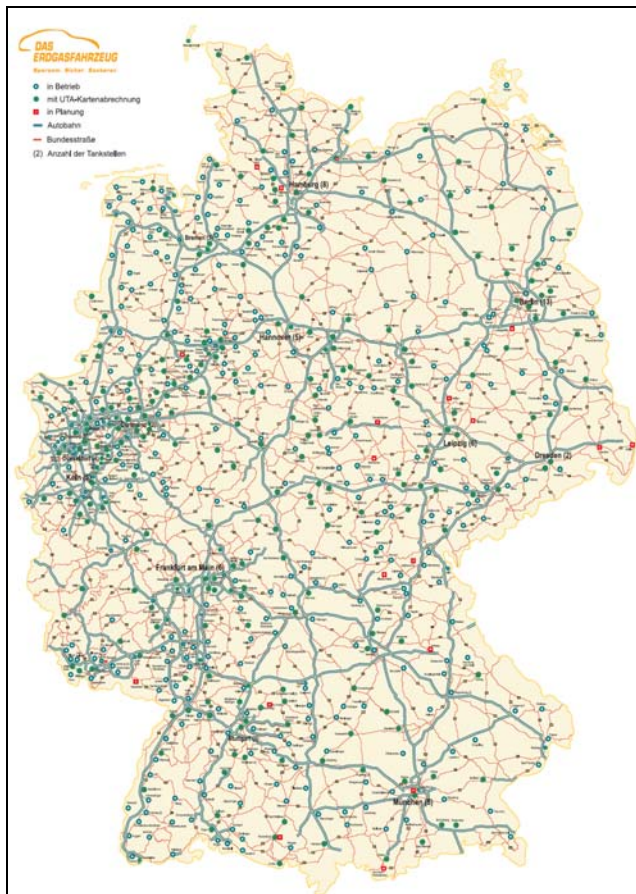
# Gas filling stations

## Background

The first gas filling station in Germany opened in the 1990's. The first filling stations in the region opened 1999 in Potsdam (capital city of Brandenburg) and in 2001 in Berlin. The amount of filling stations has increased steadily. Nowadays over 780 stations are distributed all over Germany.



Graph. Development of CNG filling stations in Germany between 1998 and 2007 ([www.erdgasfahrzeuge.de](http://www.erdgasfahrzeuge.de))



Graph: Gas filling stations in Germany ([www.erdgasfahrzeuge.de](http://www.erdgasfahrzeuge.de))

## Present situation

14 filling stations in Berlin and 42 in Brandenburg over CNG. On average the next CNG filling stations is within 10 km reach in Berlin, in Brandenburg, this distance is longer on average. One has to keep in mind however that Brandenburg is a lot less populated than Berlin. The average distance in urban areas is therefore assumed to be around the same as in Berlin.

*Table. Amount of filling stations and NGV in Germany and in Berlin-Brandenburg as of May 2008*

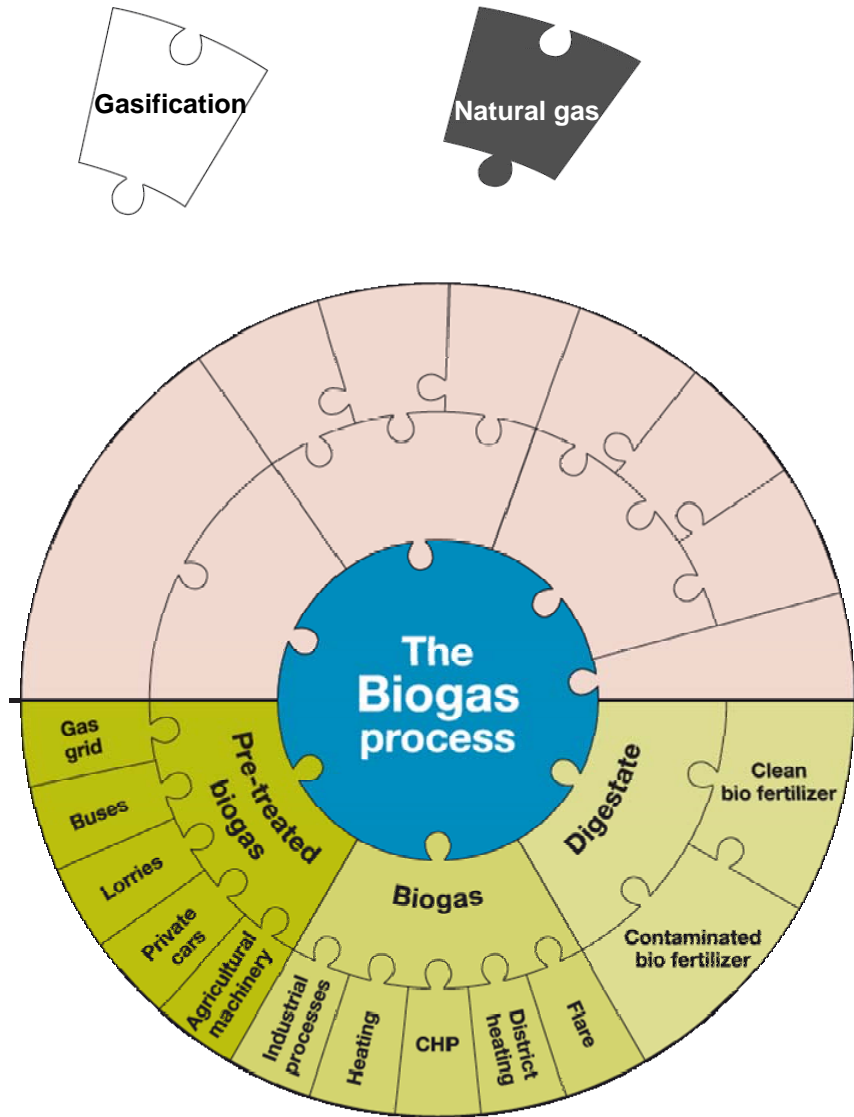
	<b>CNG filling stations</b>	<b>km<sup>2</sup></b>	<b>1 per [x] km<sup>2</sup></b>	<b>Radius [km]</b>
Berlin	14	892	59.5	7.7
Brandenburg	42	29,479	701.9	26.5
Germany	781	357,021	457.1	21.4

## Future perspectives

Within the MADEGASCAR project, the amount of NGV in the region is expected to rise to at least up to 3,500. Also, it is envisaged to promote the use of home filling stations ([www.phill.com](http://www.phill.com)) as well as the injection / usage / selling of biomethane at CNG filling stations. According to the NGV information portal of the German natural gas association ([www.erdgasfahrzeuge.de](http://www.erdgasfahrzeuge.de)), the amount of filling stations should increase up to about 1,000 at the end of 2008 in the whole of Germany.

## 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

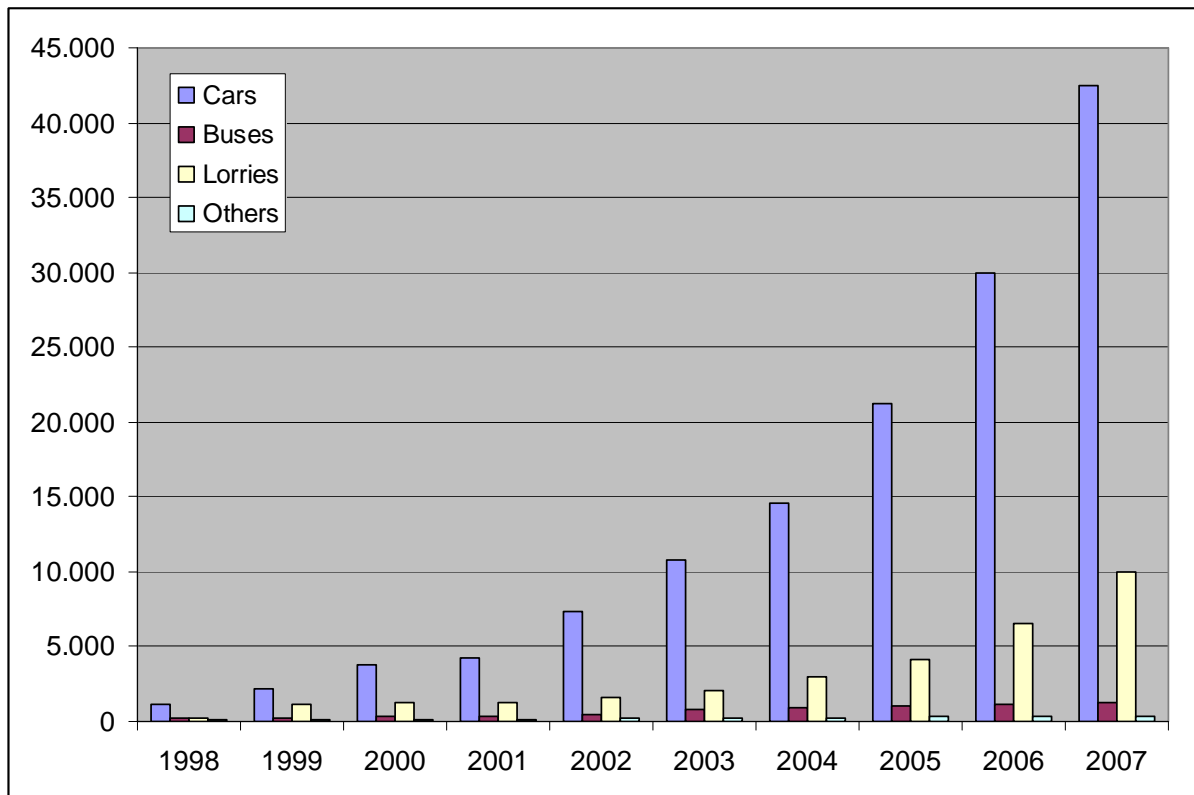
The usage of CNG in NGV is still a niche market in Germany. However due to the exemption from the mineral oil tax until 2018, CNG has – under current prices for petrol and diesel at the pump – become a very and increasingly interesting alternative as a transport fuel.

## Present situation

According to the Federal Agency for Transport [Kraftfahrtbundesamt], there were about

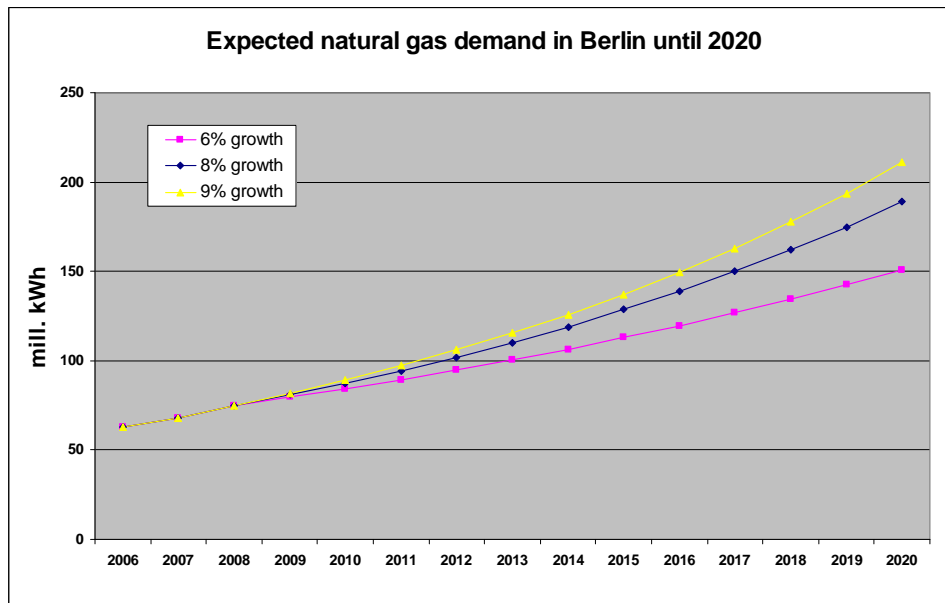
- ~ 42,500 NGV
- ~ 1,250 buses
- ~ 10,000 trucks/lorries
- ~ 400 other NGV types

in Germany as of January 2007. The development of the market is shown in the graph below.



Graph. Development of NGV in Germany between 1998 and 2007

On the regional level, there are currently more than 3,000 cars running on CNG. The amount of natural gas sold as vehicle fuel in the region of Berlin has increased with the amount of NGV sold in the local market. The market in Berlin had a volume of about 68 million kWh in 2007 and is expected to grow between 6-9 % per year. This would lead to a development as shown in the following graph.



Graph. Expected growth of the CNG market in Berlin

### Future perspectives

According to a study undertaken by the consultancy Roland Berger, the amount of NGV in Germany is supposed to rise up to 360,000 in 2010. If this amount will be reached remains to be seen.

The market development on the regional level in Berlin-Brandenburg through the MADEGASCAR project is expected to increase the amount of NGV, gas filling stations, home filling appliances, and should also stimulate the injection and usage of biomethane.

## Biogas for non transport applications

### Background

As said in the first chapter, biogas production in Germany – stimulated through the feed-in tariff law – was mainly aimed at producing electricity. The cleaned but not upgraded biogas is burned in CHP applications onsite and the electricity is fed into the power grid. A share of the excess heat is only used external (other than within the biogas production process such as the heating of the digester) in about 50-60 % of all biogas plants.

### Present situation

The main usage for biogas at the moment is the production of electricity. Moreover, there is an increasing interest in Germany by private households as well as companies and public institutions to purchase biomethane instead of natural gas for heating / cooking / CHP.

The development of this market will depend strongly on the definition of the upcoming Renewable Heat Law (Erneuerbare Energien Wärmegesetz - EEWärmeG). The law is supposed to put a mandatory renewable share within the energy supply for each new house built / re-built / or significantly refurbished after January 2009. Biomethane could be used to reach these targets if – and only if – it is used in CHP applications. Usage in regular condensing boilers does not count.

In order to serve this market, small and micro CHP blocks will have to prove market mature and successful in practical installations. There are several pilot project ongoing in the region of Berlin-Brandenburg.

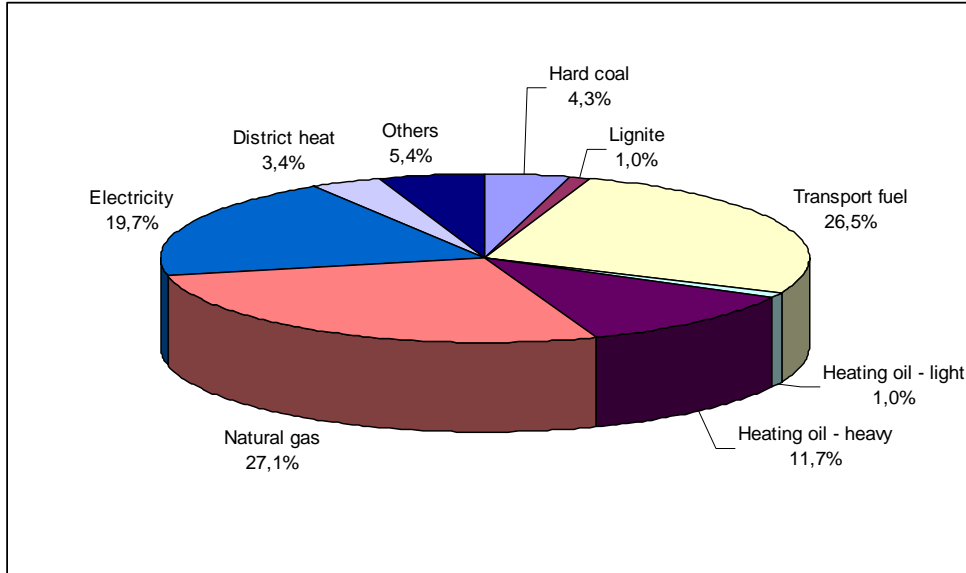
### Future perspectives

As said, the further process of defining and the final definition of the EEWärmeG as well as the product and market development for micro and small CHP blocks will frame the future development of biomethane for non-transport applications in Germany.

## Natural gas for non transport applications

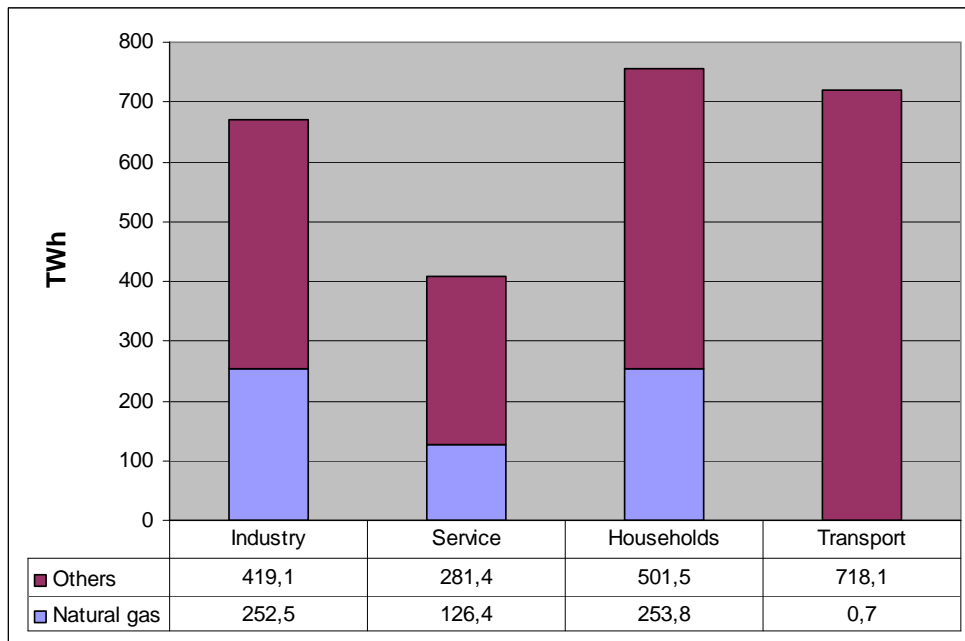
### Background

In 2006, natural gas was the largest source of primary energy in the German primary energy demand.<sup>10</sup>



Graph. Shares of each resource in the German primary energy demand in 2006

Apart from the transport sector, natural gas is a heavily utilised energy carrier. Natural gas is used in all applications: production of heat, electricity, cooling, as well as the production of mechanic energy. As the following table shows, its main use lies in the production of space heating in households. The transport sector only has a marginal share.



Graph: Amounts of primary energy sources depending on application in Germany in 2006 (in TWh)

<sup>10</sup> BMWi, 2008. Energiegewinnung und Energieverbrauch. Available at: <http://www.bmwi.de/BMWi/Navigation/Energie/energiestatistiken,did=176658.html>

## Present situation

As the following table shows, the main application for natural gas in Germany is space heating in private households. Almost 75 % of all energy consumed in private households is for space heating purposes. Of this three quarter share, natural gas makes up for 33 % - summing up to an annual consumption of almost 250 TWh.

Table. Share of natural gas in specific applications in Germany in 2006 ([www.bmwi.de](http://www.bmwi.de))

Sector	Main application	Application share [final en. demand]	Share of gas within application	TWh
Industry	Process heat	64.6%	32.6%	218.9
Service	Space heating	45.9%	22.6%	92.0
Households	Space heating	74.8%	33.0%	249.1
Transport	Mechanic energy	99.1%	0.1%	0.8

This share can be explained through the increasing substitution of traditional oil fired heating systems in households with condensing boilers. Stimuli for this development included high oil prices, increased gas network development in rural areas, space savings in-house (no oil tanks required), and also political will due to the higher efficiency values.

## Future perspectives

In general, the gas market liberalisation has lead to an increased price competition - favouring the costumer. Rising oil prices however have lead to an increase in natural gas prices. Nowadays, more and more private households are looking into using renewable energy sources such as solar thermal collectors or heat pumps.

This is enforced by the currently discussed renewable heat law (EEWärmeG). Here the German government foresees a mandatory renewable heat share in the energy supply of any newly built or significantly modified house as of 2009. Alternatively to the renewable share, the houses can fulfil pre-defined energy efficiency criteria.

Concluding, the amount of natural gas used for space heating - where it can easily be substituted for a certain share - will decrease in the long run. The natural gas consumption in industry is rather unlikely to be reduced significantly due to the often very specific production requirements.

# LPG

## Present situation

Almost 1.5 million tons of LPG are sold throughout Germany per year. The following table shows the distribution of the amount in the individual regions ('Länder') within Germany. The main parts are used in the chemical industry. Only 7 % of all LPG is used as a vehicle fuel and sold at designated fuelling stations. Within this market, the regions of Berlin-Brandenburg – with a total of 5 % - take only a minor share. 2,798 tons of LPG were sold for powering road vehicles in the regions in 2006.

Table. Present consumption of LPG in Germany in 2006 – sorted by Länder and usage ([www.dvfg.de](http://www.dvfg.de))

In tons	Bottled	Fuel gas	Power gas	Vehicles	Others	Sum	Share
Baden-Württemberg	16.634	93.582	8.880	5.384	28.390	152.870	11%
Bayern	21.316	132.927	10.493	13.944	43.839	222.519	16%
Berlin	3.964	4.101	734	838	1.284	10.921	1%
Brandenburg	4.506	31.081	1.462	1.960	16.690	55.699	4%
Bremen	930	1.452	477	975	99	3.933	0%
Hamburg	2.068	1.986	1.055	1.745	170	7.024	0%
Hessen	9.780	65.401	4.941	10.132	12.312	102.566	7%
Mecklenburg-Vorpommern	2.482	44.072	766	2.656	21.002	71.608	5%
Niedersachsen	12.389	70.600	6.954	16.443	24.345	130.731	9%
Nordrhein-Westfalen	27.586	160.118	34.711	21.053	32.022	275.940	20%
Rheinland-Pfalz	8.499	47.695	5.245	5.390	13.389	80.218	6%
Saarland	2.696	8.434	1.703	1.050	1.364	15.247	1%
Sachsen	3.879	42.160	3.692	2.430	48.447	100.608	7%
Sachsen-Anhalt	3.043	32.615	1.053	5.475	29.169	71.355	5%
Schleswig-Holstein	6.704	33.576	1.752	4.795	4.603	51.430	4%
Thüringen	2.998	33.801	1.710	5.462	12.465	56.436	4%
<b>Total</b>	<b>129.474</b>	<b>803.601</b>	<b>85.628</b>	<b>99.732</b>	<b>289.590</b>	<b>1.409.105</b>	<b>100%</b>
<b>Share</b>	<b>9%</b>	<b>57%</b>	<b>6%</b>	<b>7%</b>	<b>21%</b>	<b>100%</b>	

## Supply & Utilisation of LPG in Berlin-Brandenburg

- LPG is used as a vehicle fuel in the region; however, its utilisation is of minor importance in the overall vehicle market and fuel consumption statistic.
- A total of 2,798 tons of LPG were sold as vehicle fuel in 2006 in the regions
- 34 filling stations exist in Berlin
- 118 in Brandenburg

## Future perspectives

The infrastructure is well in place within the region – with more than 150 fuelling points offering LPG to car owners. Re-fitting petrol cars to bi-fuel usage of petrol and LPG is becoming more attractive with rising fuel prices for petrol as prices for LPG receive tax benefits until 2018. Hence, the market is currently in favour of LPG and CNG powered cars, the future perspectives for them will strongly depend on their promotion.

## Norms and Legislations

### Biogas production / usage

German national laws regarding biogas production and use		
Date	Name	Explanation
Dec 2001	TA Luft	Technical guidance for the clean-air-act (Technische Anleitung zur Reinhaltung der Luft)
April 2002	BioAbfV	Ordinance for the usage of bio organic waste material from agriculture, forestry and gardening (Bioabfallverordnung)
July 2002	BetrSichV	Ordinance for work place security and health protection (Betriebssicherheitsverordnung)
Dec 2003	DüMV	Fertilizer Ordinance (Düngemittelverordnung): sets the requirements for left over digestives from biogas production for the usage as fertilizer
Jan 2004	TierNebG	Law for the enforcement of requirements for the usage and disposal of animal by-products (Tierische Nebenprodukte-Beseitigungsgesetz)
July 2004	EEG	Renewable Energy Feed-in Law (Erneuerbaren Energien Gesetz): defines the remuneration tariffs and conditions (time, digression rate, and further requirements depending on renewable energy source) for power production from renewable energy sources.
Planned amendments & others		
Date	Name	Explanation
Jan 2009	EEG	Amendment of the above law as of 2009
Jan 2009	EEWärmeG	Renewable Heat Law: define a mandatory renewable heat share per newly erected or significantly refurbished house / buildings after 2009.

### Natural gas transportation and connection

German national laws regarding natural gas		
Date	Name	Explanation
	AVBGasV	Definition of the general supply requirements by the state for the design of the supply relationships between the individual supplier and the customer (allgemeine Versorgungsbedingungen Gas Verordnung).
Juli 2005	GasNEV	Defines the method for the calculation of the gas grid usage fee / compensation (Gasnetzentgeltverordnung)
April 2008	GasNZV	Amendment of the gas grid connection regulation (Gasnetzzugangsverordnung). Important details: <ul style="list-style-type: none"> <li>• Must-connect</li> <li>• 50/50 cost share for pipeline construction</li> <li>• Biogas producer: costs for biogas production, cleaning and upgrading</li> <li>• Network operator: maintenance of the grid connection including, pressure increase, measuring and metering equipment, and odoring</li> </ul>

## Transport

German national laws regarding transport fuels (with a focus on CNG)		
Date	Name	Explanation
July 2005	EnWG	Energy economy law (amendment): unbundling of power and gas grids from production and sales points of power and gas (Energiewirtschaftsgesetz)
July 2006	EnergieStG	Energy tax law: defines lower mineral oil taxes for natural gas until 2018 (Energiesteuergesetz)
Jan 2007	BioKraftQuG	Biofuels quota law: defines blending quotas and taxes for liquid biofuels - mainly biodiesel and bioethanol; currently being revised. Biomethane could play a role in the new version (Biokraftstoffquotengesetz).
Dec 2007	BImSchV	Federal emission protection law (Bundes-Immissionsschutzgesetz): the 10th regulatory decree of its enforcement defines the requirements for the composition and declaration (distinction) of the specific fuel qualities.
Expected in 2008	DIN 51624	Defines the composition requirements and control procedures for natural gas as a transport fuel in NGV.




## Available vehicles

### Passenger cars and light transport vehicles






BRA GmbH / PGO

	<p><b>PGO Cévennes Turbo CNG</b></p> <table> <tr> <td>Cylinder capacity</td> <td>1.598 ccm</td> </tr> <tr> <td>Power</td> <td>110 kW</td> </tr> <tr> <td>Fuel capacity CNG</td> <td>22 kg</td> </tr> <tr> <td>Range CNG</td> <td>450 km</td> </tr> <tr> <td>CO2 Emissions</td> <td>118 g/km</td> </tr> </table> <p><a href="http://www.cngpower.eu">www.cngpower.eu</a></p>	Cylinder capacity	1.598 ccm	Power	110 kW	Fuel capacity CNG	22 kg	Range CNG	450 km	CO2 Emissions	118 g/km
Cylinder capacity	1.598 ccm										
Power	110 kW										
Fuel capacity CNG	22 kg										
Range CNG	450 km										
CO2 Emissions	118 g/km										

## CITROEN




	<p><b>Citroen Berlingo 1,4 Multispace</b></p> <table> <tr> <td>Cylinder capacity</td> <td>1.360 ccm</td> </tr> <tr> <td>Power</td> <td>50 KW (68 PS)</td> </tr> <tr> <td>Fuel capacity CNG</td> <td>14 kg</td> </tr> <tr> <td>Fuel capacity Petrol</td> <td>55 l</td> </tr> <tr> <td>Range CNG</td> <td>220 km</td> </tr> <tr> <td>Total range</td> <td>930 km</td> </tr> <tr> <td>CO2 Emissions</td> <td>146 g/km</td> </tr> </table>	Cylinder capacity	1.360 ccm	Power	50 KW (68 PS)	Fuel capacity CNG	14 kg	Fuel capacity Petrol	55 l	Range CNG	220 km	Total range	930 km	CO2 Emissions	146 g/km
Cylinder capacity	1.360 ccm														
Power	50 KW (68 PS)														
Fuel capacity CNG	14 kg														
Fuel capacity Petrol	55 l														
Range CNG	220 km														
Total range	930 km														
CO2 Emissions	146 g/km														
	<p><b>Citroen Berlingo Kastenwagen Bivalent</b></p> <table> <tr> <td>Cylinder capacity</td> <td>1.360 ccm</td> </tr> <tr> <td>Power</td> <td>50 KW (68 PS)</td> </tr> <tr> <td>Fuel capacity CNG</td> <td>14 kg</td> </tr> <tr> <td>Fuel capacity Petrol</td> <td>55 l</td> </tr> <tr> <td>Range CNG</td> <td>200 km</td> </tr> <tr> <td>Total range</td> <td>910 km</td> </tr> <tr> <td>CO2 Emissions</td> <td>146 g/km</td> </tr> </table>	Cylinder capacity	1.360 ccm	Power	50 KW (68 PS)	Fuel capacity CNG	14 kg	Fuel capacity Petrol	55 l	Range CNG	200 km	Total range	910 km	CO2 Emissions	146 g/km
Cylinder capacity	1.360 ccm														
Power	50 KW (68 PS)														
Fuel capacity CNG	14 kg														
Fuel capacity Petrol	55 l														
Range CNG	200 km														
Total range	910 km														
CO2 Emissions	146 g/km														
	<p><b>Citroen C3 SYYLE 1,4i bivalent</b></p> <table> <tr> <td>Cylinder capacity</td> <td>1.360 ccm</td> </tr> <tr> <td>Power</td> <td>49 KW (67 PS)</td> </tr> <tr> <td>Fuel capacity CNG</td> <td>9 kg</td> </tr> <tr> <td>Fuel capacity Petrol</td> <td>45 l</td> </tr> <tr> <td>Range CNG</td> <td>180 km</td> </tr> <tr> <td>Total range</td> <td>872 km</td> </tr> <tr> <td>CO2 Emissions</td> <td>119 g/km</td> </tr> </table>	Cylinder capacity	1.360 ccm	Power	49 KW (67 PS)	Fuel capacity CNG	9 kg	Fuel capacity Petrol	45 l	Range CNG	180 km	Total range	872 km	CO2 Emissions	119 g/km
Cylinder capacity	1.360 ccm														
Power	49 KW (67 PS)														
Fuel capacity CNG	9 kg														
Fuel capacity Petrol	45 l														
Range CNG	180 km														
Total range	872 km														
CO2 Emissions	119 g/km														

**FIAT**


	<p><b>Fiat Multipla Bipower</b></p> <p>Cylinder capacity 1.596 ccm                      Power 68 kW (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</p>
	<p><b>Fiat Doblo 1,6 16V Natural Power</b></p> <p>Cylinder capacity 1.596 ccm                      Power 68 kW (92 PS)                      Fuel capacity CNG 22 kg                      Fuel capacity Petrol 60 l                      Range CNG 350 km                      Total range 1.000 km                      CO2 Emissions 161 g/km</p>
	<p><b>Fiat Doblo Cargo Natural Power</b></p> <p>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</p>
	<p><b>Fiat Panda Natural Power</b></p> <p>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</p>
	<p><b>Fiat Punto Natural Power</b></p> <p>Cylinder capacity 1.242 ccm                      Power 38 kW (52 PS)                      Fuel capacity CNG 11 kg                      Fuel capacity Petrol 47 l                      Range CNG 250 km</p>

	Total range	950 km
	CO2 Emissions	119 g/km




**FORD**

	<p><b>Ford Focus C-MAX CNG</b></p> <p>Cylinder capacity 1.999 ccm                  Power 93 kW (126 PS)                  Fuel capacity CNG 18 kg                  Fuel capacity Petrol 55 l                  Range CNG 270 km                  Total range 1040 km                  CO2 Emissions 158 g/km</p>
	<p><b>Ford Focus CNG</b></p> <p>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 1.070 km                  CO2 Emissions 151 g/km</p>
	<p><b>Ford Transit CNG Kastenwagen</b></p> <p>Cylinder capacity 2.261 ccm                  Power 100 kW (136 PS)                  Fuel capacity CNG 24,3 – 38,6 kg                  Fuel capacity Petrol 80 l                  Range CNG 250 - 400 km                  Total range 1005 - 1355 km                  CO2 Emissions 250 g/km</p>

## IVECO

	<b>IVECO Daily CNG</b>	
	Cylinder capacity	2.998 ccm
	Power	100 kW (136 PS)
	Fuel capacity CNG	36 – 48,6 kg
	Fuel capacity Petrol	monovalent
	Range CNG	269 – 362 km
	Total range	269 – 362 km
CO2 Emissions	k.A. g/km	

## MERCEDES

	<b>Mercedes – Benz E 200 NGT</b>	
	Cylinder capacity	1.796 ccm
	Power	120 kW (163 PS)
	Fuel capacity CNG	18 kg
	Fuel capacity Petrol	62 l
	Range CNG	300 km
	Total range	1.000 km
CO2 Emissions	168 g/km	
	<b>Mercedes B170 NGT (Herbst 2008)</b>	
	Cylinder capacity	1.699 ccm
	Power	85 kW (116 PS)
	Fuel capacity CNG	17 kg
	Fuel capacity Petrol	54 l
	Range CNG	330 km
	Total range	1.080 km
CO2 Emissions	135 g/km	
	<b>Mercedes Sprinter 316 NGT (Herbst 2008)</b>	
	Cylinder capacity	1.800 ccm
	Power	115 kW (156 PS)
	Fuel capacity CNG	39 - 46 kg
	Fuel capacity Petrol	100 l
	Range CNG	470 km
	Total range	1.200 km
CO2 Emissions	254 g/km (316 NGT) 263 g/km (516 NGT)	

**OPEL**



**Opel Combo 1,6 CNG monovalent plus**

Cylinder capacity	1.598 ccm
Power	69 kW (94 PS)
Fuel capacity CNG	19 kg
Fuel capacity Petrol	14 l
Range CNG	350 km
Total range	515 km
CO2 Emissions	133 g/km



**Opel Combo Kastenwagen 1,6 CNG**

Cylinder capacity	1.598 ccm
Power	69 kW (94 PS)
Fuel capacity CNG	19 kg
Fuel capacity Petrol	14 l
Range CNG	350 km
Total range	515 km
CO2 Emissions	133 g/km



**Opel Zafira 1,6 CNG monovalent plus**

Cylinder capacity	1.598 ccm
Power	69 kW (94 PS)
Fuel capacity CNG	21 kg
Fuel capacity Petrol	14 l
Range CNG	380 km
Total range	530 km
CO2 Emissions	138 g/km

**PEUGEOT**



**Peugeot Partner Epee 75 bivalent**

Cylinder capacity	1.360 ccm
Power	50 kW (68 PS)
Fuel capacity CNG	13 kg
Fuel capacity Petrol	55 l
Range CNG	190 km
Total range	890 km
CO2 Emissions	146 g/km



**Peugeot Partner Kastenwagen 190C**

Cylinder capacity	1.360 ccm
Power	50 kW (68 PS)
Fuel capacity CNG	13 kg
Fuel capacity Petrol	55 l
Range CNG	190 km
Total range	890 km
CO2 Emissions	146 g/km



**Peugeot Boxer Bivalent**

Cylinder capacity	1.998 ccm
Power	71 kW (97 PS)
Fuel capacity CNG	26 kg
Fuel capacity Petrol	80 l
Range CNG	250 km
Total range	850 km
CO2 Emissions	g/km

**VOLKSWAGEN**



**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 Caddy Kastenwagen**

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 Emission	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 Emission	155 g/km



**VW Passat TSI Eco Fuel (Herbst 2008)**

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 Emission	k.A. g/km

## MADEGASCAR

MADEGASCAR - market development of gas driven cars, is a project which aims at developing the market for gas driven vehicles – natural gas and biogas fuelled vehicles. Strengthening the supply and distribution infrastructure of biogas and natural gas to fuel vehicles is also a goal for the project.

## Intelligent Energy - Europe

Intelligent Energy - Europe is the EU's tool for funding action to improve the conditions for energy saving and the use of renewable energy sources in Europe. Madagascar is co-funded by the European Community through Intelligent Energy \_Europe

### Disclaimer:

The sole responsibility for the content of this 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.