This is Biogas Väst

Biogas Väst is a regional collaborative project with the overall aim of stimulating market development within biogas production, distribution and the development of the gas-powered vehicle market.
In the project, where Business Region Göteborg is the principal, some 30 organizations, municipal authorities and companies are involved, including AB Volvo, Renova, Göteborg Energi AB, FordonsGas and LRF.

Business Region Göteborg AB is dedicated to strengthening and developing trade and industry in the Göteborg region. We are a non-profit organization representing 13 member municipalities.
Our goal is to contribute to sustainable economic growth, a high level of employment and a diversified economy.

Read more at:

www.businessregiongoteborg.com
www.biogasmax.eu
www.biogasbil.nu
www.biogasvast.com

Supported by:

REGION VÄSTRA GÖTALAND

Klimp – Climate Investment Programme – Swedish Environmental Protection Agency

Vägverket – The Swedish Road Administration

biogasmax – A DRIVING FORCE

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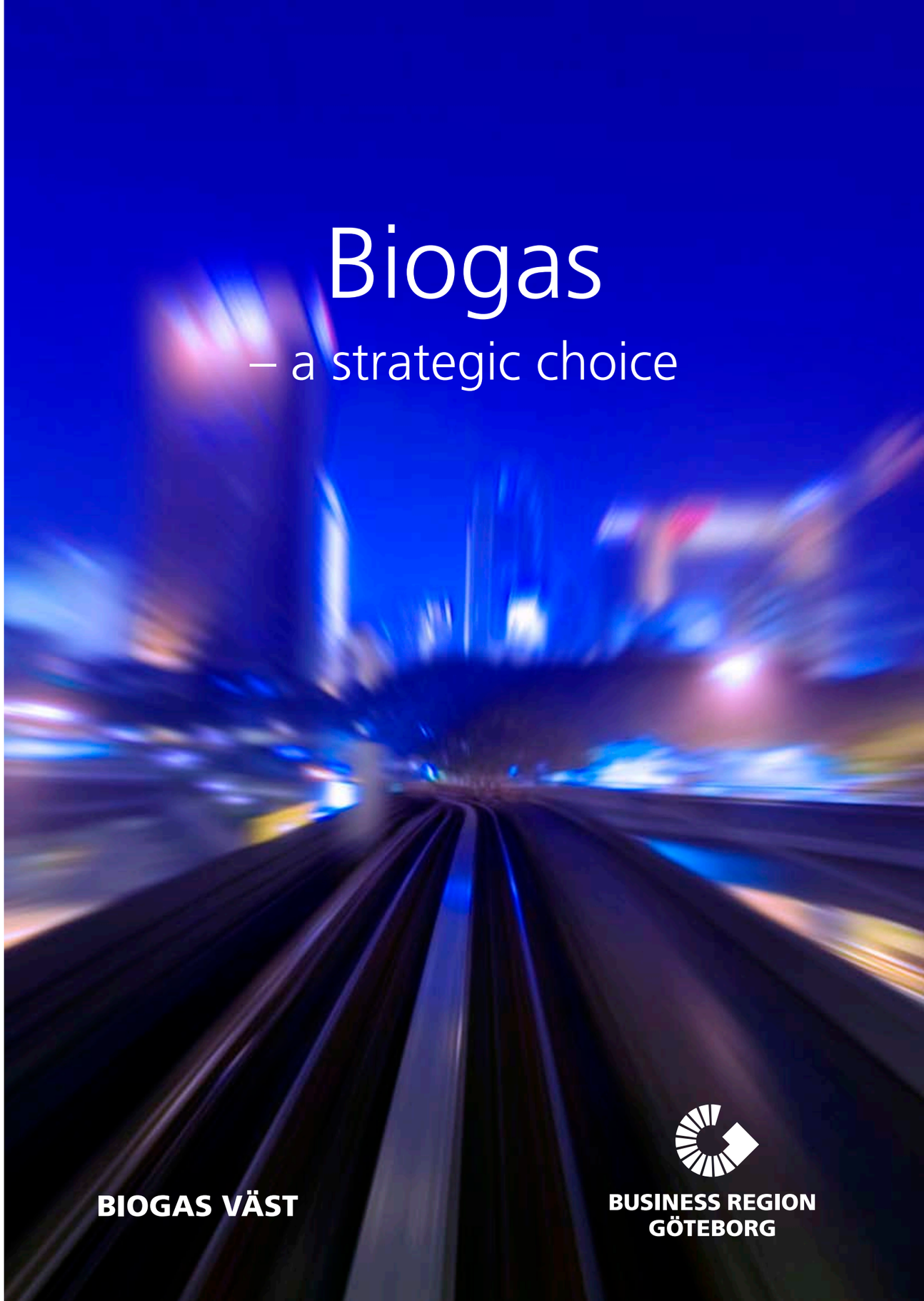
BUSINESS REGION GÖTEBORG

www.innovaform.se 237-0709. Printed on Scandia 2000. ISO 14001 certified. 50% of the forest raw material originates from saw mill Residues. 15% originates from forestes managed and certified under the PEFC-standard.

Biogas

– a strategic choice



BIOGAS VÄST

BUSINESS REGION GÖTEBORG

Biogas
– ahead of the field!

An increasing number of countries are seeking to reduce their dependence on oil and their emission of greenhouse gases. Biogas is part of the solution as it can be produced from waste and residual products in virtually every country. This opens up enormous potential for sustainable economic growth, where biogas can generate new job opportunities and new export potential because of its beneficial impact on the climate and the environment.

Biogas...

…is the vehicle fuel that generates the least emissions of greenhouse gases and regulated emissions from a life-cycle perspective

…is a domestic fuel that can be produced locally, creating a more secure energy supply and reducing dependence on oil

…is produced from waste and residual products, avoiding any competition with food production

…contributes to sustainable agriculture

…contributes to the creation of a sustainable waste system

…currently has the greatest production potential within waste, agriculture and future gasification technology using forest residuas

…is expected to be capable of supplying approximately 20% of the vehicle fleet in Sweden by 2020

…is a bridge to hydrogen gas technology

Pure facts

Biogas is formed when organic material (fertilizer, food residue, plants, wastewater etc.) is degraded by microorganisms in deoxidated environments. Biogas comprises mainly of methane and carbon dioxide but also contains small amounts of hydrogen sulfide and ammonia.

Biogas is formed spontaneously in nature, in marshes for example. Under controlled conditions in a digestion chamber microorganisms transform organic material into renewable energy in the form of methane. At the same time a highly nutritious product – biofertilizer – is produced which can replace conventional fertilizer.

The energy content in 1 m^3 of biogas (with a 65% methane content) is equivalent to approximately 6.5 kWh. One liter of oil contains approximately 10 kWh, which means that about 1.5 m^3 of biogas is needed to replace one liter of oil.

New technology

Gasification technology for the production of biogas is being developed. At a gasification facility the biofuel, in the form of forest residue, is transformed into a combustible gas. This 'synthetic gas' is purified and then upgraded to biogas with a level of quality comparable to natural gas. As the biogas is produced from renewable sources it does not lead to increased carbon dioxide emissions as is the case with fossil fuels. This technology has a very high energy-efficiency and the production potential is enormous.

Biogas as a vehicle fuel

Biogas is used as fuel for cars, buses and trucks. This requires the biogas to be upgraded to fuel quality (vehicle gas) by separating the hydrogen sulfide, water and carbon dioxide. Upgraded biogas has an energy content of approximately 10 kWh m^3, which is equivalent to one liter of oil. By compressing the biogas it can be stored in a tank (pressure chamber) in the vehicle.

The biogas can also be fed into the natural gas grid. This means that the gas can reach the vehicle market and other areas of use in the electricity, heating and petrochemical sectors.

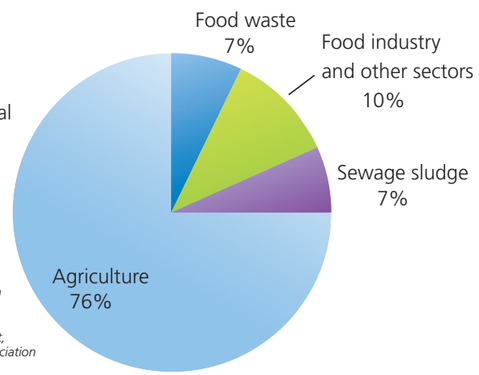
Biogas potential

The total biogas potential of digestion of domestic residual products in Sweden is 10.6 TWh/year. This is equivalent to 12% of the energy consumption attributable to road transport.

The potential for biogas produced from the combustion of residual products from the forest industry in Sweden is estimated to be 59 TWh/year. One of the advantages of biogas is that waste and residual products are used. It is also a domestic fuel which is produced locally and the process does not involve any competition with food production.

In total, biogas can replace more than half of all petroleum and diesel used in Swedish road transport.

Total biogas potential with limitation from domestic residual products (10.6 TWh, excluding residual forest products)



Source: *Swedish biogas potential from domestic residual products Lund 2008*

BioMil AB: *Maria Linné (Project leader); Alexandra Ekstrand, Rolf Englesson and Emelie Persson*
Envirum AB: Lovisa Björnsson and Mikael Lantz

Produced on behalf of: *Swedish Waste Management, the Swedish Biogas Association, the Swedish Gas Association and the Swedish Water and Wastewater Association*

Focus on the environment, jobs and the economy

Biogas – the fuel of today and the future

Biogas is a sustainable fuel that stands out from other biofuels because of the major environmental and socio-economic benefits that can be achieved.

Biogas generates a range of socio-economic benefits. According to the Swedish Gas Association's 'Biogas Report June 2006', 60,000 jobs could be generated in Sweden by 2020 in the event of a 20% transfer to biogas as a vehicle fuel. Job opportunities are generated at every stage in the biogas chain, such as raw materials and substrates, production, distribution and use in vehicles. Around 20,000 jobs are expected to be created in Västra Götaland in the automotive, construction and engineering industries as well as agriculture. In other words Sweden could become a world leader in the export of biogas technology. This would have a positive effect on the balance of trade through an increase in export income and reduced oil import costs.

There is considerable development potential for engines powered by methane gas (biogas and natural gas). The high octane level of methane gas can be utilized to improve the efficiency of the engine. The EU 'well-to-wheel analysis' also demonstrates that hybrid technology makes gas-powered vehicles more efficient than both petrol and diesel hybrid engines. Biogas hybrid engines in combination with emerging electricity plug-in technology could prove to be the vehicle of the future.

Biogas is strategically linked to hydrogen gas. With a hydrogen gas mixture (8%) in the methane gas fuel consumption is reduced by 25-30%. The biogas fuelling station infrastructure can be used for a hydrogen gas mixture. The technology and know-how to handle biogas in vehicles and engines can also be used for the introduction of hydrogen gas.

Several companies in western Sweden are investing in new technology and new markets:

AB Volvo has a concept truck with a diesel engine that can run on methane gas (dual-fuel technology). This new engine technology will open up a new market for biogas.

The Volvo-owned and Göteborg-based company Terracastus Technology has the technology to produce biomethane in liquid form. The first facility in Sweden is currently being built in Lidköping and is expected to be completed by 2010.

A new type of fuelling station, LCMG, is being produced by FordonsGas Sverige for fuelling trucks and buses with liquid biomethane and light vehicles with compressed gas.

The world's largest gasification plant for biomass is in Göteborg and is operated by Göteborg Energi and Chalmers University of Technology. This research facility is part of Göteborg Energi's plans for commercial gasification of biomethane by 2011.

Shipping is a future market for liquefied biogas and natural gas. The engine manufacturer Wärtsilä has a range of dual-fuel engines for ships.

Biogas – a convenient truth

Biogas contributes to the realization of half the 16 Swedish environmental objectives, which is unique in comparison with other biofuels. Biogas offers the largest reduction in greenhouse gases compared with the biofuels currently available on the market. Biogas is as good as or even better than the 'second-generation' biofuels (ethanol, methanol and DME from forest materials). In addition, the biofertilizer that replaces conventional fertilizer can reduce emissions of the strong greenhouse gas nitrous oxide.

Biogas Väst

– the world's first regional project for biogas as vehicle fuel

Biogas Väst is a regional collaboration project in western Sweden – covering the Göteborg region and the county of Västra Götaland – focusing on biogas for vehicles. The project principal is Business Region Göteborg AB. The project commenced in 2001 to pursue market development within biogas production, the distribution and expansion of gas fuelling stations and the use of gas-powered vehicles. Biogas Väst is also seeking to develop expertise in concepts that could be exported.

When Biogas Väst started in 2001 there were nine gas fuelling stations and approximately 800 vehicles in western Sweden. By 2008 Western Sweden had the best infrastructure in the country with 36 gas fuelling stations, approximately 7,000 vehicles and eight facilities producing biogas for automotive purposes. Methane gas for vehicles (biogas and natural gas) replaced around 18 million liters of petrol in 2007, which is expected to reduce greenhouse gases by the equivalent of 22,000 tonnes of CO_2 per year.

Investment in western Sweden in biogas facilities, the infrastructure, fuelling stations, pipelines and swapbodies up to and including 2007 is estimated at around SEK 670 million.

Investment in gas-powered vehicles – cars, light transport vehicles, buses and trucks – is estimated at SEK 1.8 – 2 billion.

How efficient are biofuels?
How far can you drive on 1 hectare of biomass?

Ethanol/wheat	12 000km
Ethanol/wood – energy crop	26 000km
Biogas/sugar beet	38 000km
DME/wood – energy crop	43 900km
Biomethane/wood – energy crop	49 900km

Source: *Biomedel ur ett systemperspektiv (Biofuels from a system perspective)*
Pål Börjesson. Lund University

Biogasmax

Biogas Väst has been involved in the EU project Biogasmax since 2006. It will continue through to 2009 with the aim of highlighting biogas as a vehicle fuel on a European level. Some 30 partners from eight European countries are involved. The main partners are the cities of Lille, Göteborg, Rome, Stockholm, Berne, Torun, Zielena Góra and the Lombardy Region. Included in the Göteborg consortium are Göteborg Energi, FordonsGas Sverige, Falköping Municipal Authority and Business Region Göteborg/Biogas Väst. Biogasmax has a total budget of EUR 19.5 million.
www.biogasmax.eu

Klimp – The Swedish Environmental Protection Agency Climate Investment Program

Klimp is government investment support handled by the Swedish Environmental Protection Agency with the aim of reducing emissions of greenhouse gases. Business Region Göteborg/Biogas Väst is currently the owner of two Klimp programs and has received SEK 83 million in grants for local climate investments. It is estimated that the project will lead to a reduction in greenhouse gas emissions of 56,000 tonnes per year. The total investment for the planned measures is SEK 342 million.

The Klimp programs will continue until 2012 and are aimed at bringing about a production facility for liquid biogas, expansion of the infrastructure, conversion of heavy vehicles and information initiatives.
www.naturvardsverket.se

Public-Private Partnership

Biogas Väst is the world's first regional project for biogas as vehicle fuel. Some 30 participants from privately and publicly owned companies, organizations, public authorities and municipal authorities make up the core of this unique Public-Private Partnership. The concept has been a source of inspiration and has been copied not only in Sweden but also internationally.

In 2008, Business Region Göteborg received the American environmental prize 'The Blue Sky Award' for the creation of Biogas Väst. The prize was presented by the American non-profit organization Calstart, which has its operating base in California.
www.calstart.org

Biogas Väst offers

Investment financing programs and applications: venture capital, EU funding and other government funding.

Business development, which includes co-operation with new companies and agencies in the industry.

An exchange of experience and networking in company clusters within waste, energy, water purification, transport and automotive manufacturing.

Technology development projects in co-operation with the agencies involved in the project, including kryotechnology for the production of liquid biomethane, fuelling stations for liquid methane and dual-fuel for heavy vehicles and shipping.

Co-ordination of production with marketing projects.

Communication projects that include information to decision-makers, not only locally but also regionally, nationally and internationally.

Influencing public opinion – advertisements, brochures, participation in trade fairs, seminars and articles.

Vision – a leading world-class region

It is Biogas Väst's vision that the Västra Götaland region will become the leading region in European collaboration. The aim is that 100,000 vehicles in the region will be powered by biogas by 2020.

It is already the case that…
…Western Sweden is at the forefront internationally within waste research and development through the Waste Refinery competence centre.

…through the Göteborg Energi research facility and Chalmers University of Technology, Western Sweden has a leading role in research and development dealing with the gasification of biomass for the production of biomethane.

In the future…
…the region will play a leading role internationally with a research and development centre for liquid biomethane and engine development through collaboration between universities and companies in the energy, gas, automotive and shipping sectors.

…the region will have a leading role to play through the development of biogas systems for agriculture.

…there will be an eco-friendly coastal and lake shipping sector – thanks to natural gas and biogas as a fuel – which has developed into a strong alternative to transporting freight by road.