

## Market Potential and –analysis of Biogas Fuel Cells in Germany, Austria and Slovakia

H<sub>2</sub> Expo  
2nd AMONCO Business Interest Group Meeting  
17/09/04  
presented by Michael Schlieker (EBV) and Volker Jaensch (dena)

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## Introduction to EBV Group



- Founded in 1994, with business focus on planning, realisation, installation and management of renewable energy projects in Germany and abroad with an emphasis on wind energy
- Business areas are divided into: project development and financing, funds issuance, building development and services
- Realised projects so far: 20 wind farms (146 wind turbines with 161,4 MW total installed capacity) and 1 hydro power plant (0,407 MW installed capacity)
- October 2003: EBV became 100% subsidiary of Gamesa Energía; new board of executives: Holger Maug, Stefan Blankemeyer, Dr. Daniel Brickwell and Marta Fernández Bordóns

## Basic Principles of the Market Assessment



- The market assessment will be based on the total substrate potential for anaerobic digestion in the respective countries and will therefore demonstrate the maximum market potential.
- To which extent this maximum market potential will be exploited depends on the market environment and the existing barriers and can therefore be influenced by politics.
- If future biogas applications will be combined with fuel cells depends on the outcome of their competitive race with internal combustion engines. The evaluated market potential is therefore primarily related to biogas technology as such.

## Market Assessment Germany Substrate Potential for Biogas Production



Substrate	Substrate Potential in Mio. t/a	Biogas Potential in Mio. m <sup>3</sup> /a
Manure and other agricultural residuals	180	5,491
Energy Crops	58	10,000
Sewage Sludge	33	833
Organic Waste	15	1,453
<b>Total</b>	<b>286</b>	<b>17,777</b>

Source: Institute for Energy and Environment, 2002 and own calculations

## Market Assessment Germany Energy Production Potential



Substrate	Potential for electricity production in GWh/a	Potential for heat production in GWh/a	Potential for installed el. capacity in MW
Manure and other agricultural residuals	12,493	16,063	1,562
Energy Crops	22,750	29,250	2,844
Sewage Sludge	1,896	2,438	237
Organic Waste	3,306	4,250	413
<b>Total</b>	<b>40,445</b>	<b>52,001</b>	<b>5,056</b>





### Market Assessment Germany Market Environment and Main Barriers

**Market Environment**

- Access to the grid is guaranteed by the Renewable Energy Law
- Fixed feed-in tariffs for 20 years: 8.40 -11.50 €cent / kWh depending on the electrical capacity of the biogas plant
- Bonuses are available for the utilisation of energy crops, of combined heat and power plants and of innovative conversion technologies
- Loans with low interest rates are available via the state owned KfW bank
- Complicated authorisation procedure especially for larger plants

**Main Barriers**

- Comprehensive authorisation procedures
- Bonus for using innovative conversion technologies might not be sufficient for the economic application of fuel cells, yet





### Market Assessment Slovakia Substrate Potential for Biogas Production

Substrate	Substrate Potential in Mio. t/a	Biogas Potential in Mio. m <sup>3</sup> /a
Manure and other agricultural residuals	13.2	333
Energy Crops	0.8	138
Sewage Sludge	1.2	29
Organic Waste	1.2	108
<b>Total</b>	<b>16.4</b>	<b>608</b>

Source: University of Nitra, 2004 and own calculations





### Market Assessment Slovakia Energy Production Potential

Substrate	Potential for electricity production in GWh/a	Potential for heat production in GWh/a	Potential for installed el. capacity in MW
Manure and other agricultural residuals	758	975	95
Energy Crops	314	404	39
Sewage Sludge	66	85	8
Organic Waste	246	316	31
<b>Total</b>	<b>1,384</b>	<b>1,780</b>	<b>173</b>





### Market Assessment Slovakia Market Environment and Main Barriers

**Market Environment**

- No guaranteed access to the grid
- No special feed in tariffs for renewable energy
- No special loans available for renewable energy projects
- Regulations for the support of renewable energies are in the preparation phase, details are not clarified, yet

**Main Barriers**

- Financial viability of biogas projects cannot be achieved in the existing economic environment
- Strong lobby of fossil fuel industries constrains political support for renewables
- Technology is not available / import is too expensive
- Low level of public awareness regarding environmental issues





### Market Assessment Austria Substrate Potential for Biogas Production

Substrate	Substrate Potential in Mio. t/a	Biogas Potential in Mio. m <sup>3</sup> /a
Manure and other agricultural residuals	26.9	753
Energy Crops	6.6	1,150
Sewage Sludge	3.7	94
Organic Waste	1.2	88
<b>Total</b>	<b>38.4</b>	<b>2,085</b>

Source: Haas, 2001 and own calculations





### Market Assessment Austria Energy Production Potential

Substrate	Potential for electricity production in GWh/a	Potential for heat production in GWh/a	Potential for installed el. capacity in MW
Manure and other agricultural residuals	1,714	2,204	214
Energy Crops	2,616	3,364	327
Sewage Sludge	213	274	27
Organic Waste	201	258	25
<b>Total</b>	<b>4,744</b>	<b>6,100</b>	<b>593</b>

## Market Assessment Austria Market Environment and Main Barriers



### Market Environment

- Access to the grid is guaranteed by the Green Electricity Act
- Fixed feed in tariffs for 13 years:  
10.30-16.50 €cent / kWh depending on the electrical capacity of the biogas plant
- Subsidies and loans with low interest rates are available via the financial institution "Kommunalkredit Austria"

### Main Barriers

- The Austrian Federal Ministry for Economics and Labour has taken an initiative to revise the Green Electricity Act with the aim to introduce tender procedures for renewable energy projects

## Key Success Factors for using Fuel Cells in Biogas Applications



- The fuel cell has to outperform the internal combustion engine economically regarding the use of biogas in order to replace the currently used biogas / internal combustion engine combination by the innovative biogas / fuel cell technology.
- Governments and therefore the society have to be willing to support the innovative technology for a transition period in order to enable its further development and the realisation of its cost reduction potential.
- The fuel cell / biogas technology has to gain or further develop a positive image in public based on non economic benefits in order to qualify for the necessary political support.



## Summary and Conclusions

- A remarkable potential for the production of renewable energy from organic substrates was identified in Germany, Slovakia and Austria
- The utilisation of the potential depends on the support mechanism in place. The market environment is currently most beneficial in Germany, followed by Austria. Slovakia is still lacking appropriate support mechanisms.
- The avoidance of external costs of conventional energy systems has to be taken into account in order to provide for the necessary economic environment
- Fuel cell systems have to be developed further in order to be able to replace internal combustion engines in their combination with biogas technology



Thank you for your attention !

EBV Management Holding AG  
Staulinie 14 - 17  
D-26122 Oldenburg  
Tel.: +49 (0)441 9 25 40 - 318  
Fax: +49 (0)441 9 25 40 - 325  
[schlieker@ebv.ag](mailto:schlieker@ebv.ag)

dena – Deutsche Energie Agentur  
Chausseestr. 128a  
D-10115 Berlin  
Tel.: +49 (0)30 726 16 56-88  
Fax: +49 (0)30 726 16 56-99  
[jaensch@deutsche-energie-agentur.de](mailto:jaensch@deutsche-energie-agentur.de)