

## AMONCO: Biogas - Fuel Cells

### Objectives

The cost-effective utilisation of biogas from anaerobic digestion (AD) in fuel cells is the primary activity of AMONCO project.

The core objectives include:

- the avoidance of detrimental trace gases in biogas through optimal composition of feed-stocks,
- the advanced controlling of the anaerobic digestion (AD) process to hinder the formation of trace gases while keeping high CH<sub>4</sub> yield,
- suitable and cost-effective biogas cleaning towards the utilisation in fuel cells,
- the investigation und assessment of the performance of biogas in fuel cells,
- the development of techno- and socio-economic "market driven" implementation strategies.

### Major Work Tasks

The major work tasks of AMONCO project include the development of a knowledge based decision support tool (DST) with the capability to predict trace gases in dependence of the fermented substrates and a cost-effective cleaning process removing the significant trace gases detrimental for fuel Cell Systems.



The decision support tool (DST) assists on the one hand the operators of biogas plants in the selection of composition of input substrate causing the lowest possible concentration of trace gases.

On the other hand the decision support tool provides the ability of the in-situ control of anaerobic digestion (AD) process towards lowest concentration of trace gases while keeping a maximum yield of CH<sub>4</sub>.

### Results, Dissemination & Implementation

Expected achievements and project results include:

- The accomplished analyses on the influence of different substrates on the fractions of produced biogas provide clear guidelines for optimal substrate composition.
- Attractive concepts (neural network and expert system based on fuzzy logic) for a "decision support tool" were developed. Results demonstrate that an advanced controlling system shows higher CH<sub>4</sub> yield and perspectives for substantial improvements in predicting and influencing the formation of trace gases.
- First, a cost effective biotrickling filter was implemented, obtaining promising results for H<sub>2</sub>S removal to values under 10 ppm. Its effectiveness for halogenated hydrocarbons and siloxanes displays a good potential but also a need for further research. And second, a concept for a

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chemical gas purification system was elaborated, which is intended to achieve a sustainable removal not only of H<sub>2</sub>S, but also of siloxanes and halogenated hydrocarbons.

- In the comprehensive single fuel cell test series, the influence of trace gases (CO, H<sub>2</sub>S, NH<sub>3</sub> and siloxanes) was investigated. The test series yielded illuminative results on performance and poisoning effects on fuel cells dependent on time and concentration.
- The market assessment for biogas fuel cell applications identifies a great potential, but also some barriers to be overcome in the future (mainly the costs for investment, operating and maintenance) in order to gain higher market penetration.

The outcomes of the AMONCO project are fully in line with the EU energy policies and can support future agenda settings. A higher market penetration of biogas fuel cell systems will help to meet the targets of the Kyoto Protocol and will improve the security of supply to a great extent.

As factors for success appear this technology's characteristics, like high energy efficiency, even of small scale systems, modularity, and capability for decentralised heat and power generation. The involvement of the company MTU CFC Solution, which is possessing technology leadership in biogas fuel cell applications, in the project's dissemination activities aims at the direct exploitation of the project's outcomes.

Further market development of this technology will be based on renewable energy sources, which have a huge potential for the European Union, like organic wastes, plants and manure.

Next steps for the deployment of fuel cell technology have to be taken. Therefore the Strategic Research Agenda and the Deployment Strategy published by the "European Hydrogen and Fuel Cell Technology Platform" ([www.hfpeurope.org](http://www.hfpeurope.org)) and the 7th RTD Framework Programme are suggested to provide an ideal framework for continuous research activities.

## Project Deliverables

The project involves the following deliverables (only deliverables having a public dissemination level are shown):

- D4 - Report on Substrate analyses (PU = Public)
- D5 - Report on Biogas analyses (PU)
- D6 - Report on single cells test (PU)
- D7 - Guidelines for use of Biogas in FCs (PU)
- D8 - Results of the correlation analyses (PU)
- D10 - Record of simulation (PU)
- D12 - Report on the improvements through validation (PU)
- D15 - Handouts for the training of the personell (PU)

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- D16 - Records on substrates and Biogas quality (PU)
- D17 - Report on validity of the trained neural net (PU)
- D18 - Report of the pre-treatment of wastes (PU)
- D19 - Study about expectancy, acceptance and request of new modern biotechnological cleaning methods at large scaled Biogas plants (PU)
- D20 - Results of the biological cleaning process (PU)
- D22 - Reports on Round tables of the Business Interest Group (PU)
- D23 - Information folders for dissemination (PU)
- D24 - Pamphlets for dissemination (PU)
- D25 - Newsletter for dissemination to end-users (PU)
- D26 - Assessment of the market Biogas/FCs (PU)
- D27 - Holistic assessment to the economic efficiency of different input substrates for AD (PU)

## Business Interest Group (BIG)

A Business Interest Group (BIG) was established with the intention to implement achieved project results in further market-driven spin-off projects. The information exchange of state-of-the-art project results will enable interested companies, operators of biogas plants and other stakeholders to be among the first to implement AMONCO biogas fuel cells in competitive markets.

In 2004, two Business Interest Group meetings were scheduled. Progress and results of the project were presented and in-depth discussions were facilitated within a wider auditorium.

The first BIG meeting took place in Vienna on April 1st, 2004 in the framework of the International workshop on "Hydrogen and fuel cell based energy systems in a future sustainable energy world". The second meeting was a side event to Hamburg's "H2-Expo – International Trade Fair for Hydrogen and Fuel Cell Technologies" on September 17th, 2004.

## 2nd Business Interest Group-Meeting & Expert-Workshop "state-of-the-art Utilisation of Biogas in Fuel Cells"

### PROJECT-INFO

#### Project name:

Advanced prediction, monitoring and controlling of anaerobic digestion processes behaviour towards biogas usage in fuel cells (AMONCO Biogas Fuel Cells)

#### Client:

DG Science, Research and RTD Actions

BMBWK

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**Project start:**

1.12.2001

**Project end:**

30.11.2004

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**PUBLICATIONS**

- Presentation "Advanced Prediction, Monitoring and Controlling of Anaerobic Digestion Processes Behavior Towards Biogas Usage in Fuel Cells"  
Marianne Haberbauer, PROFACTOR Produktionsforschungs GmbH/Austria (15 pages)
- D8 - Results of the correlation analyses (14 pages)
- D10 - Record of simulation (10 pages)
- D16 - Records on substrates and Biogas quality (58 pages)
- D18 - Report of the pre-treatment of wastes (25 pages)
- D19 - Study about expectancy, acceptance and request of new modern biotechnological cleaning methods at large scaled Biogas plants (37 pages)
- D22 - Report of the 1st business interest group (BIG) meeting (58 pages)
- D22 - Report of the 2nd business interest group (BIG) meeting (58 pages)

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- D23 - Information folder for dissemination I (2 pages)
- D23 - Information folder for dissemination II (2 pages)
- D24 - Pamphlet for dissemination (1 page)
- D25 - Newsletter for dissemination to end-users (PU) I (2 pages)
- D25 - Newsletter for dissemination to end-users (PU) II (2 pages)
- D26 - Assessment of the market Biogas/FCs (45 pages)
- D27 - Holistic assessment to the economic efficiency of different input substrates for AD (52 pages)

*First published: 2003-03-28 / Last automatic update: 2005-03-15*

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