

Research & Development Support in the Field of Biogas Production and Utilization



Sixth meeting of Task 37

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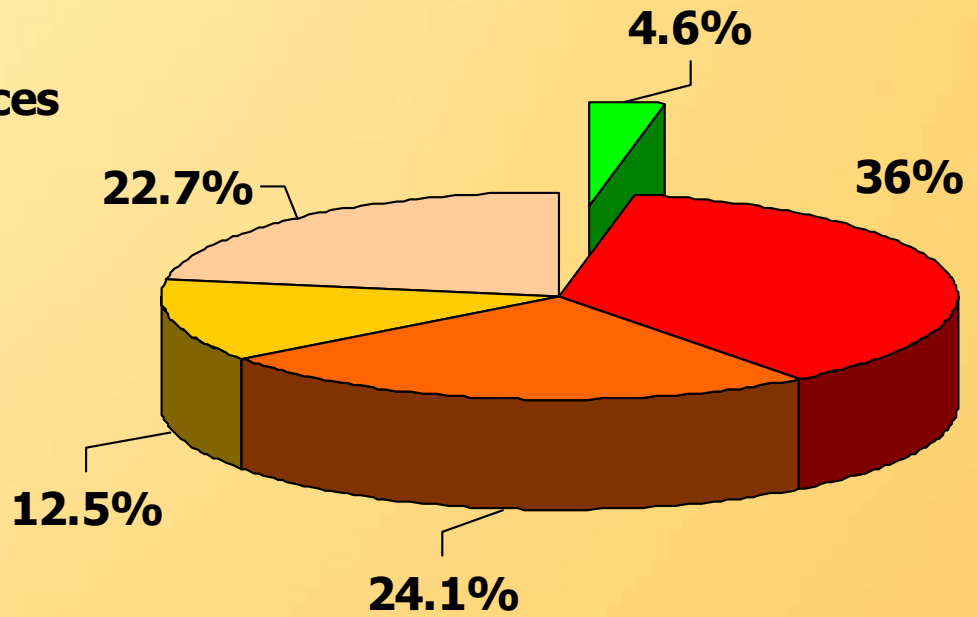


State-of-the-Art of Bioenergy

Total Primary Energy Supply 14,238 PJ
provided by Renewable Resources 652 PJ



- Renewable Resources
- Crude Oil
- Coal
- Nuclear power
- Natural gas





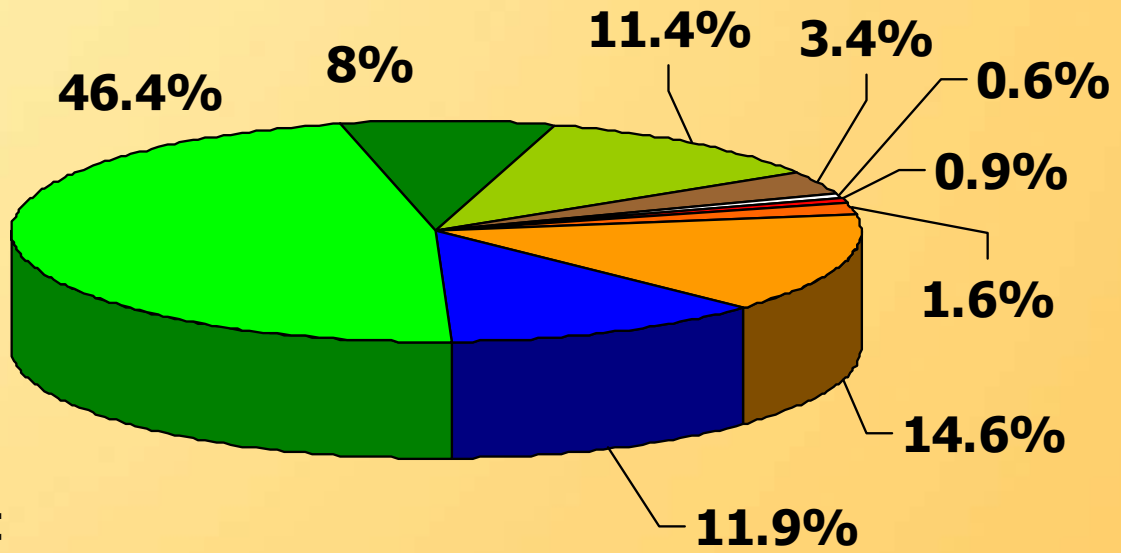
State-of-the-Art of Bioenergy

Total Primary Energy Supply 14,238 PJ
provided by Renewable Resources 652 PJ

Bioenergy: 66 %
other Renewables: 34 %



- ☐ Photovoltaics
- ☐ Geothermal
- ☐ Solarthermal
- ☐ Wind Energy
- ☐ Water Energy
- ☐ Bioenergy - Heat
- ☐ Bioenergy - Electricity*
- ☐ Bioenergy - Biofuels
- ☐ Biogenic waste



*Biogas, sewage and landfill gas

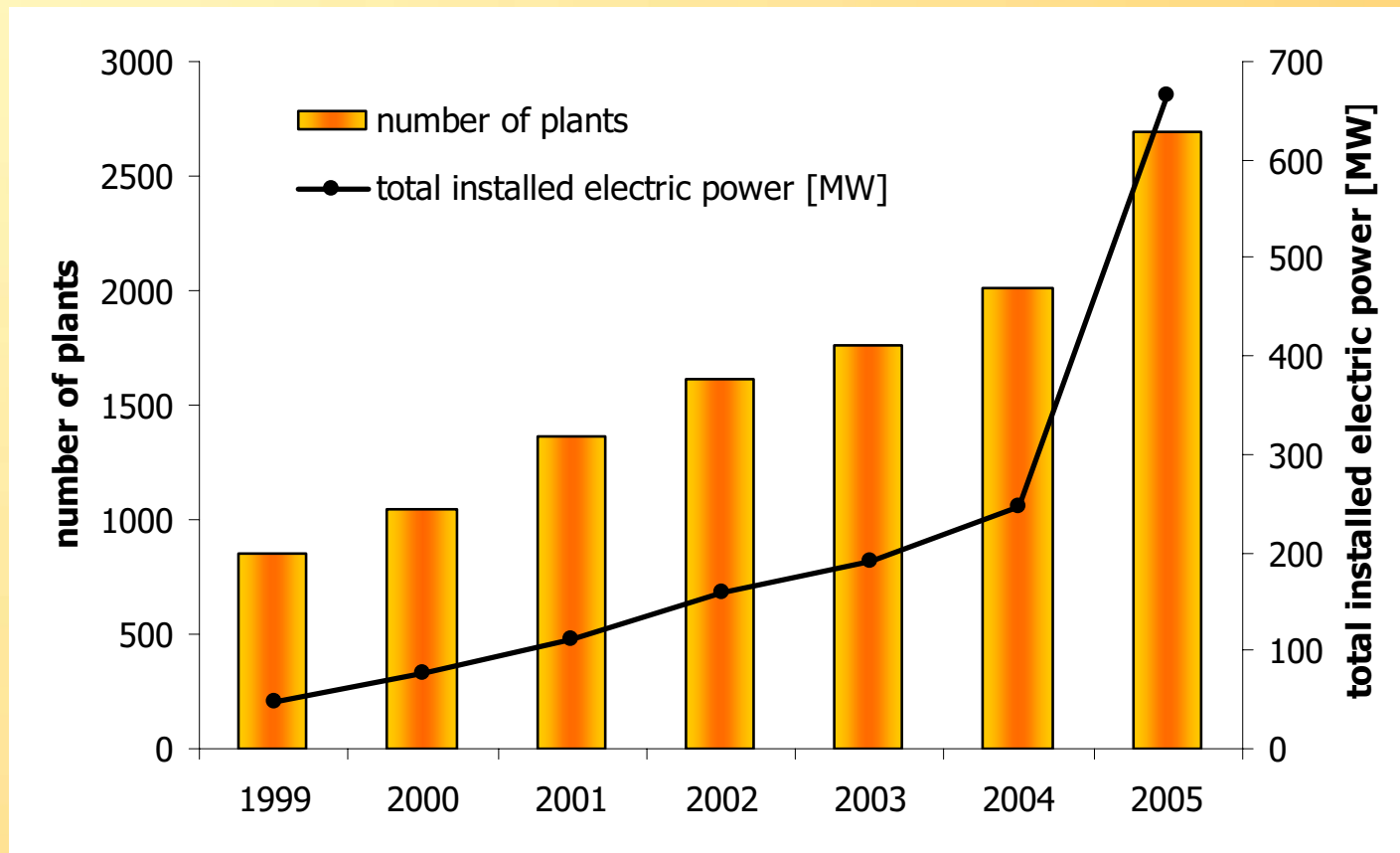
Source: BMU 2006 , Data for 2005

Biogas in Practice – Status quo

- ▶ Increasing number and dimension of biogas plants
(> 2700 biogas plants, > 650 MW installed electric power)
- ▶ Improvement of basic conditions for biogas production
 - Amendment of the Renewable Energy Sources Act (EEG)
 - Market Incentive Programme for Renewable Energy
 - Area bonus for cultivation of energy crops on basic area
(Bonus of 45 €/ha)
- ▶ Less than 10 % of the estimated biogas potential (417 PJ in 2030) is actually used for energy production
- ▶ Actually used substrates are manure, harvest residues, residues from foodproduction, potato pulp, draff, mash grape marc and energy crops
- ▶ Energy crops (e.g. maize, grass and whole crop cereal silage) gain in importance
- ▶ Growing demand for technologies to optimize the production and utilization of biogas



Development of Agricultural Biogas Plants in Germany





Renewable Energy Sources Act (EEG)

Basic payments (2006)	Cent / kWh
until 150 kW	11,16
until 500 kW	9,6
until 5 MW	8,6
over 5 MW	8,2
Boni	
Biomass bonus until 5 MW	6
Biomass bonus over 5 MW	4
Innovation bonus	2
bonus for utilisation of heat	2

Prices are guaranteed for 20 years, annual price decrease of 1.5%



Fachagentur Nachwachsende Rohstoffe e.V. (FNR)

Position:	Federal Agency for Renewable Resources, Project Management Organization on behalf of the Federal Ministry of Agriculture, Food and Consumer Protection
Formation:	Oktober 1993
Office:	Gülzow near Rostock, MV
Funding:	Federal Ministry of Agriculture, Food and Consumer Protection (BMELV)
Members:	64
Employees:	50
Legal status:	Registered association



Main Duties of FNR

- ✓ **Support of R&D and Demonstration Projects**
 - Supporting Programme „Renewable Resources“
 - Responsibility: BMELV
 - Target: nationwide support of R&D in the field of material and energetic use of RR
 - Funding budget: 27 Mio. € in 2006
 - since 2006 Guideline for Demonstration Projects „Bioenergy“
- ✓ **Market Introduction**
 - Market Introduction Programme „Renewable Resources“
 - Responsibility: BMELV
 - Target: market introduction of insulation material made of RR, biodegradable lubricants, biofuels
 - Funding budget: 26,6 Mio. € in 2006
- ✓ **Information and Consulting Activities**
- ✓ **Activities on European Level**
 - ERAnet Bioenergy, EUBIONETII, IEA Bioenergy



Applied R&D

Objectives

- Promotion of a sustainable raw material and energy supply
- Environmental protection due to resource efficiency, CO₂ emission reduction and environmentally friendly products
- Strengthens of the competition of the German agriculture and forestry as well as the areas connected to.



R&D Programme
„Renewable Resources“

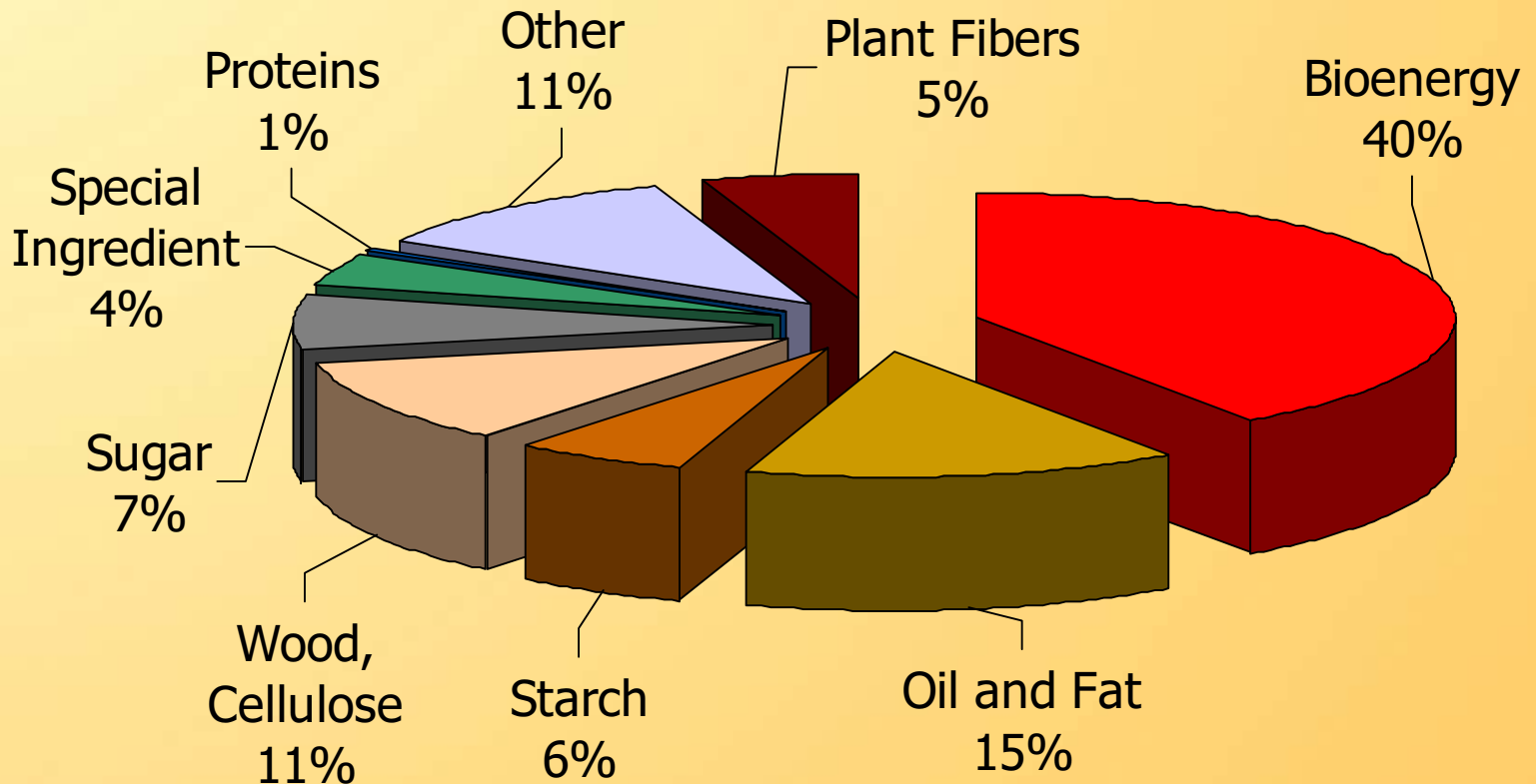


Applied R&D

Scope of currently funded projects

Funding: 70,8 Mio. €

Projects: 277





Activities in the Field of Biogas

- ✓ **Funding of R&D in the Field of Biogas (since 2000)**
 - 81 projects (**58 ongoing projects**/23 completed projects)
 - 21 Mio. € funding (**15,9 Mio.€**/5,1 Mio.€)

- ✓ **Realisation of different Workshops to identify Research Requirements**
 - „Prozessing/Upgrading of Biogas“ *June 2003*
 - „Solid State Fermentation I“ *February 2004*
 - „Process Optimization – Process control/Microbiology“ *September 2004*
 - „ Growing Energy Crops for Biogas Production“ *November 2004*
 - „ Solid State Fermentation II“ *February 2006*

R & D Targets in the Field of Biogas

Development of new energy crop production systems

- Cultivation of energy crops
- Breeding and technical improvements

Optimization of fermentation technology

- Substrat conditioning
- Microbiological investigations
- Development of prozess control systems and measuring technology



Development of new digestion technologies

- Solid state fermentation

Application of modern utilization technologies for biogas

- Fuel cell or microgas turbine
- Conditioning and injection of biogas into the gas distribution system
- Utilization of biogas as biofuel
- Development of measures to improve the utilization of heat from combined heat and power generation

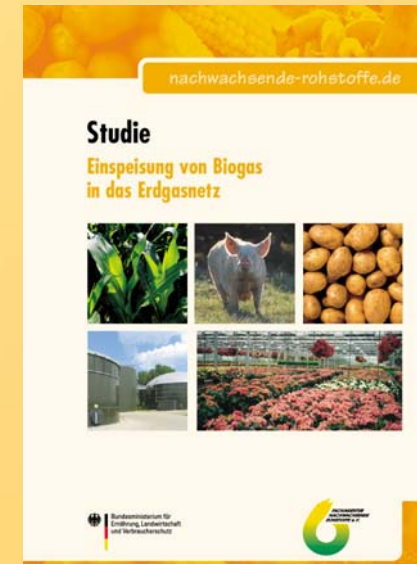
Economical and ecological valuation

Reasonable use of digestate from anaerobic digestion

Examples for R&D Projects - Biogas

Completed Projects

- ✓ Guide book biogas (IE, FAL, KTBL)
- ✓ Nationwide measurement programme of 59 biogas plants (FAL)
- ✓ Feasibility study about conditioning and injection of biogas into the gas distribution system (IE)



Examples for R&D Projects - Biogas

Ongoing Projects:

- ✓ Development of cultivation systems for energy crops (TLL u.a.)
- ✓ Research on solid state fermentation (Uni Rostock, BTN, Bauhaus-Universität Weimar, S.I.G. GmbH, ATB, IE)
- ✓ Development of measurement and control engineering (KSI, IBA, ATB, Uni Kiel)
- ✓ Continuation of the nationwide measurement programme (FAL)
- ✓ Microbiological investigations/ Use of enzymes for substrate processing (ATB/Uni Bonn, Bioreact, ASA GmbH)
- ✓ Examination of effects on natural environment (Agroplan, ZALF)
- ✓ Utilisation of biogas in a microgasturbine (Uni Rostock, Loick)
- ✓ Reformation of biogas for fuel cells (ATB)
- ✓ Study about heat utilization from combined heat and power generation (BremerEnergieInstitut, Uni Bremen)
- ✓ Utilization of digestate from anaerobic digestion (Uni Trier, IASP)

Examples for R&D Projects - Biogas

✓ Scientific Examination of different Pilot Plants:

- Pilot biogas plant with tub reactor in Clausnitz (ATB) (Fig 1)
- Pilot biogas plant with combined solid state and wet fermentation in Pirow (ATB)
- Slurry free biogas plant in Schornbusch (FAL) (Fig 2)
- Comparison of different mixing systems in Nusbaum-Freilingen (FAL)



Source: FNR 2004



Source: Schornbuscher Biogas GmbH



“Development and comparison of optimized cultivation system for agricultural energy crop production at different places in Germany”

Duration: 15.03.2005 – 14.03.2008

Coordination: Dr. Vetter (Thuringian State Institute for Agriculture)

Funding: FNR/BMELV (5.500.000 €)

The project consists of 6 different research parts:

1. Development and improvement of different energy crop rotations in different cultivation areas of Germany
2. Ecological impact of energy crop cultivation
3. Economical evaluation of energy crop production and the following utilization for biogas production
4. Research on the impact of plant species and silage production on the biogas yield
5. Irrigation impact on the biogas yield
6. Research on double-cropping system with two harvests per year



The objectives of this projects are:

Short term:

- to find the best ecological and economical energy crop cultivation system for a specific cultivation area
- improve the yield of biogas of different energy crops

Long term:

- to find the adequate alternative energy crops with the aim to substitute maize for energy production
- increase the biodiversity of energy crops in rural areas of Germany
- to create broad feedstock resources not only for biogas production but also for biofuel production

Future Prospects of Biogas

- ▶ Biogas can be supplied in considerable amounts by german agriculture. Its use reduces the dependance on energy import
- ▶ Biogas is an important energy source. Biogas can contribute an energetic potential of 417 PJ (including sewage and landfill gas), that corresponds to
 - 2.9 % of the current total primary energy consumption and
 - 8.6 % of the current consumption of electricity
- ▶ In comparison to the previous decades the political and economical framework for biogas is favourable
- ▶ Utilization of biogas save fossil resources and reduce the emission of green house gases being relevant to climate changes
- ▶ Biogas production and utilization creates values and strengthens rural areas
- ▶ Related activities in research and development will enhance the know-how and technology progress in the field of biogas production and utilization



**Thank you very much
for your attention !**

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