

International Conference on Sustainable Development of Non-Timber Forest  
Products and Services, Beijing, P.R. China, 26-28 September 2007

# Biomass for independent supply of power and heat (bio- energy) at village level

Case study: Bio-energy village Juehnde,  
Germany

Presented by Peter Schroeder, Germany



# The challenge of Forest-based bioenergy

- The International ITTO/FAO Conference on wood based bioenergy, held in Hannover (Germany) from 17 to 19 May 2007,

concluded with a number of key messages, among them:



# Key messages

- Wood-based bioenergy offers countries, including developing countries in the tropics, opportunity to improve their **energy security**
- A wood-based bioenergy sector needs to be developed on the basis of sustainable forest management (**SFM**)
- The use of wood-based bioenergy can contribute to reduce greenhouse gas emissions (**mitigate climate change**)
- Wood-based industries can use wood residues for co-generation of energy, thereby improving energy efficiency and cost-effectiveness (**strengthen business** )
- The international community should support the development of wood based bioenergy in tropical countries (**need for technical assistance**)



# Potential of biomass for bioenergy

- The ITTO/FAO Conference drew particular attention to the fact that :
- biomass offers potential for generation of „bioenergy“ at village or regional level and
- various technologies are available for generation of electric power and heat either separately or jointly (co-generation).
- supply of bioenergy , generated from local biomass resources, not only contributes to local or regional self-supply of energy but also enhances economic and social development (employment, income ,reduction of poverty etc.) .



# The EU and EU-member states promote energy from renewable resources

- At the level of the EU and in most of the EU Member states, the development of renewable energies is subject of EU-legislation and special support schemes to
  - enhance R&D on wind-, hydro-,solar-, bio- energy
  - encourage technological development
  - facilitate operation of pilot plants and
  - encourage investment in plants, infrastructure, training.



# Germany gained experience, offers examples and technical solutions

- In Germany, since more than 10 years, the utilization of forest-based and agro-based biomass as a renewable source for bio-energy has been given priority consideration at political level and in R&D - in view of its potential:
  - to contribute to energy-efficiency,
  - to improve energy-security
  - to make value-added use of available biomass, residues and waste
  - for CO<sub>2</sub> reduction and thereby to mitigate climate change



# Importance of agro-and forest-based biomass for bioenergy

- In this context, agro-based and forest-based resources for generation of bioenergy are given high priority in particular :
- **Biogas** from renewable agro-resources **for power generation (electricity)** and
- **Forest-based resources** and industrial wood residues for generation of **heat**
- **Co-generation of both power and heat .**
- Joint projects: biomass-based bio-energy with solar-,wind-,hydro-energy projects

Support schemes have enhanced strong development since a decade.

„Bio-energy village Juehnde“ –Germany (south of Hannover) has become a successful and now well known model case since 2005 .





Jühnde

Landkreis Göttingen







# Bioenergy Village Juehnde

- **Basic situation prior to the project :**
- Agro-based and forest based biomass growing in the fields around Juehnde; manure available from animal husbandry at Juehnde
- Juehnde heavily dependant on fossil-fuel based power supply from the public grid
- Juehnde dependant on fossil-fuel supply for heat (coal,oil,gas)
- Juehnde population noted rising world market prices for energy , growing supply risks and became aware of climate change risks through growing CO<sub>2</sub> emissions.
- Public financial incentives and R&D support were offered for a bioenergy village project.

In this situation, Juehnde population agreed in 2003 to apply; and its bid was successful; a cooperative business model for the project was designed to use agro-and forest biomass for a local bioenergy plant sized for local heat self-supply, combined with power generation to be fed into the public grid against payment (legally guaranteed revenue per kWh power for two decades).



# Juehnde village, key figures of project

- Population 761
- Number of households 220
- Agricultural companies/farms 9
- Cows 400
- Pigs 1500

## ***Energy consumption village/year***

2,06 Mio. kWh electric power  
6,79 Mio. kWh heat for  
households

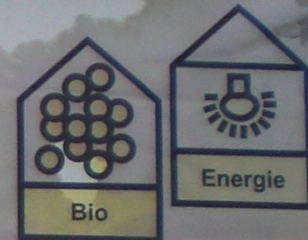
## ***Available resources***

Manure 9400 m<sup>3</sup>  
Agro-area 1300 ha  
Forest area 800 ha





# BioEnergieAnlage Jühnde



Bioenergieanlage Jühnde

Diese BioEnergieAnlage besteht aus einer Biogasanlage (Energiepflanzen und Gülle) und einem Holzhackschnitzelheizwerk. Sie dient der Versorgung des Dorfes Jühnde mit Wärme. Über ein ca. 6 km langes Nahwärmenetz werden ca. 140 Haushalte versorgt. Mit der Anlage solle jährlich 4 Mio. kWh an umweltfreundlichen Strom (doppelt soviel wie Jühnde jährlich benötigt) erzeugt werden.

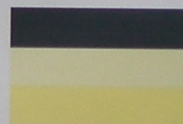
Die wissenschaftliche Begleitforschung erfolgt durch:  
IZNE Uni Göttingen, FAL Braunschweig, HAWK Göttingen

Generalplanung / Entwurfsverfassung / Projektsteuerung:  
Tannhäuser Ingenieure GmbH, Northeim

Fachplanung Nahwärmenetz:  
Gesellschaft für umweltfreundliche Technologie e.V., Kassel/Einbeck

Das erste Bioenergiedorf in Deutschland wurde mit ca. 1,5 Mio. € aus öffentlichen Mitteln gefördert. Die Gesamtbausumme beträgt ca. 5,3 Mio. €.

## Fördermittelgeber:



Bundesministerium für  
Ernährung, Landwirtschaft  
und Verbraucherschutz



Land Niedersachsen

LANDKREIS GÖTTINGEN



Gemeinde Jühnde



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# Overall bio-energy concept of Juehnde

- Fermentation to produce biogas, subsequently used for generation of electric power ( which is sold to and fed into the public electricity grid)
- Use of surplus heat from biogas-based power generation a) to feed it into the village heating grid and b) to supply supplementary heat for second stage of biogas-fermentation
- Burning of wood chips to produce heat for supply into the village heating grid
- Cooperative enterprise model: village population as shareholders and contract partner/ consumers of heat from the village grid.



# Modell of bio-energy plant Juehnde

Wood chip burning  
station (heat)

Biogas-fed power station (electricity)

Storage of agro-  
material for  
fermentation

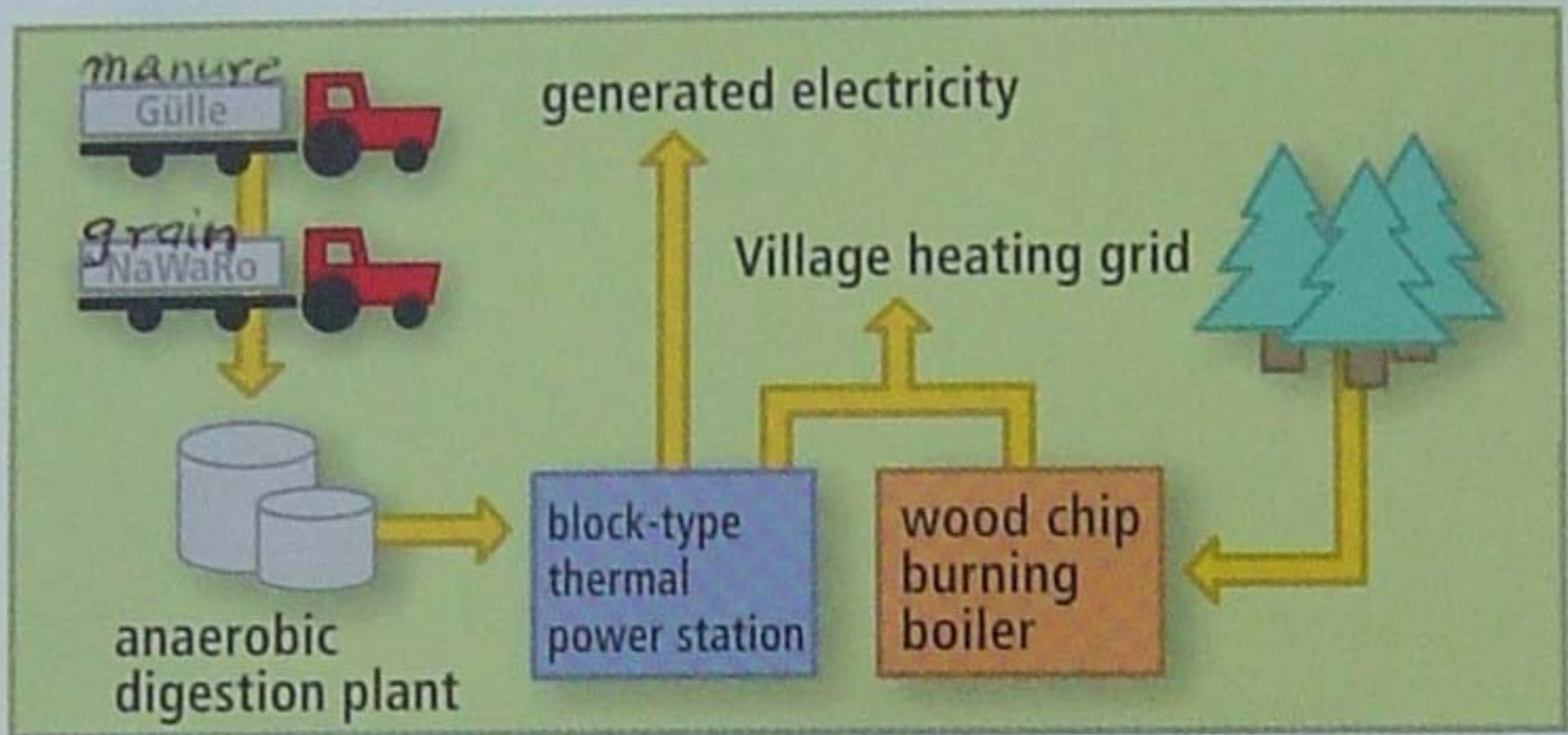
Fermenter for  
biogas

Further  
processing of  
biogas





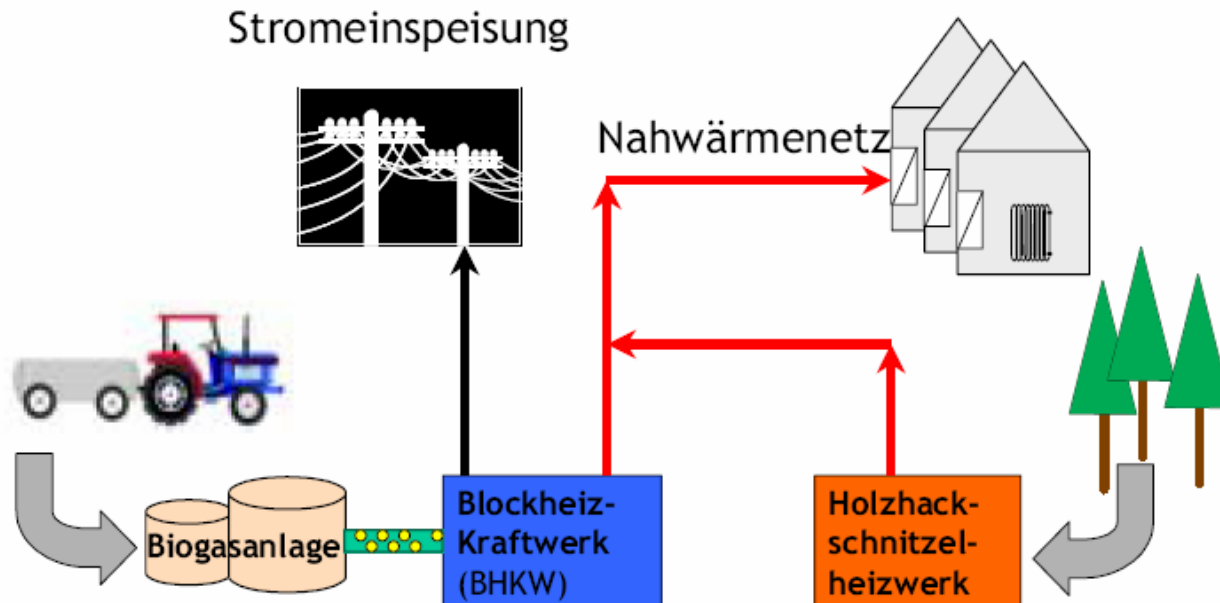
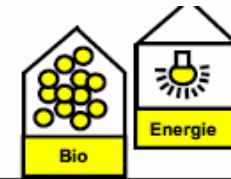
# Structure of bio-energy plant Juehnde





# Overall bio-energy concept of Juehnde

## Gesamtkonzept Bioenergiedorf Jühnde



03.Oktober 2003

7

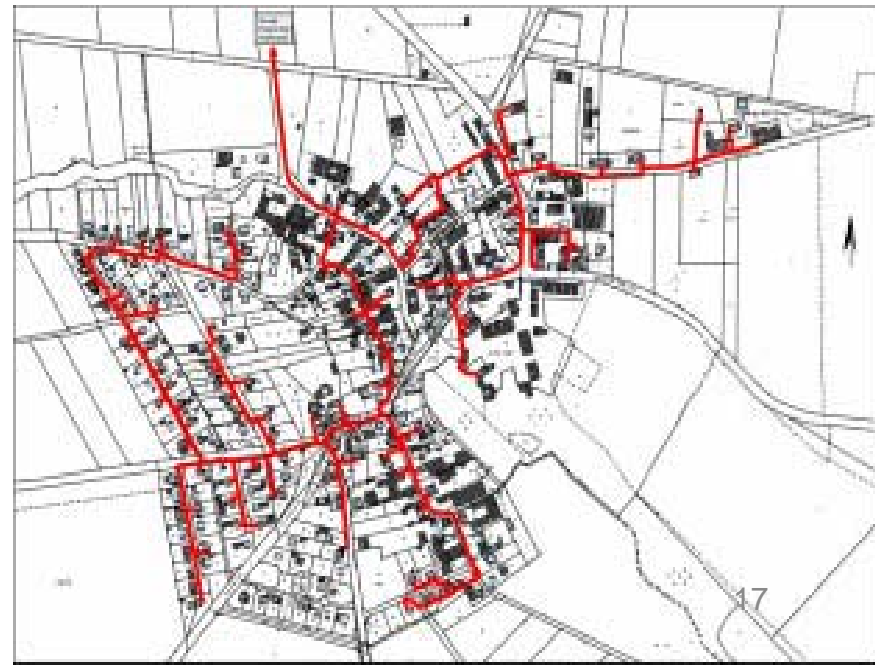
Bioenergiedorf Jühnde GbR/Fangmeier



# Explanation of bio-energy plant

The plant has three essential components:

1. Anaerobic digestion plant (biogas) with a block-type thermal power station (electricity)
2. Wood chip burning boiler (for heat to supply households)
3. Village heating grid





## Explanation of **section central heating grid**

The village central heating grid has capacity of 3.500.00kWh/year to cover Juehnde's overall need of heat

The grid consists of 6000 m of pipes and supplies up to 200 household on contractual basis

Juehnde households who receive heat supply on contractual basis and at preferential rates as consumers are at the same time shareholders of the Bioenergy cooperative which runs the total operation with profit.



## Explanation of **section fermentation** for production of biogas

- silage (of corn, grain etc) and liquid manure (from local cattle/pig raising) are fermented by anerobic digestion to produce biogas (methane)
- biogas is used to feed the block-type thermal power station to produce electricity
- electricity is supplied into the public grid (revenues returned to Juehnde cooperative)
- surplus heat from biogas powerstation is fed into the village heating grid



















## Explanation of section fermentation for **production of biogas**

- Technical details:
- Fermenter has 700 kWel. capacity; 3000 m<sup>3</sup> volume ;24 m diameter; 8 m high
- Storage area 5.200 m<sup>3</sup> ; silo for 8.000 m<sup>3</sup>; pit for 280 m<sup>3</sup>
- Fermenter needs per year 10.000 m<sup>3</sup> liquid manure and 12.000 t of renewable biomass (wheat, rye, triticales, corn, sunflower and agro- residues)
- About 4.500 000 kWh of electricity generated per year and fed into public power grid
- About 3.000 00 kWh of surplus heat from power station is fed into village heating grid covering 67 % of annual heat demand







## Explanation of **section wood chip burning** for heat production

. Wood chips are burned to supply heat for central water heating grid of Juehnde

Wood chips are supplied from local forest area , stored, air-dried and kept in storage of 250 m<sup>3</sup> for supply of wood-chip burner

The wood chip burner (oven) has 550 kWth capacity;

Total heat production for local grid is 1.200.000 kWh /year (32 % of local heat demand) at 80 degree C. is stored in isolated tanks

For emergency purposes a fossil fuel fed oven is available































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# Achievements

**Aspects/objectives that have been achieved with the co-operative project/case of Bio-energy Village Juehnde:**

- . Sustainable economic use of **local renewable resources for local energy supply** at equitable price level
- . Contribution to maintain **local demand for locally produced agro-and forest-based resources**
- . **Use of value added and job opportunities** to strengthen the local and regional economy; substitute fossil-fuel based power and heat supply by renewable biomass-based energy; increased energy **supply security**
- . **Contribution to protect** natural resources , climate, soil , water and biodiversity through sustainable use of renewable biomass for energy

**Strengthening solidarity and community** thinking at village level.







## Conclusions and recommendations

- The case of Bio-energy village Juehnde may serve as a basis or example for consideration of similar project approaches in other ITTO/FAO Member countries.
- NTFP , including bamboo, rattan, and other biomass resources could be subject of similar local or regional projects of bioenergy generation.
- **Timber** as forest product , wood-residues from sustainable forest management and industrial processing  
as well as **NTFP** and residues obtained during exploitation , processing, manufacture , extraction or other transformation  
both (Timber and NTFP) and their residues qualify as „biomass for energy generation“.  
Markets will offer the indicators to decide on the most economic options to use Timber, NTFP and residues :
  - a) As resource for timber products or products from NTFP **only**  
**or**
  - b) As a resource for timber products **and** NTFP products **and** for bio-energy .



## Summary

1. I Thank you for your attention  
and now
2. I suggest that you consider the bioenergy options as  
case for your country, region and/or company.