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German Biogas Association Association Allemande du Biogaz Asociación Alemana de Biogás www.biogas.org

# Options, structures and examples for biogas self-consumption

Frank Hofmann Consultant International Affairs, German Biogas Association



## **Community based bioenergy in Thailand**

Fachverband BIOGAS

- 3 types of bioenergy available:
- Anaerobic Digestion (biogas) Sources: manure, agriculture residues, industrial residues, organic wastes
- ► Focus of this presentation!
- Solid biomass
  Sources: wood, paper, Municipal Solid Waste (MSW)
- Liquid Biofuels Sources: Oily seeds (biodiesel), starch (bioethanol)







### Possibilities for the use of biogas





## Size of biogas plants



#### Biogas plants can be built at nearly any size:

- Domestic biogas plants (domestic digesters):
  - Small volume, from some liter to some m<sup>3</sup>
  - Low amount of biomass needed; some kg to some ton per day
  - Low biogas production
  - Cheap; some hundred until some thousand €

- Industrial scale biogas plants:
  - Bigger size, high biogas production
  - Electricity generation or bio methane as transportation fuel production
  - Biomass 5 up to 100 ton per day needed
  - Higher investments; some 100 k€ until some M€

## Domestic digesters: Example Ökobit





01 Input	Organic waste is fed into HoMethan
02 Manhole	A special gas-tight opening facilitates installation and maintenance
03 Output	The output is a valuable and high quality biofertiliser
04 Agitator	Stirring increases the overall efficiency of the biogas production process

## **Domestic digesters: Example Ökobit**

- Input 200 kg/d
- Manure and agriculture
- residues
- 5 m<sup>3</sup>/d Biogas
- About 25 30 kWh/d
- Similar to 2 kg/d LPG
- Investment costs 2000 €







## Under which conditions might industrial biogas plants be interesting for Thailand?



- Biomass availability
  - High amounts of biomass? Some thousand tones per year
  - Interesting groups:
    - Big farmers: animals (manure), fruits (residues),...
    - Municipal waste: organic fraction, canteens, restaurants,...
- Off grid situations
  - Black outs vs. biogas CHP runs reliable for above 8,000 h/a
  - Conventional electricity production might be expensive in rural areas due to fuels transportation cost and small installations
  - Biogas can be produced locally, no fuel costs only investment (capital costs) and plant operation

## Example: municipal waste treatment biogas plants



- Waste treatment is a challenge for each community
- Landfilling or dumping has negative consequences
  - Methane emissions ► Climate change
  - Wash out effects to ground water: heavy metals, nitrate,...
  - Hygienic problems: pathogens on / due to landfills
- Waste can be treated by the following technologies:



## Example: municipal waste treatment biogas plants II



- Important issue: Who is responsible?
  - Waste collection
  - Waste treatment, e.g. is dumping allowed?
  - Waste treatment (biogas) plant
  - Digestate / fertilizer quality
- Only the organic fraction of the waste can be digested
  - Option 1: Separation at the source, households
  - Option 2: Technical separation in the biogas plant
    - Magnetic => iron containing materials
    - Blower => plastics, paper
    - Water tank => separation of floating, sinking layers from "diluted" material
    - Sieves: All material which passes the sieve is pumped into the digester
  - Option 3: Dry fermentation, partly feedstock separation

## Example: Biogas waste treatment plant in Berlin



- Organic household wastes are collected
- Digested in the biogas plant
- Biogas is produced
- Biogas is upgraded to bio methane quality
- Collection truck fleet is operated with bio methane from the biogas plant
- Nutrients are recycled and spread on the field
  - Liquid fertilizer
  - Compost

## **Biogas for own consumption?**

#### Domestic biogas is usually used for

- Cooking (some burning hours per day) and
- lightning for
- one or sometimes for more households







Source of the pictures: myclimate.org

## **Biogas for own consumption?**



At industrial scale:

- Production of electricity and heat for own consumption through a CHP
- Electricity
  - Own consumption, reduce the own electricity bill
  - More than own consumption: Share in community, sell or grid connection
- Heat
  - in Germany new biogas plants are obliged to have above 60% of useful heat use!
  - Own heat demand:
    - Warm water,
    - drying processes cereals, wood
  - Sells to
    - industry (process heat), cleaning, sanitation
    - neighbors, hotels, etc.
- Cold, heat, biogas or electricity can be used to generate cold

## **Biogas for own consumption?**



- Biogas to biomethane?
  - Only interesting for high volume rates; high investment needed (M€)
  - Result is (pure) methane which can be used
    - Transportation fuel
    - Compressed biomethane (substitute for CNG); e.g. as bottles 250 bar can substitute LPG, CNG, kerosene in households



## Biogas, storage and transportation?



Industrial scale biogas plants

- Biogas production between 30 5,000 m<sup>3</sup>/h
- Gas storage typically for 4 to 8 hours of production
- Bio methane injected into the gas grid: storable and transportable
- Bio methane in pressurized cylinders (250 bar)
  - Storable
  - Transportable

## Conclusions



- The energy transition in Germany shows that RE can be the basis for energy production within a decade
- Biogas is flexible, storable and can be used for various purposes:
  - Electricity
  - Heat
  - Transportation fuel
  - Substitution for fossil energy, like natural gas, LPG, kerosene
- Biogas in Thailand
  - Domestic biogas: Availability for many persons but low energy production
  - Industrial scale: If biomass is available, electricity or transportation fuel production

### **Information material**



#### biogas.org



#### german-biogas-industry.com



## **Information material**

Biowaste to Biogas

<u>http://biowaste-to-biogas.com/</u>

Biogas knowledge compact

 <u>http://www.biogas.org/edcom/webfvb.nsf/id/DE\_P</u> roduktuebersicht/\$file/Biogas%20Wissen\_eng.pdf

"Biogas an all-rounder"

• http://www.german-biogas-industry.com/







## Thank you for your attention!

