AGROPTI-gas

Demonstration of an optimised production system for biogas from biological waste and agricultural feedstock

A project implemented through financial assistance from funds of EUROPEAN COMMISSION – DG Tren 5th FW Programme
Main objectives

To demonstrate:

• Co-digestion of source-sorted municipal waste and energy crops in a large scale system
• Biogas from waste and crops as a competitive vehicle fuel
• Recycling of municipal waste as a high-quality organic fertiliser in conventional and organic farming including advantages for farmers to participate in such systems.
Why combine energy crops and organic waste?

The farmers perspective
• Improvement of soil fertility when e.g. grass/clover are introduced in cereal dominated crop rotation systems
• Improve economic conditions for biogas production by gate fee from waste
• Farmers will have new possibilities as hired contractors for coordinated harvest and ensiling

The municipalities perspective
• Better acceptance of digestate as organic fertiliser when farmers deliver feedstock
• Facilitates municipalities in reaching sustainable targets (e.g. CO₂ reduction, recycling of food waste)
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Västerås biogas plant (AGROPTI-gas)

14 000 tonnes source-sorted municipal solid waste
4 000 tonnes grease trap removal sludge

5 000 tonnes ley crop
300 ha

N: 150 tonnes
P: 30 tonnes
K: 100 tonnes

15 GWh = 1500 m³ petrol
23 GWh incl. sewage gas

Solid digestate: 6 500 t
Liquid digestate: 15 000 t

14 000 ton källsorterat hushållsavfall
4 000 ton fettavskiljarslam
Mälarenergi

20%

Vafab

40%

Swede Agri-Invest (LRF)

20%

"The Växtkraft company"

Agreement between the 17 farmers for coordination of their participation in the Växtkraft company (20% of the company’s share-capital)

Farmer Farmer Farmer .....
10 ha ley crop

10-20 km to biogas plant

1000 m³ digestate storages
• Clover (27%), timothy (25%), fescue (25%), cocksfoot (10%) and ryegrass (13%)
• Harvest 2-3 times per year
• 2-3 year
• Approx. 15% is grown on organic farms (4 of the 17 farmers)

Mower conditioner: 10 ha/h
9 m working width → 1 swath (pre-wilting)
Precision chopping (15 mm) into 40 m³ containers
11 tonnes/container
1 container ⇔ 1 ha
Capacity of chopper: 7 containers/h
Loading containers to truck at the side of the field
3 containers/truck (max 40 tonnes)
ca 20-30 min for loading truck with 3 containers
2 trucks used for transport to biogas plant
4-5 containers/h
ca 20 min for transport to biogas plant
Ensiling on 7000 m² storage place at biogas plant
Packing machine (self-propelled) 100 tonnes/h
Bag silos: diameter 3.5 m, length 90 m
1st harvest: 3200 tonnes (340 ha) 7 active days
2nd harvest 2800 tonnes (300 ha) 6 active days
Total capacity ca 50 ha/d (10-16 h)
Model for energy crop handling

- **Overall input**
  - Dry matter content
  - Yield data
  - Start date for first harvest

- **Input for fields**
  - Size
  - Shape
  - Distances

- **Input for machines**
  - Width laid in swath
  - Work speed
  - Transport speed
  - Time to change container

- **Input for transport**
  - Number of trucks
  - Number of trucks with trailers
  - Loading time
  - Unloading time

- **Costs input**
  - Price/ha for mowing
  - Price/h for chopper
  - Price/h for trucks
  - Price/h for bagger

- **Time to transport**
- **Time to chop**
- **Machine capacities**
- **Transport capacities**
- **Prognosis of the total time to chop and transport**
- **Timeliness cost**
- **Total costs**
The AGROPTI-gas project includes:

- Biogas plant for treating organic waste and agricultural crops
- Plant for up-grading the biogas to vehicle quality and filling stations
- Pipelines for transportation of raw and purified biogas
- Storage for ensilage and system for harvesting and handling ley crop
- Storages and handling system for digestion residuals
Source-sorted municipal solid waste
Ley crop
grass/clover
Vafab delivers source-separated, clean organic waste

Biogas is bought from the sewage treatment plant

In the Växtkraft-plant, the waste and ley crop is treated and the biogas is up-graded to vehicle fuel

Individual farmers grows ley crop and uses digestion residuals in plant cultivation

The Växtkraft company sells vehicle fuel, and biogas for production of electricity and heat
Storage for solid digestion residuals and reject material

Digester

Bio filter

Storage for liquid digestion residuals

Receiving-hall

Entrance for trucks with waste and crops
Gryta, Biogas plant and plant for up-grading of the biogas to vehicle fuel

Hökåsen

Bus depot, refuelling of buses, refuse collecting vehicles and cars

Sewage treatment plant
Digestion residuals

- Digestion residuals are obtained in one liquid and one solid phase
- Are accepted for the usage in organic farming and conventional farming
- Are stored close to the fields
- The Växtkraft company transports the digestion residuals to the storage facilities
- The farmers get digestion residuals in proportion to the acreage of ley crop
- The digestion residuals potential is utilized by using modern spreading technique
- It is up to the farmer how the digestion residuals are used
WP8. Hanteringssystem

- Utvärdera/dokumentera kapacitet och resursbehov i hanteringskedjan
- Identifiera ”flaskhalsar” i olika delar av hanteringssystemet (fokus på vallgröda och biogödsel)
  - Samla data på utrustning, maskiner, geografisk data för enkel modell
  - Undersöka möjligheten att använda GIS-verktyg för beskrivning
  - Jämföra/verifiera framtagna bedömningar på flaskhalsar genom intervjuer
Biogas till fordonsgas

GWh/år

2003 2005 2007/08 2010
Model for energy crop handling

- Transport system design
- Distance from field to storage
- Dry matter content
- Dry matter yield

- Harvest time and costs
- Timeliness – comparing the value at the time of harvest to the value at optimal harvest time