Cooperation - key to developing regional biogas projects in Sweden






Content

1. Introduction to JTI
2. Using JTI as an example of public-private partnership
3. Services and resources at JTI
4. Example project
5. Production costs and sales prices - to set the back drop
6. Where are we now – Swedish biogas statistics
7. How did we get there?
   a) Policy drivers
   b) Incentives
   c) Cooperative effort
   d) The hen or the egg…first comes the market
   e) How to get the first project up – the Uppsala example
   f) Final tips
8. Thank you an contact information

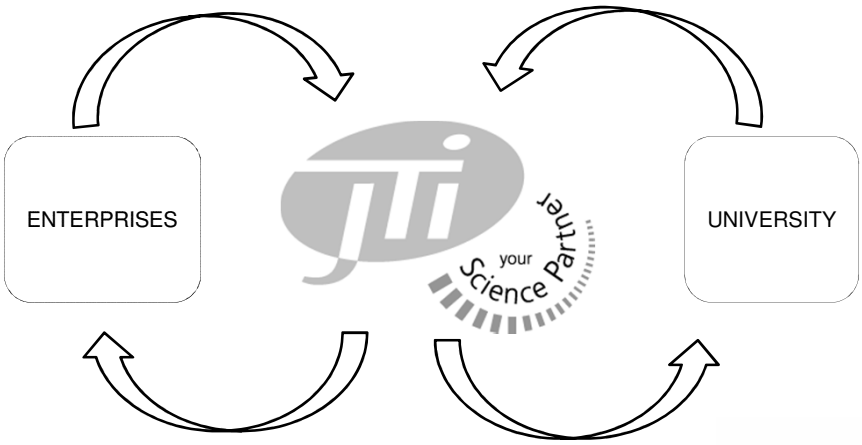
JTI – Swedish Institute of Agricultural and Environmental Engineering

An agricultural engineering institute with
a distinct environmental and energy profile

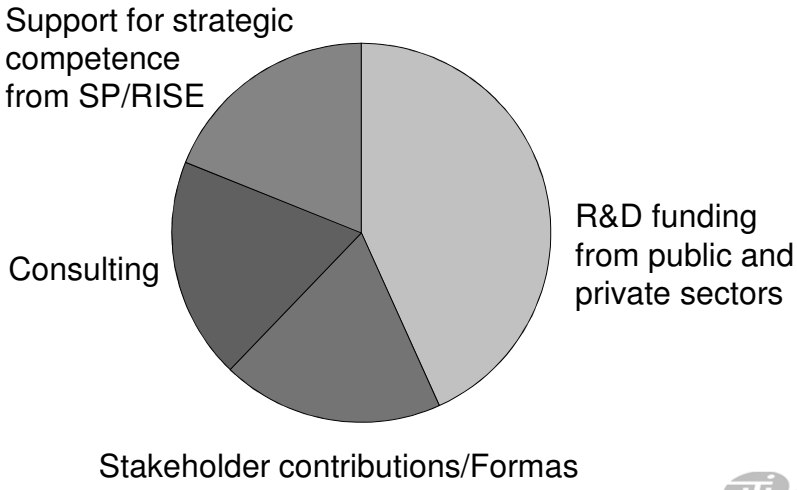
part of the SP Group

2012-02-08

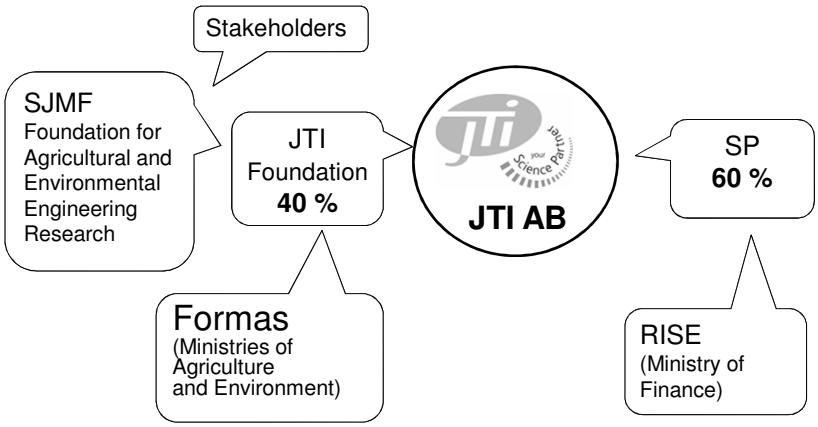
JTI is the link



Annual turnover of $ 6 M CAD



Owned by Industry and the State



Stakeholders in JTI

AGCO
Agria Djurförsäkring
Agro Miljö, Norge
Akron-maskiner
Biosling
Bjärefågel i Torekow
Browik Installation
DeLaval International
Dina Försäkringar
Disperator
Götene Gårdsgas
HIR Malmöhus
HS Förbund
HS Kristianstad
Ideon Agro Food
Jordbrukstekniska föreningen
Kommunal
Lantmännen R & D
Lovang Lantbrukskonsult
LRF
Länsförsäkringar
Partnerskap Alnarp
Perstorp
Ragnar Sellbergs Stiftelse
Ranaverken
Rekordverken Sweden
SITA Sverige
SLA, Skogs- och Lantarbetsgivareförb.
Sveaverken
Svebio, Svenska Bioenergiföreningen
Svensk Mjölk
Sveriges Frö- och Oljeväxtodlare
Tekniska Verken i Linköping
Tornum
Uppsala Vatten och Avfall
Vafab Miljö
WSP Sverige
Växjö kommun
Överums Bruk

JTI´s areas of expertise

- Waste- and sewage management
- Energy production and efficiency
- Livestock and nutrient management
- Machinery and safety
- Crop production




JTI Biogas

- Biogas research and development since 1978
- The biogas group consist of 9 full time staff
- We work in all areas of biogas production
- We provide:
  - Desktop feasibility studies and process optimization evaluations
  - R&D projects at lab-, pilot- and full-scale
  - Prototype construction and testing

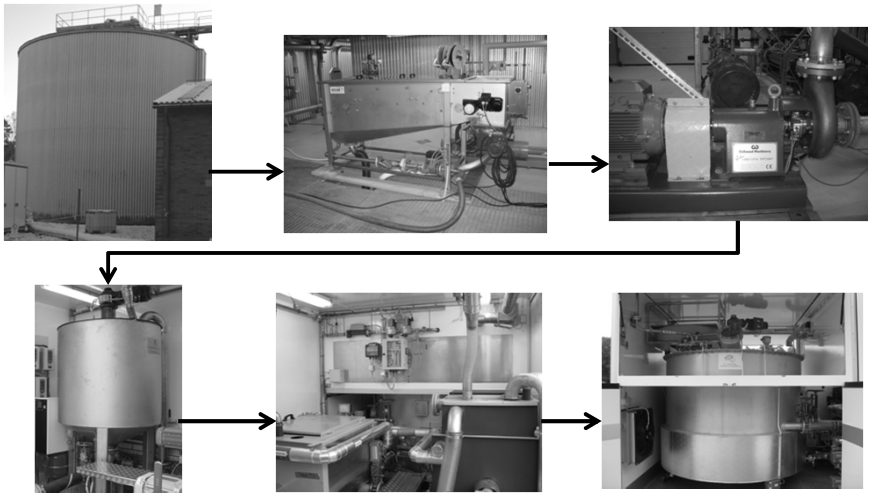
JTI Resources

- Experienced researchers
- Extensive database of biogas data
- Excellent lab facilities
- Both fixed and mobile pilot plants
- Direct access to a full scale plant
- Well equipped work-shop

Example project

- Helping Växjö municipality to evaluate two different options for process re-configuration to enable co-digestion of sewage sludge and food waste
- The mobile pilot plant acts as the second digester in a test of two-step digestion and energy efficient pasteurization

Example project



Project setup: From the digester at the WWTP to a dewatering unit (from 3 to 9 % DM) and on to a mincer, then in to the mobile pilot plant where the sludge goes from the reception tank to the pasteurizer units and finally to the digester.

Example project

Results:

- 17 % more raw biogas from already existing feedstock
- Secondary digestion “pays” for pasteurization energy
- Energy efficient and affordable pasteurization provides for the ability to accept food waste
- Now the municipality can start source separation project for household organics
- Accepting food waste will double biogas output
- Now there is enough biogas to motivate conversion of the whole public transit fleet to biogas busses

Swedish cost statistics ($ CAD)

Typical costs (centralized biogas production from SSMO and food processing waste, approx. 35 000 tpy)

- Production cost raw biogas – 0.04 / kWh
- Upgrading cost from biogas to biomethane – 0.02 / kWh
- Transportation of feedstock to plant and digestate to farms – 0.05 / kWh
- Distribution of biomethane to fueling stations - 0.04 / kWh

Total cost at pump – 0.15 / kWh

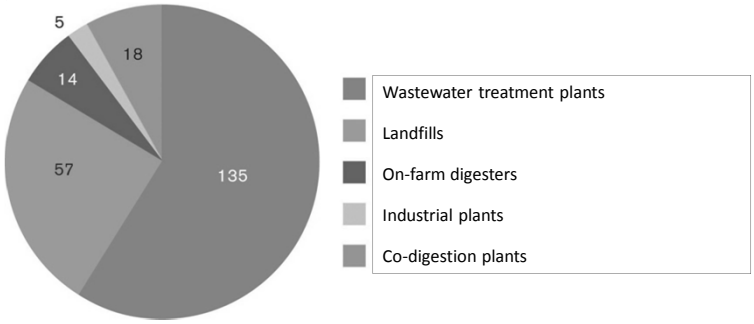
Sales price

- Gasoline at the pump – 2.2 / l (0.24 / kWh)
- Diesel at the pump – 2.1 / l (0.24 / kWh)
- Biomethane at the pump – 2 / Nm3 (0.21 / kWh or 1.8 / l gasoline eqv)

Swedish biogas statistics

Biogas plants

Number of plants



47 upgrading plants (33 water scrubbers, 7 PSA and 7 Chemical absorption)
6 injected to the national grid, 9 injected into local gas grids, the rest is distributed by truck to fueling stations

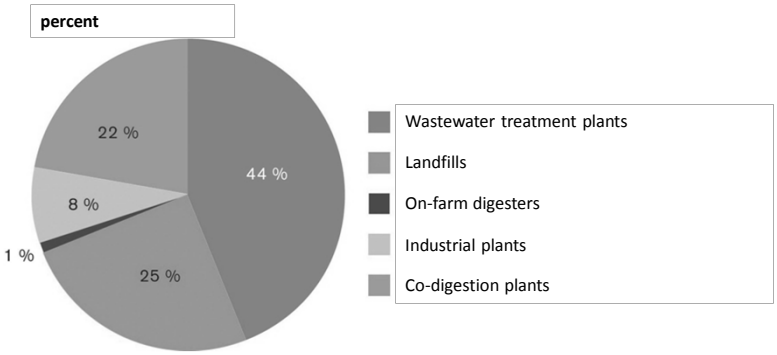
Swedish biogas statistics

Substrate use for biogas production in Sweden, metric tons wet weight

Plant type	Food waste (SSMO)	Sewage sludge	Manure	Food processing waste	Slaughter waste	Energy crops	Other
WWT Plants	44 807	5 700 000[1]	0	65 609	0	11 756	93 610
Co-digestion plants	103 725	0	136 638	66 554	114 954	27 138	141 743
On-farm plants	150	0	63 250	800	2 500	0	200
Total	**148 682**	**5 700 000**	**199 888**	**132 963**	**117 454**	**38 894**	**235 553**

Swedish biogas statistics

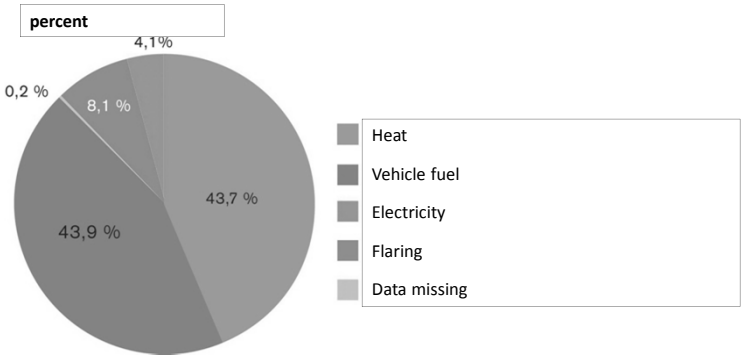
Biogas production



Total production 1387 GWh

Swedish biogas statistics

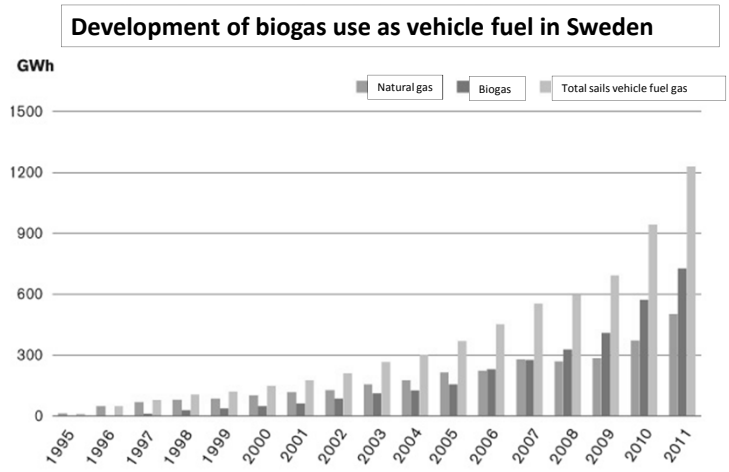
Biogas utilization



Biogas upgraded to vehicle fuel increased by 25% between 2009 and 2010. The increase continued during 2011

In 2011, the Swedish biogas fleet consisted of 36528 cars, 552 trucks and 1529 busses. Since 2008, the fleet has more than doubled

Swedish biogas statistics



Swedish policy drivers

A number of both national and local policy drivers that facilitates development of biogas production and distribution exist

- National environmental goals
- Ban on landfilling organics
- National targets for source separation of organics
- Carbon tax / biogas exempt
- Requiring alternative fuel pump at large gas stations
- 5 years of road tax exemption for biogas vehicles
- Explicit preference given to biogas vehicles when tendering for municipal and regional fleets and services (busses, taxi, recycling collection, home care, etc.)
- Free parking and road toll exemptions for biogas vehicles
- Reduced benefit tax on biogas fuelled company cars

Swedish incentives

To go with the policy drivers Sweden has seen a number of incentive programs come and go – and some we are still waiting for…

- Cost share programs for:
  - large GHG-reducing infrastructure projects ($100M CAD)
  - small-scale agricultural biogas plants ($30M CAD)
  - pre-commercialized biogas technologies ($22M CAD)
  - building biogas fueling stations ($22M CAD)
- Environmental car check ($1500-6000 CAD / car)
- Discussion about a methane reduction incentive for manure based biogas production ($0,03 CAD / kWh raw biogas). We are looking forward to this one!!

How did we get here??

It all started with a handful of plants in the mid 90-ties and now we have 18. The key to success has been cooperation

- Political agreement across party lines at local level is crucial
- Municipal and regional governments drive development by:
  - explicit requirements in tendering processes
  - operations directives to municipal corporations
- Broad based local/regional planning projects involving all stakeholders
- Long term contracts for feedstock delivery and biogas production, distribution and utilization as well as digestate use are drawn up

What comes first the hen or the egg??

Create your own market for biogas by gradually converting the municipal fleet to biogas vehicles

Use fossil natural gas as a transition and back-up fuel

Build up the biogas production in steps

The Uppsala example
– what do you do if you are one of the first?

The development of biogas production in my home town of Uppsala is a real life example of how to get the first plant up without an existing market for biogas.

First busses was tried in 1995 and first plant built in 1996 based on slaughter waste

WWTP and biogas plant shares an upgrading unit

Expanded in 2008 – now based on SSMO – 50 000 tpy

Today 66 city busses, taxi fleet and private cars run on the biogas from the plant

Common progress of implementation when you are first:

1. Local transit providers orders biogas vehicles (NGV) to fit first phase of biogas production

2. Fuelling stations for local busses and one biogas pump for cars are built with natural gas back-up (starting small but having space for more)

3. If the wastewater treatment plant already have biogas production build an upgrading facility with over-capacity there

4. Start source separation project for municipal organics

5. Start running biogas vehicles on a mix of natural gas and whatever upgraded biomethane you can get from the wastewater treatment plant

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Continues from previous slide:

6. Construct first phase pre-treatment facility for source separated organics and anaerobic digsters as close as possible to the waste water treatment plant and the upgrading plant 7. Link the biogas plant to the upgrading facility at the wastewater treatment with a local gas grid

8. Face out natural gas at the fuelling station as the biogas production and upgrading ramps up

9. Build out biogas vehicle fleet and production capacity gradually as public support, feedstock supply, available space and digestate use allow

Some other tips:

- Use the advertisement space on transit vehicles to get the positive message out to tax-payers
- Use local air quality arguments – reduction of particulates, NOx, SOx and ground level ozone compared to diesel busses (hits closer to home than GHG-arguments)
- Allow the public (early adapters) to fuel at the biogas pump – this gives you ambassadors in the community and will in time build the biogas market and allow you to build more biogas pumps

Thank you for your attention!

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