



Large Scale Agricultural Bio-Methane Production

Peter Undén
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◆ **Business Model:**

- ◆ Own and Operate bio-methane plants.
- ◆ Operate and Optimize biogas and bio-methane plants with profit sharing.
- ◆ Project management and operational support for farm-size biogas plants.

◆ **Leading long-term experience from stable and high load operation within:**

- ◆ Biogas from Waste Water Treatment Plants.
- ◆ Biogas from Industrial Organic Wastes (Slaughter house, food waste, etc)
- ◆ Biogas from Agricultural Organic Substrates (Ethanol stillage, crops, etc)



- 15 years experience from process-, production, and market development of bio-methane to vehicles.
- 3 production plants, 13 public fuelling stations, and 1 bus depot.
- Bio-methane sales represent ~6% of the total vehicle fuel volume in Linköping.
- Bio-fertilizer is sold to farmers and replace fossil fertilizers.
- Employs >40 persons in production, process, and market, of which 9 persons within Swedish Biogas.
- Process development within Biogas Center of Excellence.
- Export of knowledge, patents, and production concepts through Swedish Biogas International AB.



Development from Linköping



WWTP sludge

- Available in most cities and likely to be under utilized
- Focus on increased digestion of sludge to get more biogas, reduce handling- and operational cost.



Industrial Organic Waste

- Industrial organic waste is treated to generate biogas and certified bio-fertilizer.
- Focus on stable treatment process and reduced handling costs.

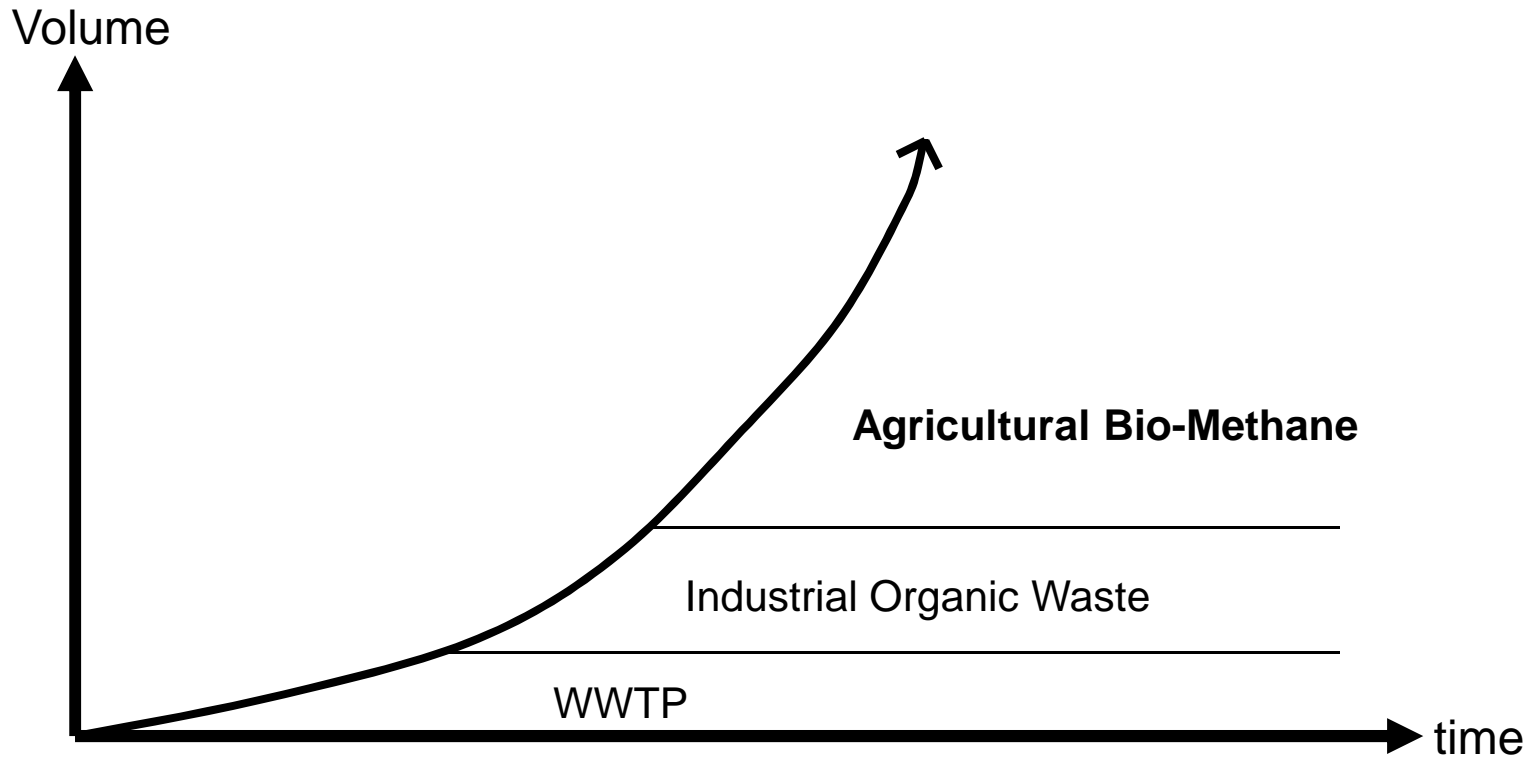


Agricultural Organic Substrates

- Industrial clean wastes, stillage, crops, etc are bought to generate biogas and ecological bio-fertilizer.
- Focus on increased energy efficiency and diversification.
- Manure is treated to generate internal energy and reducing handling costs.



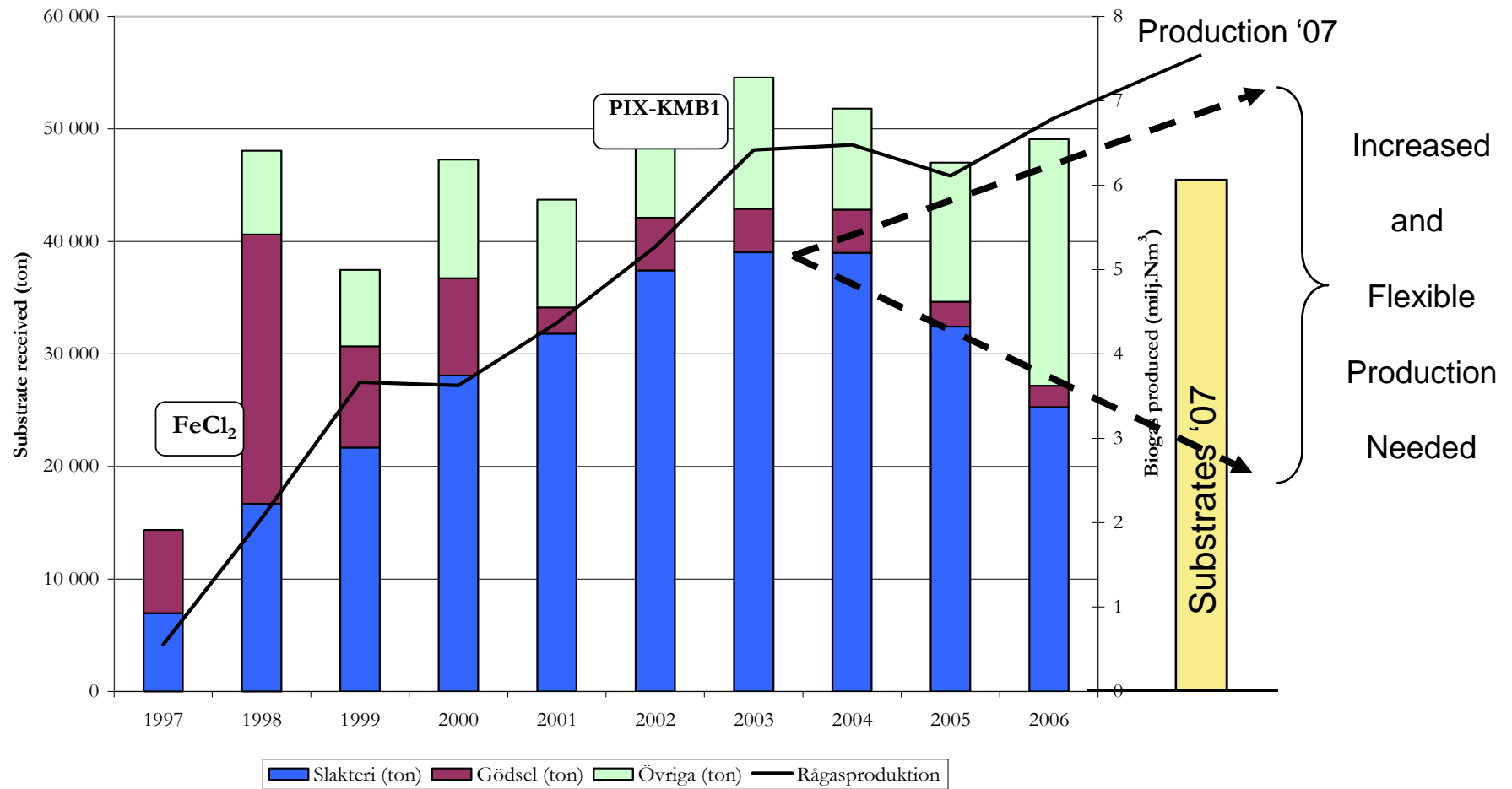
One Process – Three Solutions



Early assumptions

1. The market for industrial organic wastes will be over-loaded in time.
2. Less dependency on Oil will entail higher dependency on other energy sources.
3. Strategies and efficient handling of agricultural wastes and crops are needed to secure a cost-efficient volume build-up of bio-methane.





The prediction turned out to be correct

- Focus on finding a stable mono-culture biogas process with high-yield.
- A wide range of laboratory scale tests were, and are, performed. Loading rates increased from 2,5 – 8 kg VS/m³d.
- Decision made to verify select laboratory trials in pilot plant scale (40 m³) to judge scale effects and gain a better view of handling the substrates.
- Based on results from laboratory tests and pilot plant the Norrköping Biogas plant was designed by Svensk Biogas and purchased from YIT.
- Valuable experience regarding differences between laboratory scale and full-scale digestion was gained.



Initial Process Development

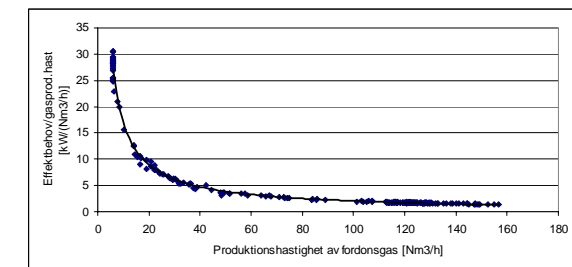
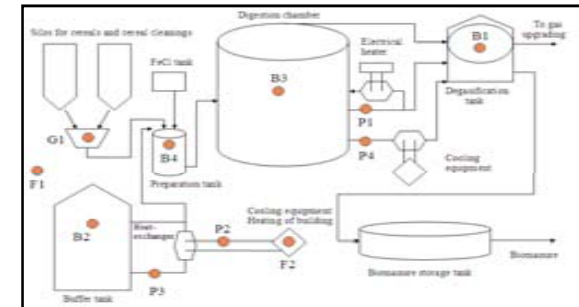
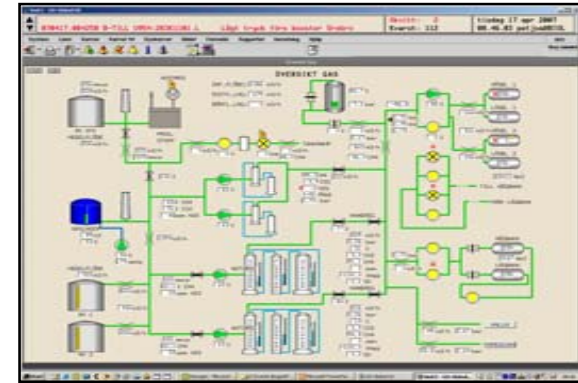


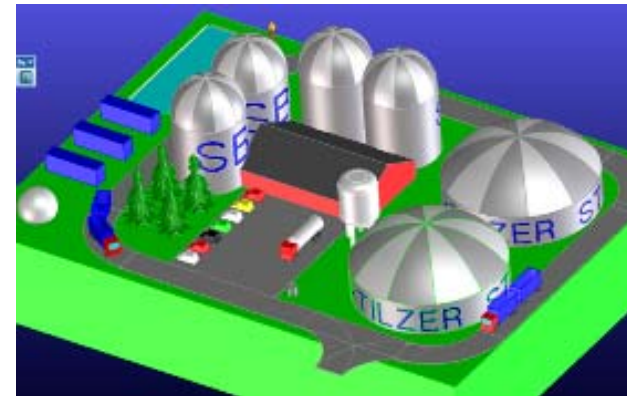
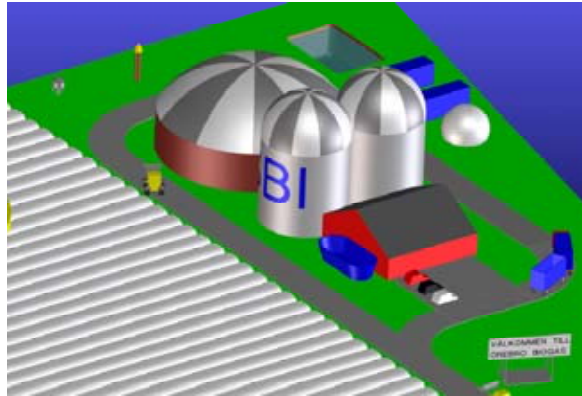
- First full-scale combined ethanol to bio-methane concept plant.
- Developed, Owned and Operated by Svensk Biogas in Linköping.
- Production today is 1,3 MNm³/yr and planned expansion to 5,5 MNm³/yr (to meet expanding regional market).



Norrköping Biogas Plant

- Control system adaptation reduces operator time and increases gas production by approx. 15 %.
 - in-house adaptations and co-operation with Bioprocess Control.
- Detailed monitoring and adaptation of energy use decreased electricity need by 13 %.
 - difference between estimation by supplier and reality was 34 %.
- Adaptations in co-operation with ethanol plant will change energy quota (in/out) from 3,3 to 4,8.
- Stability of process reduces operational costs and has verified that large-scale agricultural bio-methane plants are viable with current pricing.

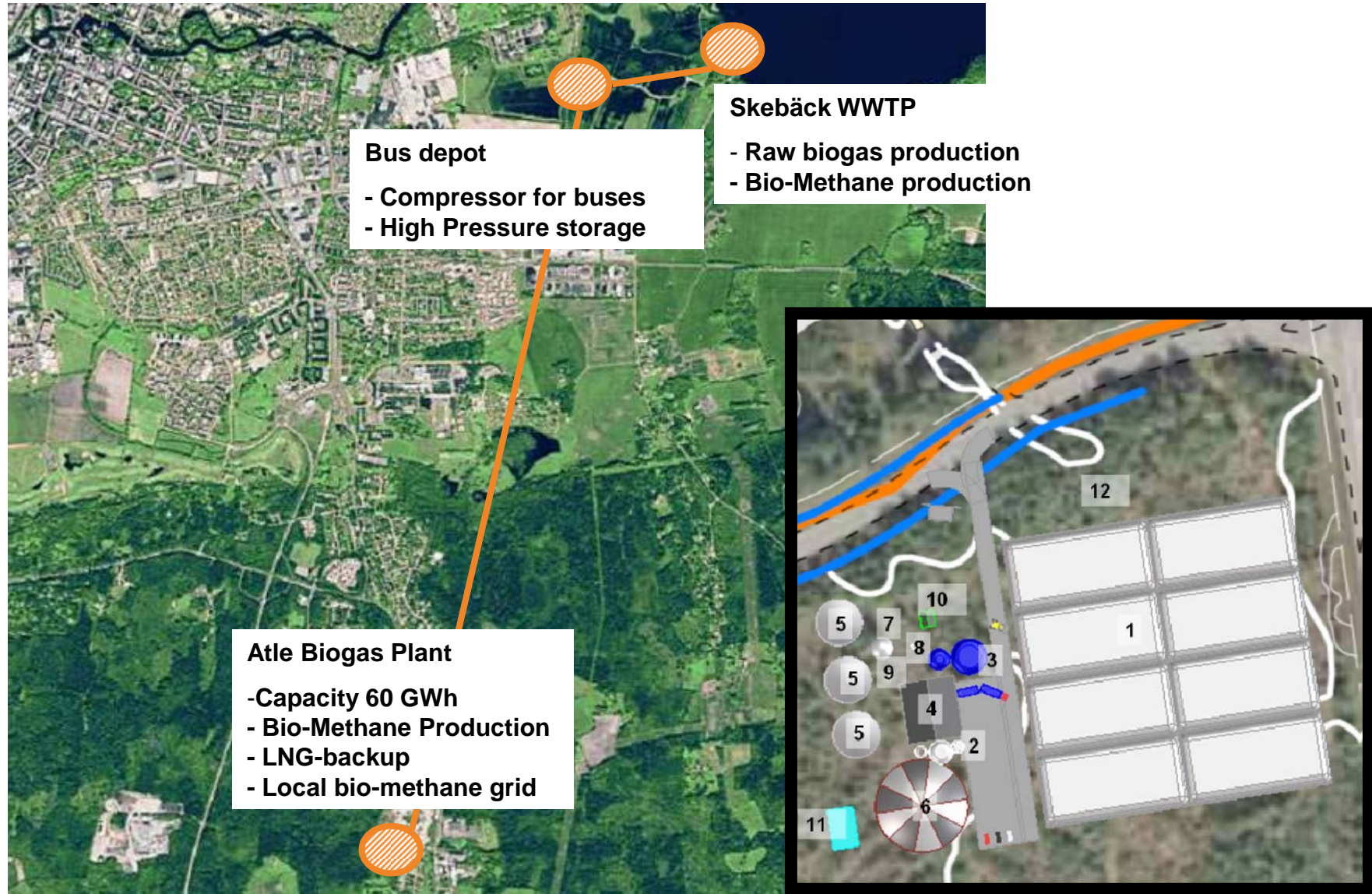




Plant	Bio-Methane capacity	Substrate	Customer	Build/Operate	SBI role
Örebro	6 MNm ³ /yr	Silage/Crops /WWTP	Busses/ Gas Grid	2008/2009	Own/ Operate
Stockholm	10,5 MNm ³ /yr	Silage/Crops	Gas Grid	2009/2010	Own/ Operate



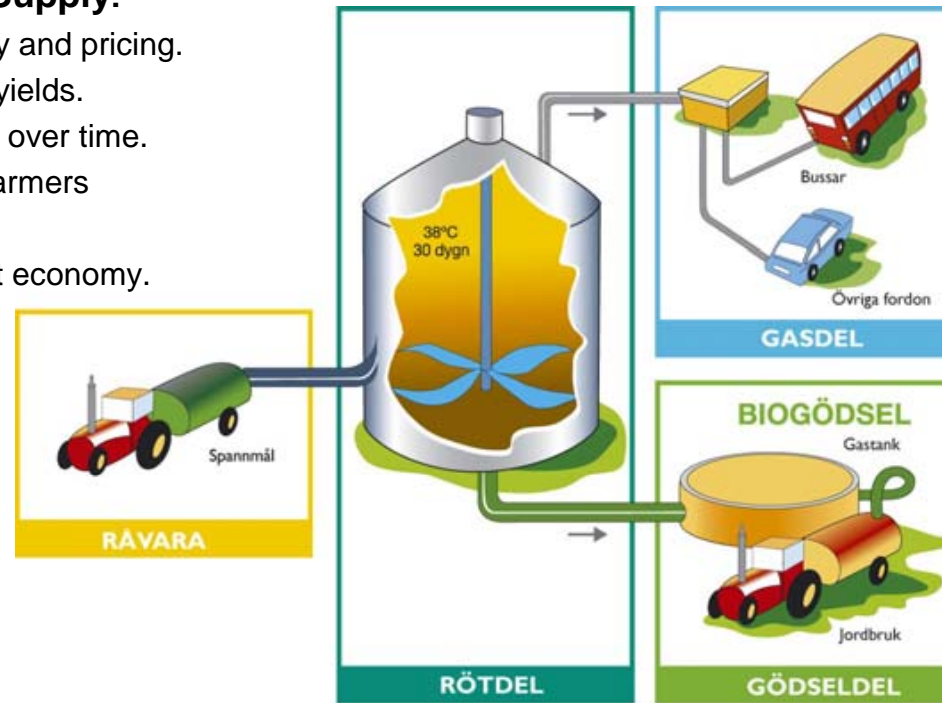
Coming Agricultural Biogas Plants



Example Örebro Biogas Plant

Farmer benefits of Supply:

- + Reduced risk in quality and pricing.
- + Benefits in increased yields.
- + Leveling of work need over time.
- + New crops keep the farmers in the front lines.
- + Energy crops with best economy.



Customer benefits :

- + Local production and local consumption generate jobs.
- + Pricing of fuel less dependent on oil prices.
- + Reduction of CO₂-emissions and positive market value.

Customer benefits :

- + Ecologically approved fertilizer.
- + Pricing less dependent on fossil conventional fertilizer.
- + New technology gives possibility to tailor make fertilizer.

Proven track record and technical solution for Agricultural Biogas gives necessary security in investment.



Agricultural Bio-Methane is Integrated



Peter Undén
Managing Director

www.swedishbiogas.eu

+46-13-465 08 88
+46-70-340 81 41
peter.unden@swedishbiogas.eu

www.sbilantbruk.se



Thank You for Your Time!