



Case Linköping Biogas - challenges and solutions

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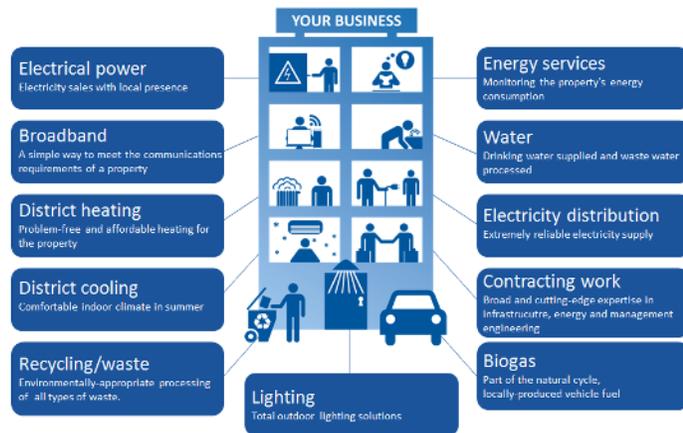


Erik Nordell



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Tekniska verken i Linköping



Tekniska verken is owned by the municipality of Linköping

Financial key figures 2019

- Clients: $\approx 260\,000$
- Employees: 958
- Sales: M € 550
- Profit*: M € 72
- Net investments: M € 140

* after financial items



Linköping biogas plant started in 1997

Why biogas in Linköping?

- Problems with soot particles in the air and noise in the city centre
- Complex management of organic waste from one of Sweden's biggest slaughterhouses in Linköping
- The municipal transport company needed a focus area to strengthen their competitiveness

Challenges

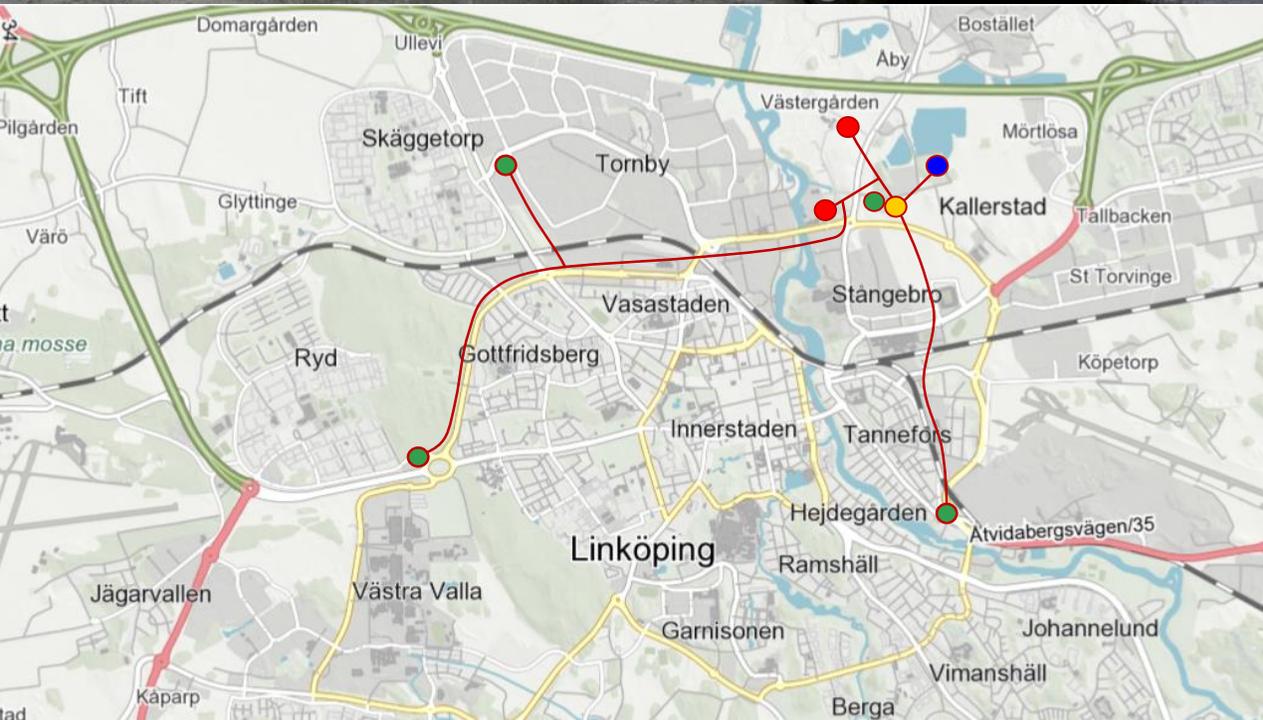
1. Non-existing biogas market
2. Foaming, process problems and bad odour
3. Introduction of organic fraction of municipal solid waste (food waste)
4. Expansion to new markets

Year: 2001

1. Non-existing biogas market

TV decided to create a market

- Workshop converting petrol cars
- Local gas grid to fuelling stations
- Primarily local busses, garbage trucks



2. Foaming, process problems and bad odour

Foaming

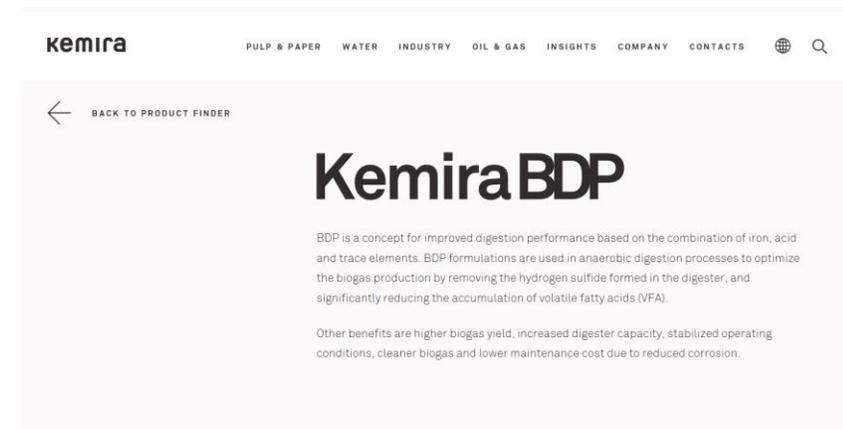
- Reoccurring problems with foaming when treating slaughterhouse waste (rich in fat and proteins)
- Caused by poorly degraded fat and accumulated LCFA

Process problems

- VFA-accumulation, risk for low pH
- High $\text{NH}_4\text{-N}$ due to high protein content

Bad odour

- Protein degradation leads to the release of H_2S
- Substrate



The screenshot shows the Kemira website interface. At the top, there is a navigation menu with links for PULP & PAPER, WATER, INDUSTRY, OIL & GAS, INSIGHTS, COMPANY, and CONTACTS, along with a globe icon and a search icon. Below the navigation, there is a 'BACK TO PRODUCT FINDER' link with a left-pointing arrow. The main heading is 'KemiraBDP'. Below the heading, there is a paragraph of text: 'BDP is a concept for improved digestion performance based on the combination of iron, acid and trace elements. BDP formulations are used in anaerobic digestion processes to optimize the biogas production by removing the hydrogen sulfide formed in the digester, and significantly reducing the accumulation of volatile fatty acids (VFA).'. Below this, there is another paragraph: 'Other benefits are higher biogas yield, increased digester capacity, stabilized operating conditions, cleaner biogas and lower maintenance cost due to reduced corrosion.'

2. Foaming, process problems and bad odour

Foaming

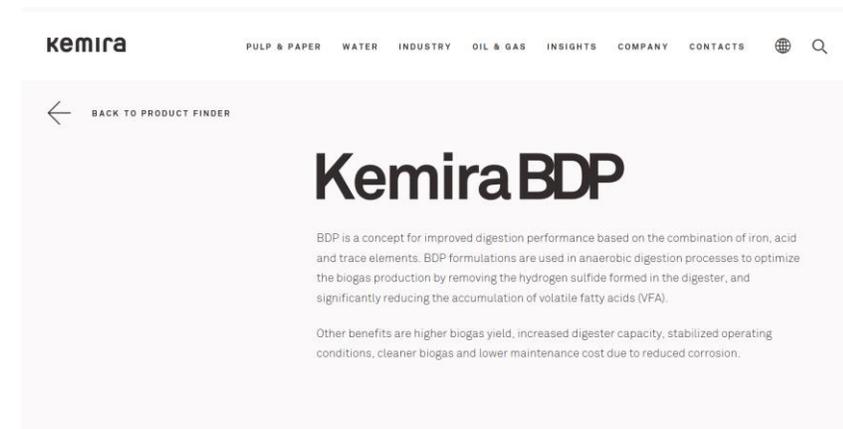
- ~~Reoccurring problems with foaming when treating slaughterhouse waste (rich in fat and proteins)~~
- ~~Caused by poorly degraded fat and accumulated LCFA~~

Process problems

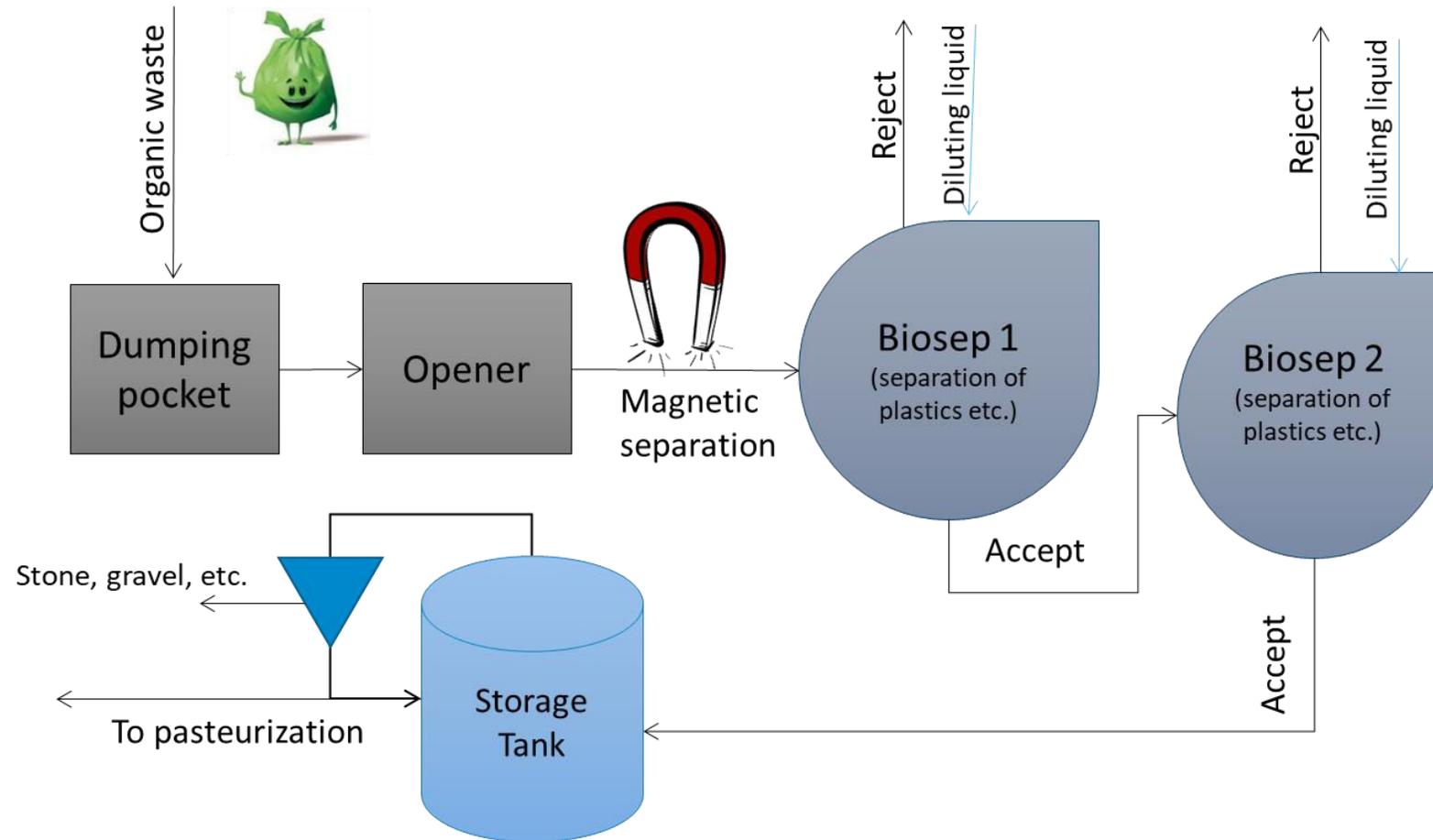
- ~~VFA accumulation, risk for low pH~~
- ~~High $\text{NH}_4\text{-N}$ due to high protein content~~

Bad odour

- ~~Protein degradation leads to the release of H_2S~~
- Substrate ← Closed substrate treatment, only pumpable fractions



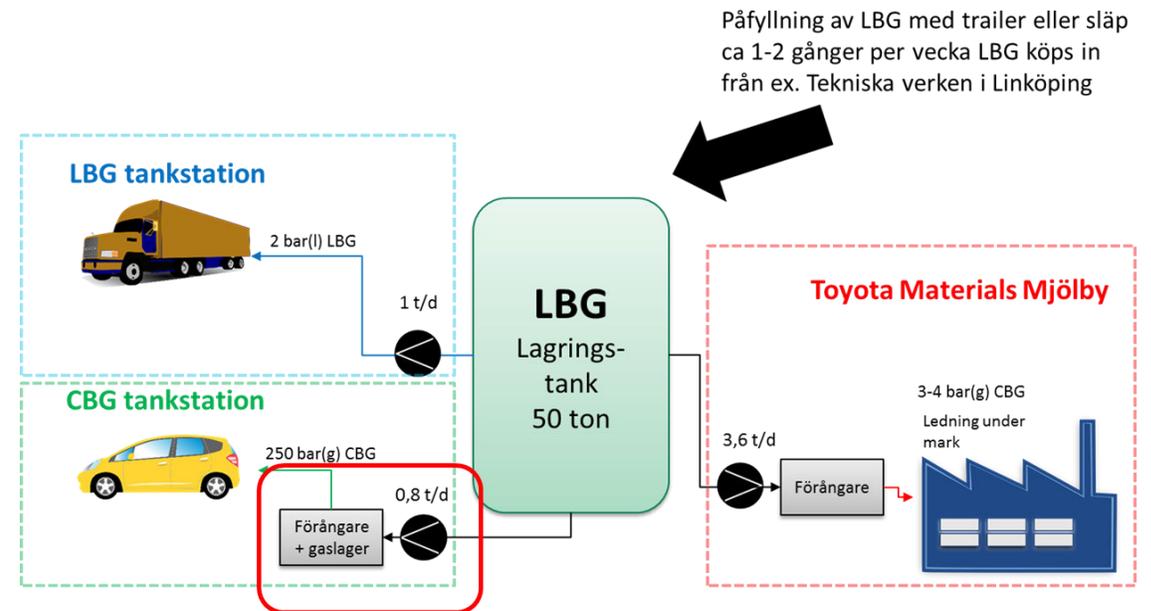
3. Introduction of organic fraction of municipal solid waste (food waste)



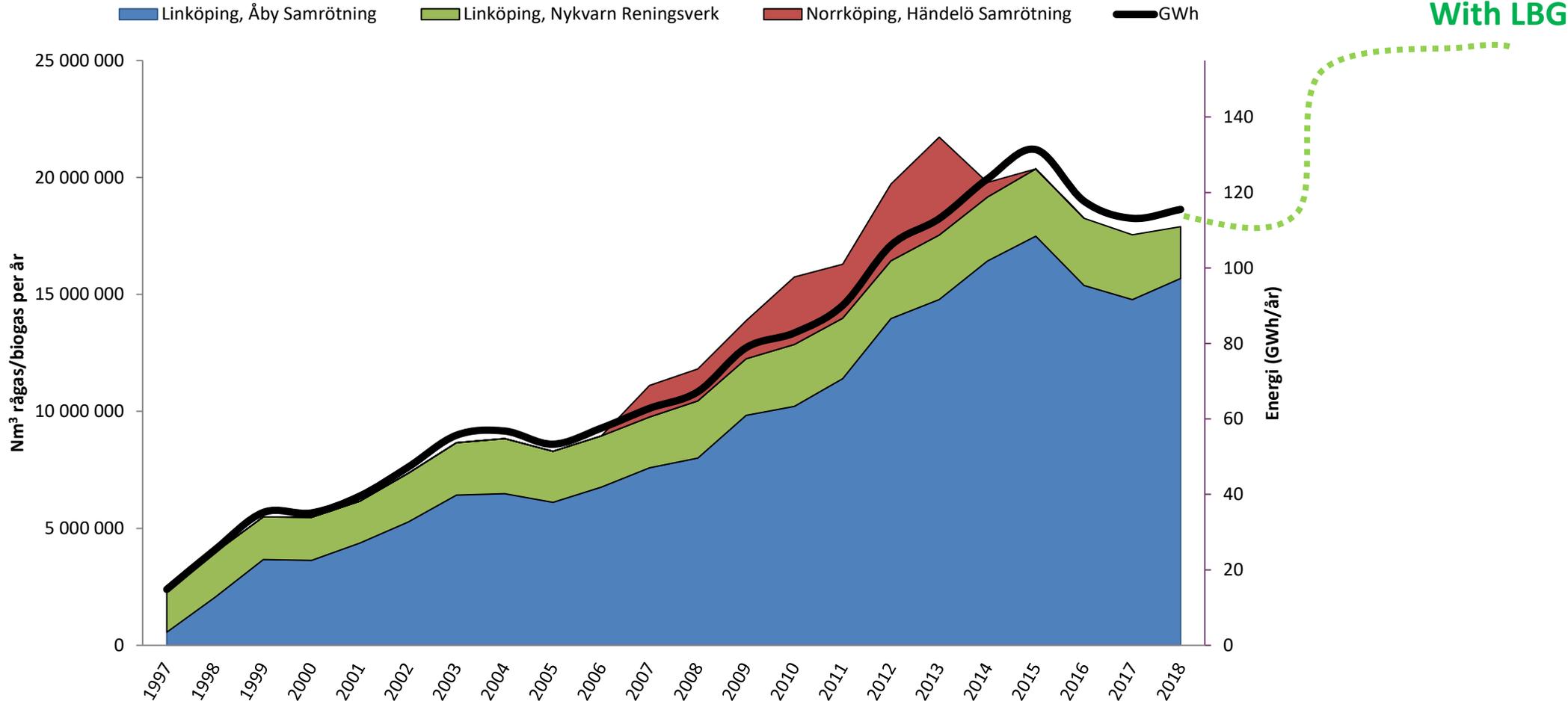
3. Introduction of organic fraction of municipal solid waste (food waste)



4. Expansion to new markets



4. Expansion to new markets



Year: now

Whats next?

- Negative CO₂-emissions with CCU/CCS
- Power 2 Gas
- Waste2Fish
- Biofertilizer to private persons



Tack!

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**Tekniska
verken**