Energy management at Sundet WWTP

Today, in the past and the future

Ingrid Palmblad Örlander, City of Växjö, Sweden
IWAMA workshop

SCZCECIN JUNE 7TH, 2017

The city of Växjö

- 66 000 inhabitants (90 000 in the municipality) and steady growing
- Surrounded by forest and lakes
- Linneus university
- ”The greenest city in Europe”

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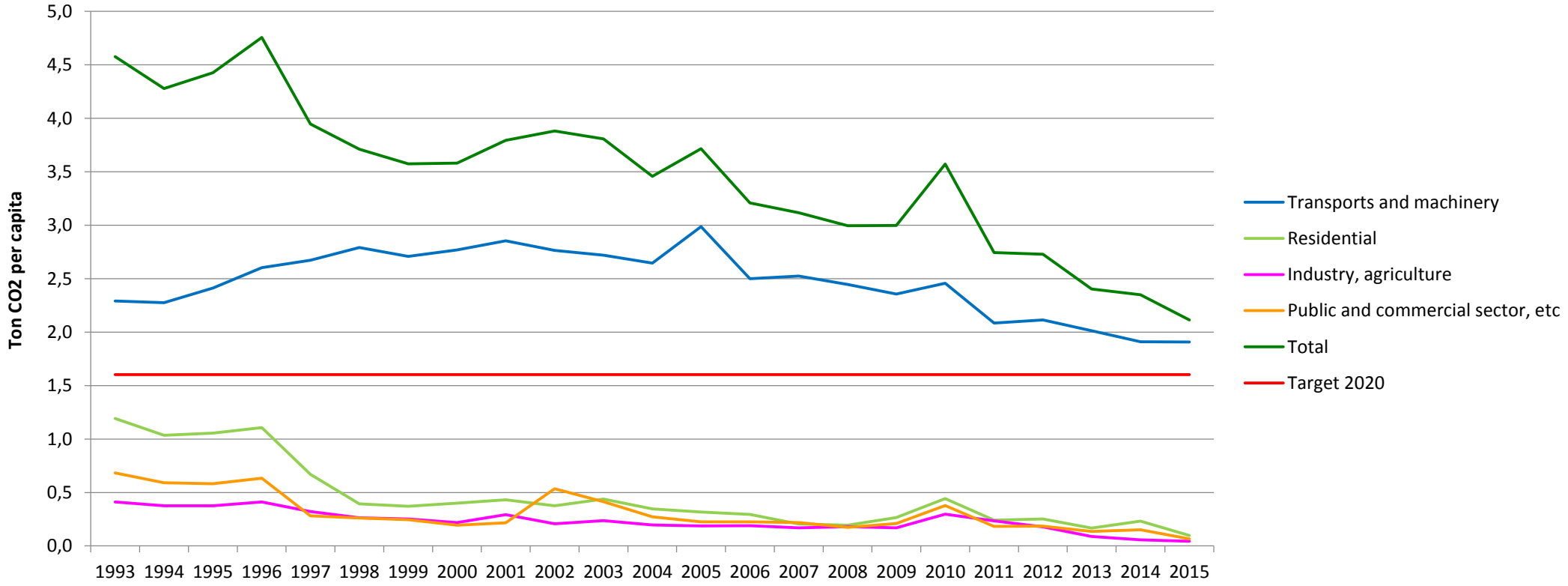
Växjö – the greenest city in Europe

both a vision and ambition.



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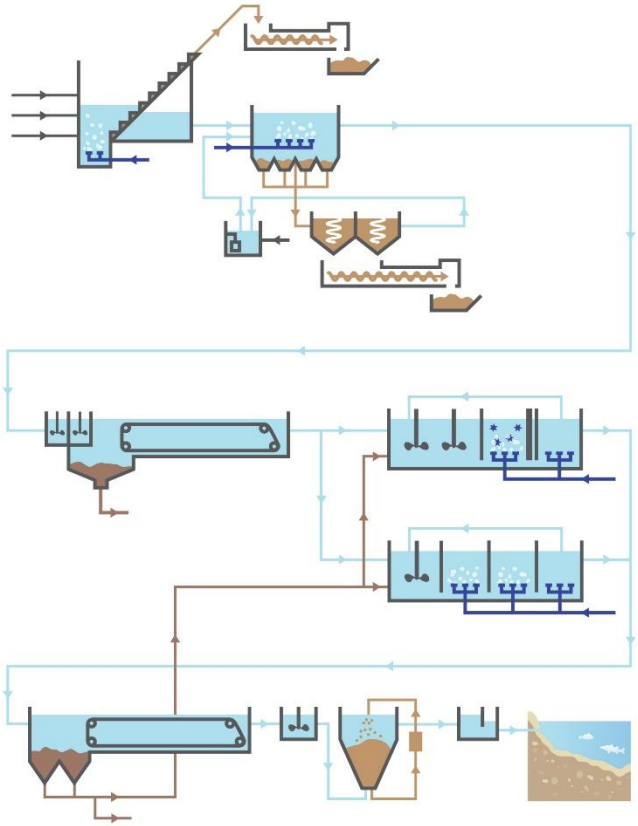
Sundet WWTP (1994)

A resource recovery plant

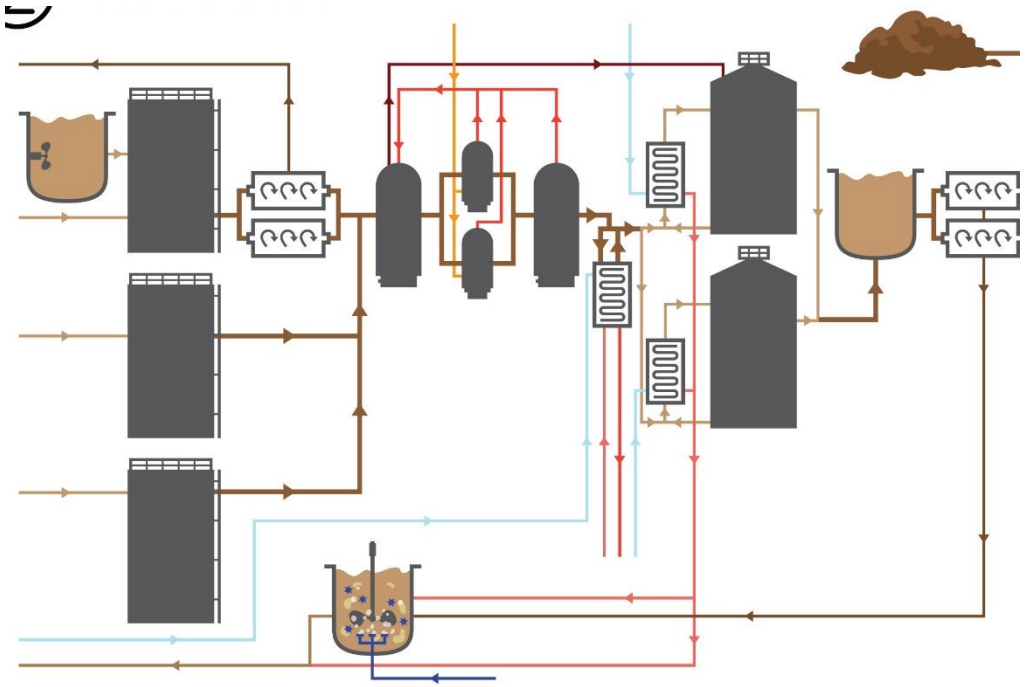
Sundet WWTP

Waste water treatment



- Mechanical grid
- Aerated sand trap
- Chemical treatment with primary clarifier
- Biological treatment with nitrification and denitrification - two trains with Hybas/IFAS, four trains with activated sludge
- Final clarification
- Continuous sand filters

Sundet WWTP
Sludge treatment



- Dewatered sludge, food waste and grease
- THP pre-treatment
- Anaerobic digestion
- Sludge (now hygienized) is dewatered and after being controlled spead on aerable land.
- Sidestream treated by AnitaMox

Capacity and results (2016)

- Qdim – 1500 m^3/h, Q_{max} – 3000 m^3/d
- $Q_{average}$ – 20 000 m^3/d
- Capacity 95 000 pe, real value: 67 670 p

	Influent (mg/l)	Load (kg/d)	Effluent (mg/l)	Removal efficiency (%)	Required efficiency
BOD	201	3449	<3,0	99	10 mg/l
COD	487	8338	32	93	-
Tot-P	5,4	94	0,052	99	0,2 mg/l
Tot-N	46	785	17	60	Under investigation
NH_4-N	32	584	<3,4	89	Temporary 60 %

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2002-2005

Energy management in focus

- Intitated by co-workers
- Energy optimization group/meetings

Energy management driven by:

- Energy supply reliability
- Cost savings by energy efficiency
- Several measures taken

2002 at Sundet WWTP:

- 54 000 persons
- Electricity: 3 560 MWh (WWTP) where 1 100 MWh (30 %) came from gas engine
- Heating: 1 752 MWh from gas engine and use of 73 m^3 E01

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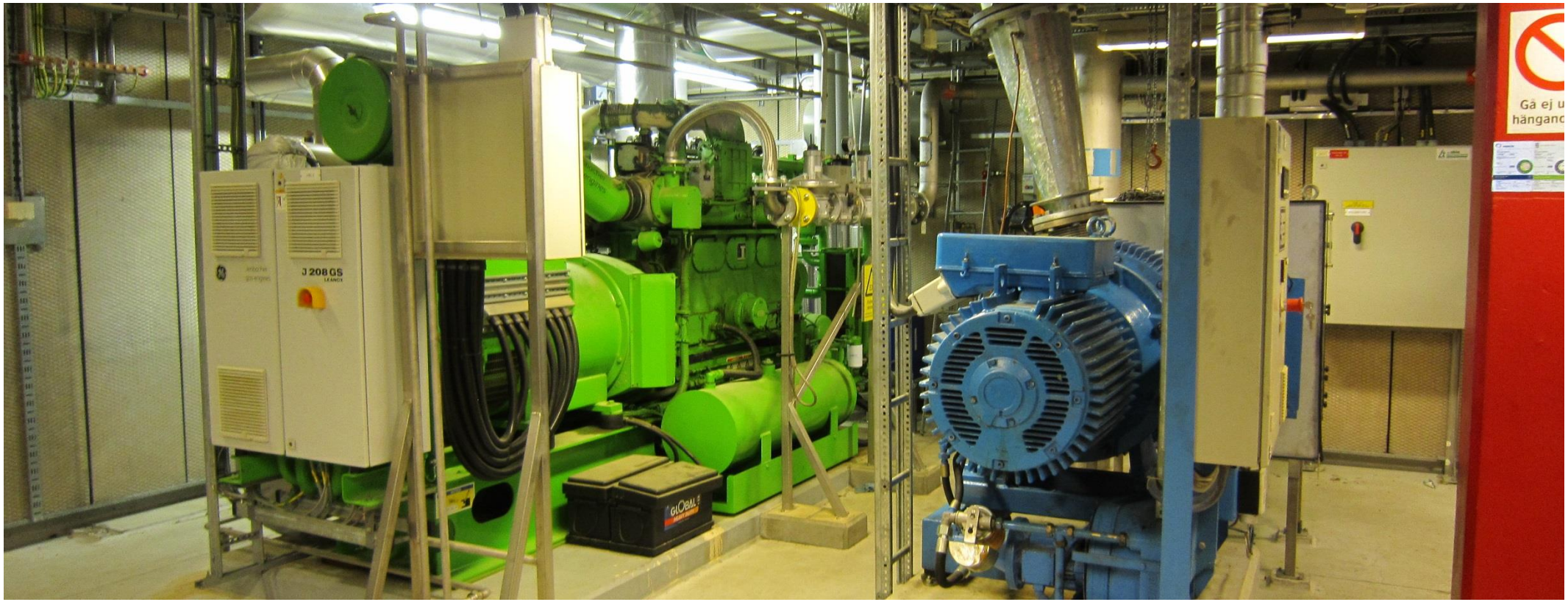
Larger and more effective gas engine to produce more electricity and heat



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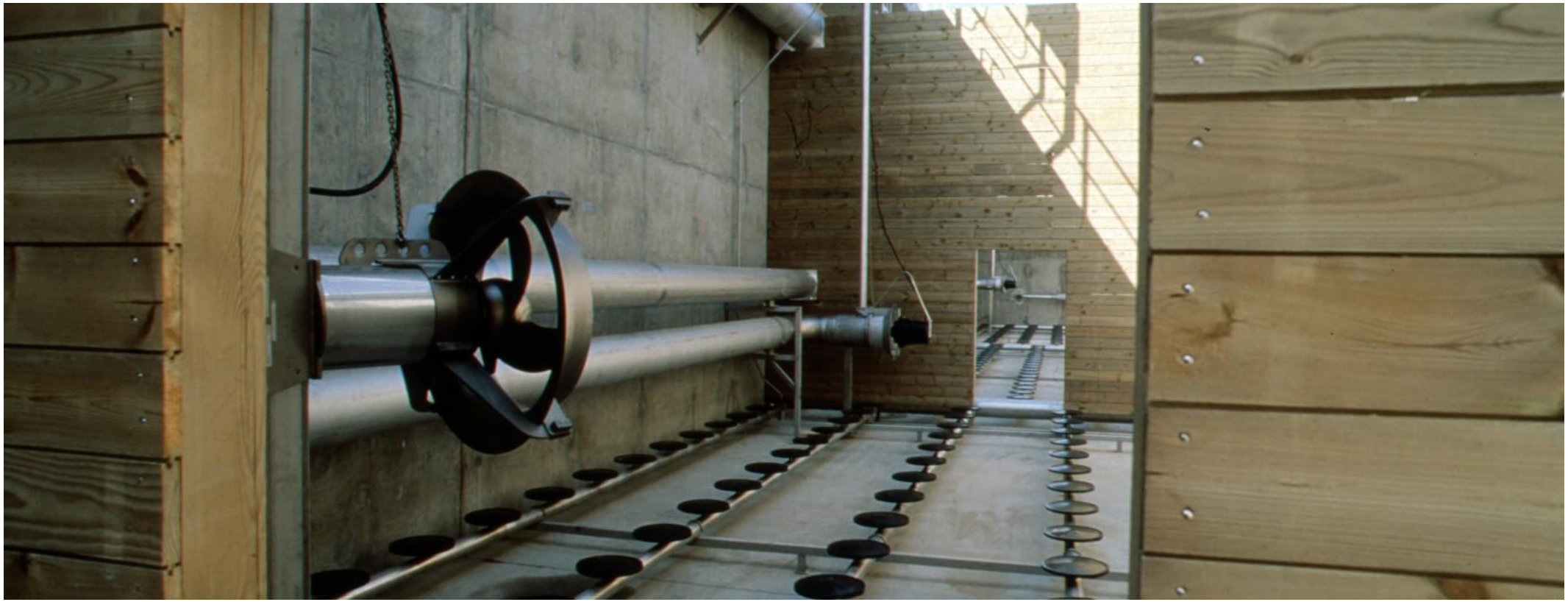
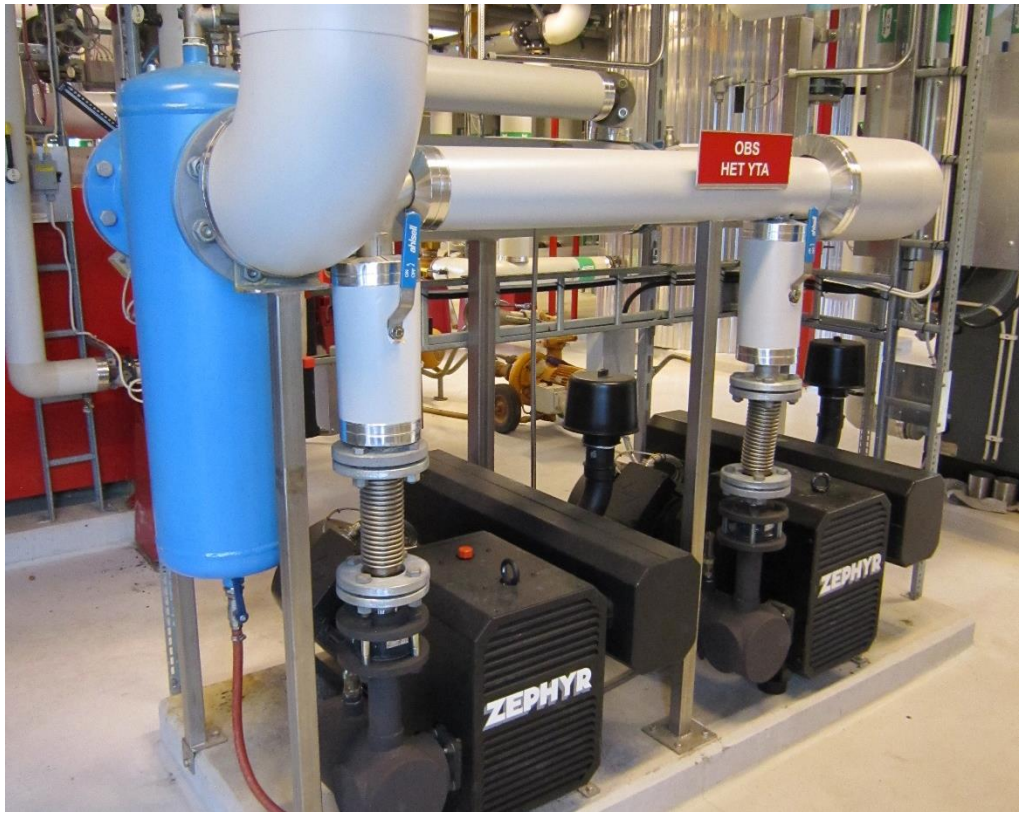
Utilization of excess heat from blowers to heat ventilation air

All membranes in aeration system was exchanged (in time)



Low pressure system for continuous sand filters



- Air supply to mammut pumps
- Before; high pressure air from compressor had to be reduced
- Saves almost 100 MWh/y

SVU Rapport 2014-05

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2005-today

Energy management integrated in ongoing projects

Increased biogas production and more qualified usage (political decision):

- Electricity and heat production since 1994
- 2007: co-digestion of external organic material
- 2012: separation, collection, and pre-treatment of organic household waste and a new facility to upgrade biogas into vehicle fuel for buses
- 2014: installation of THP (thermal hydrolysis plant)

New environmental permission – total nitrogene requirement under investigation…

- Hybas/IFAS
- Anita Mox

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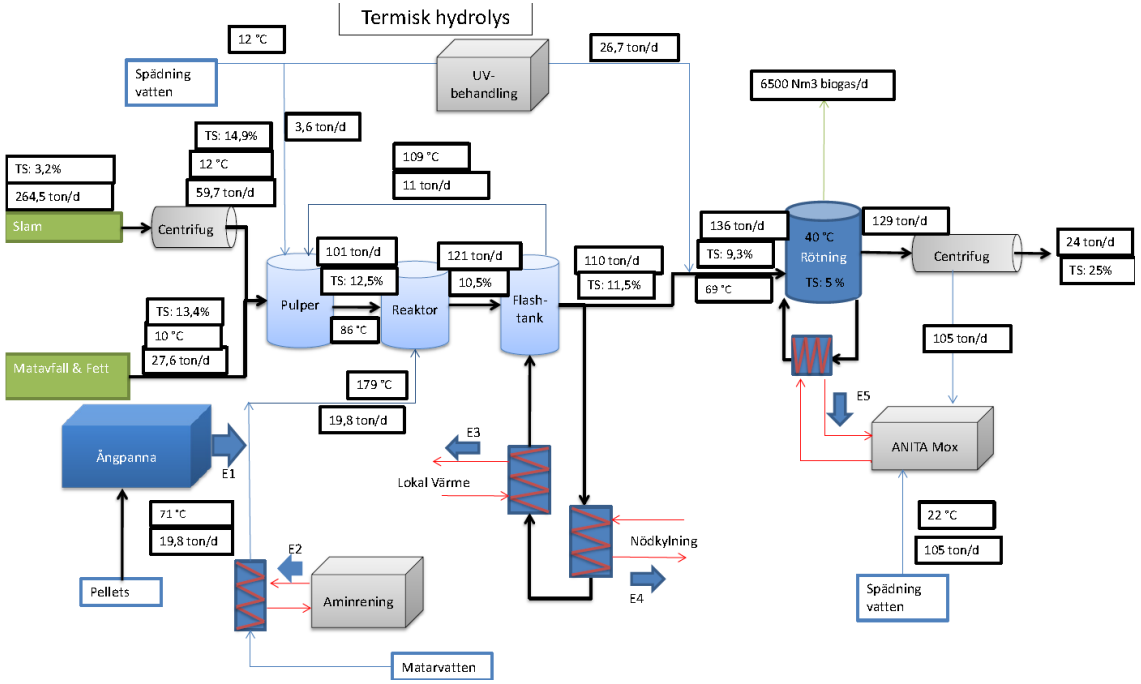
Projects today: CAMBI - THP

First of its kind in Sweden



- Evaluated by Energiforsk (laboratory study and full-size):
  - Gas production
  - Microbial community
  - Energy balance
- RAPPORT 2017:367 has an english summary
- Result: The energy required was of the same size as the increased biogas production but several other values comes with the THP.

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A lot of excess heat from THP…

Heating sidestream flow

Excess heat from CAMBI

Before CAMBI:

- Sludge to digesters was heated by effluent water

Today:

- The sludge is much warmer and is cooled by effluent water that is used to dilute AnitaMox.
- Additional effluent water used for dilution is heated with the heat exchanger

HYBAS/IFAS in mainstream

- Energy comparison between reference train and test train, not in favour for IFAS
- Improved construction
- Result: comparable energy consumption

Thickening of sludge and transportation to storage area

Today:

- Two decanter centrifuges consumes 50 MWh/y (2015)
- Air pressure system 100 MWh/y

New system (2017):

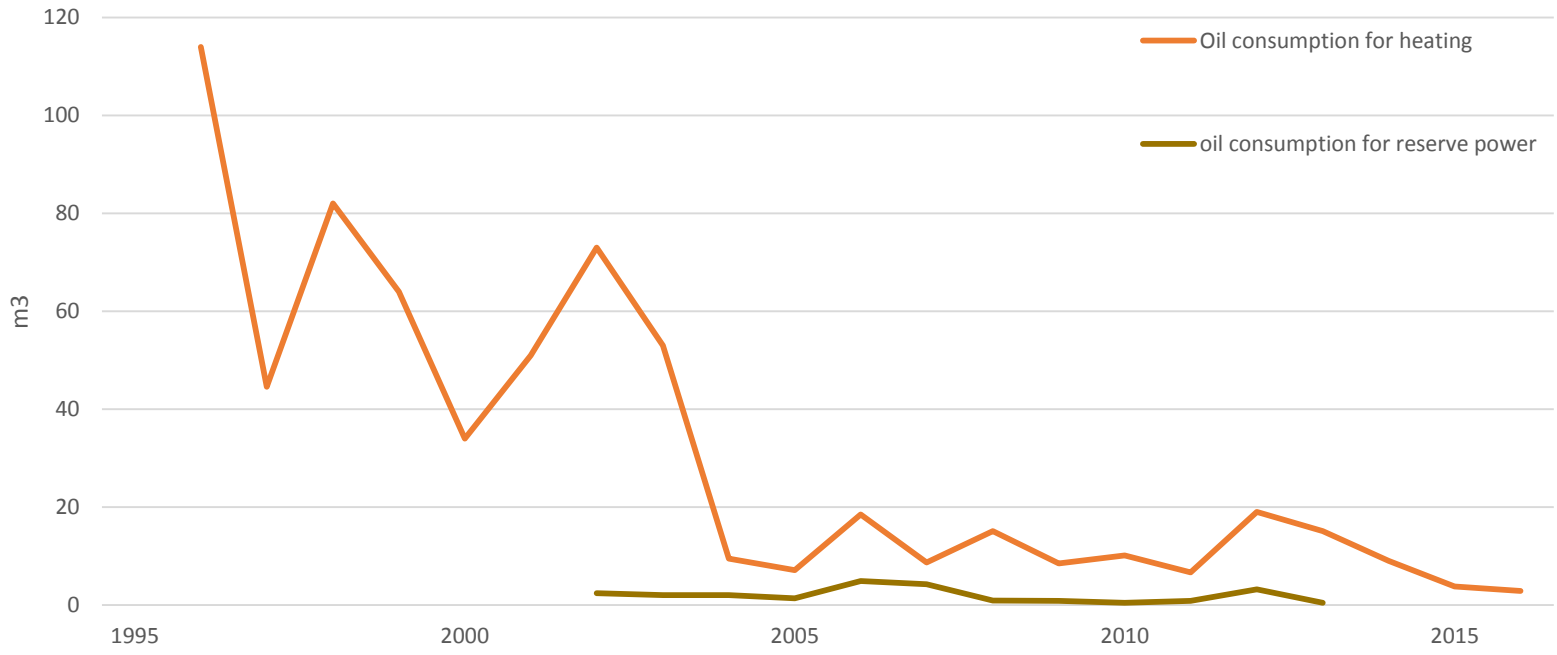
- Screw press 15 MWh/y
- Transport band 32 MWh/y

Photo: Mats Samuelsson

New compressor

90 kW -> 75 kW

Oil consumption at Sundet WWTP



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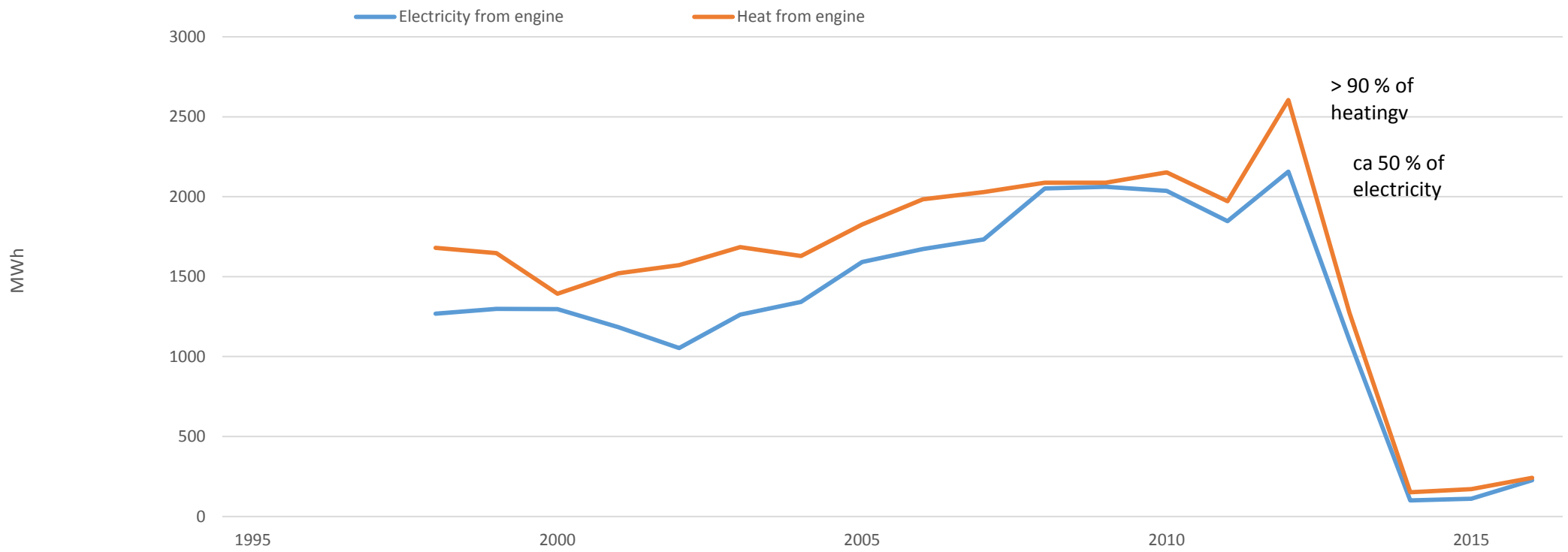
Self produced electricity and heat



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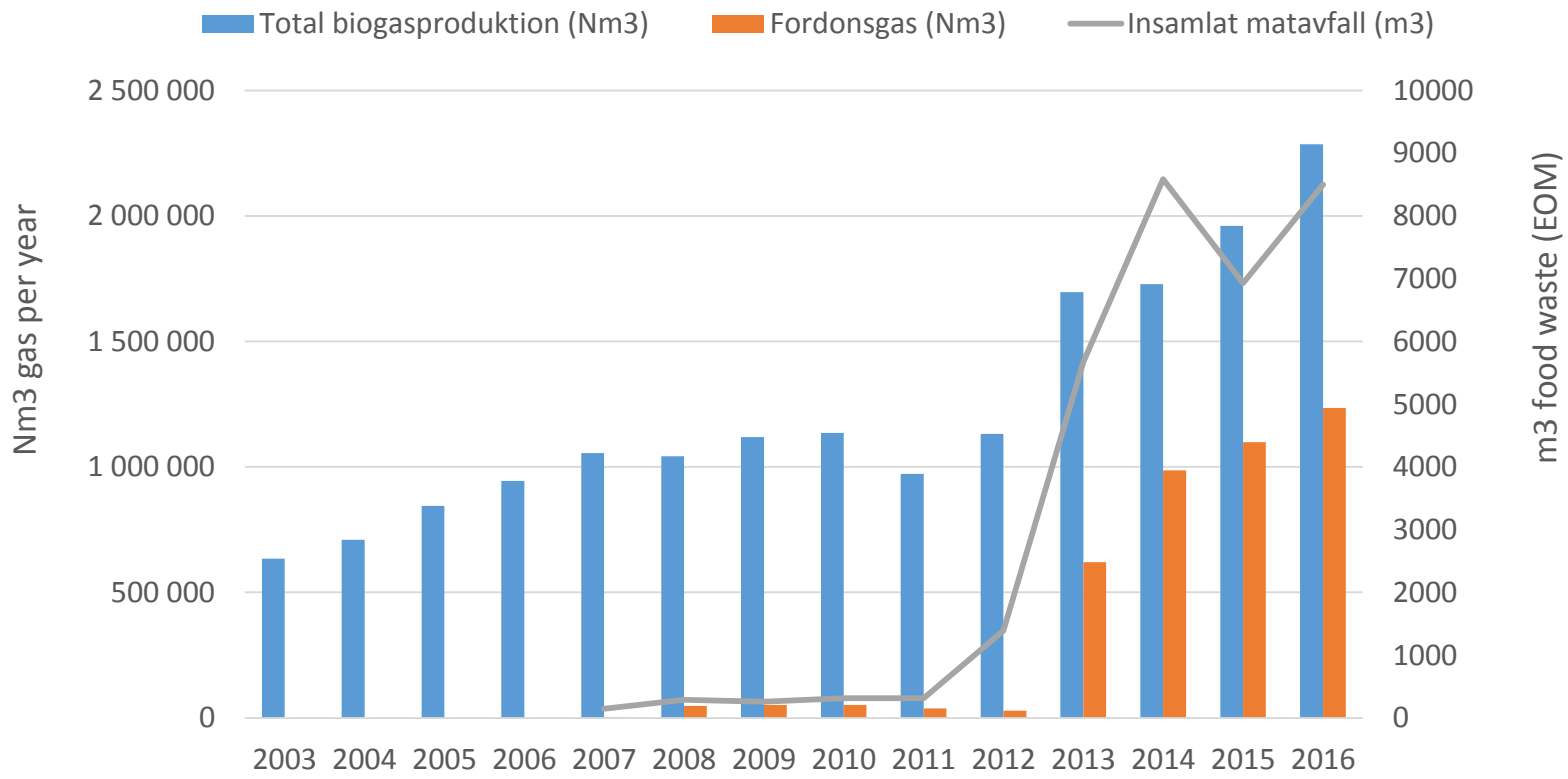
Biogas production at Sundet



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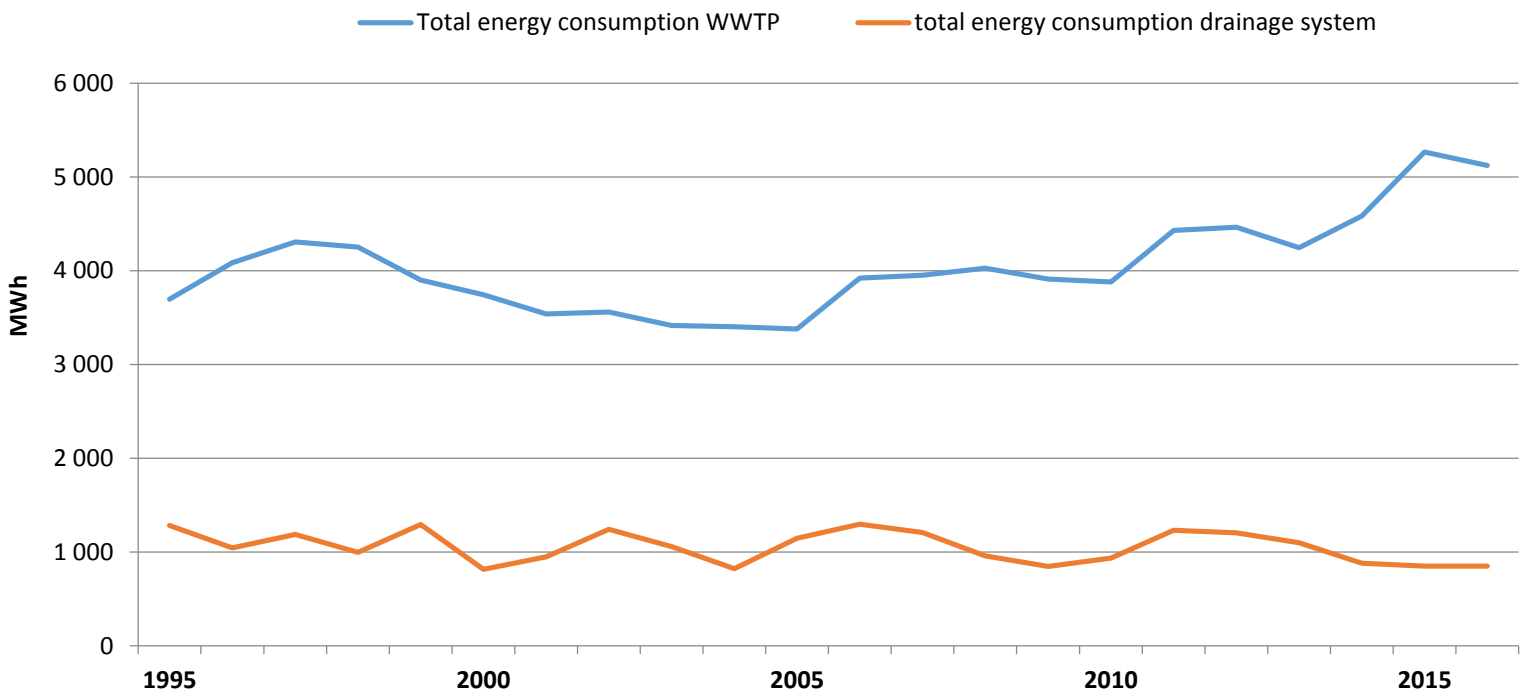
Energy consumption (total)



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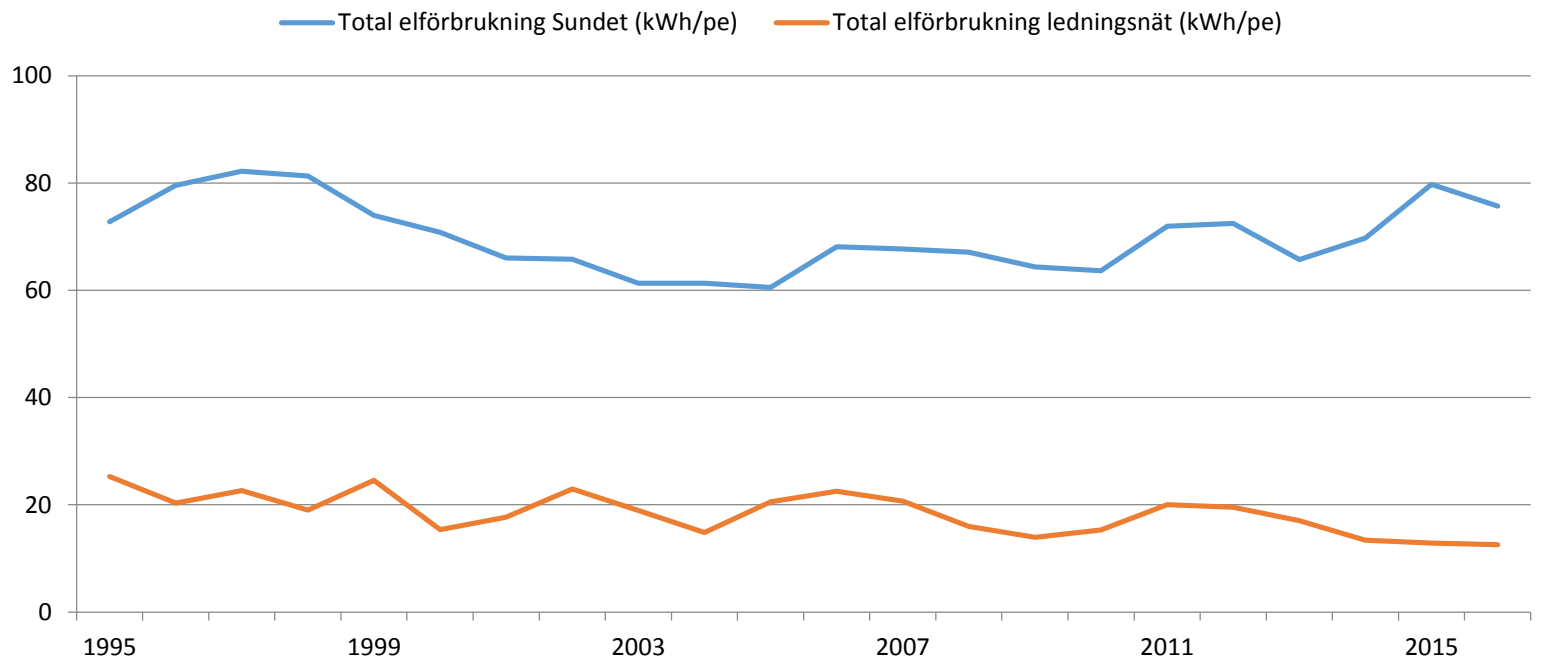
Energy consumtion (per person)



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The future

- New (?) aearation system
- Measures related to nitrogene requirements?
- Continue to integrate energy management in on going projects

The future…

- Time to focus again?
- How to improve our energy management?
  - Sweden and Växjö has energy/GHG goals but not the WWTP.
  - Total energy audit?
  - Improve evaluation
  - How to become less dependent again?

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