



STORMOSSEN

Biogas as an Important Part of the Sustainable Development in our Society

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Vaasa City Hall

Finland

CONTENT

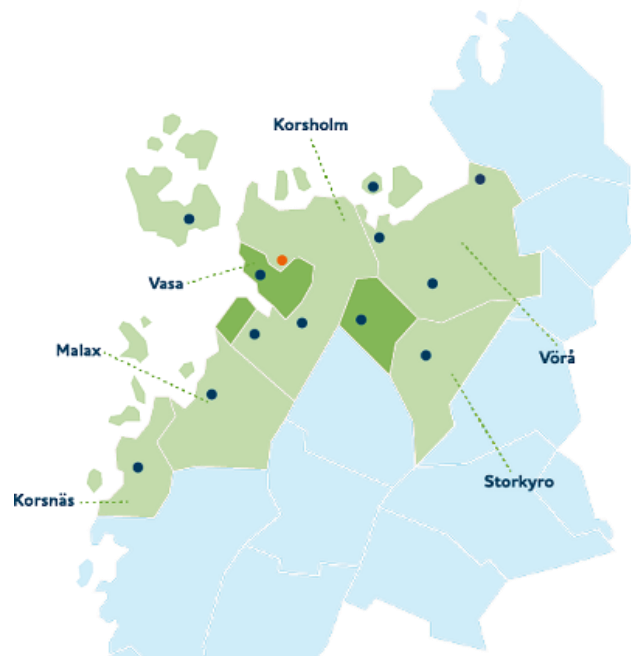
- Background
- Biogas production
- Biogas as vehicle fuel
- Benefits of biogas
- Summary



STORMOSSEN



- **Founded 1985**
- **Employs 40 persons**
- **Owned by 6 municipalities**
- **100 000 residents in the area**
- **Waste recycle rate 98,5 % (2017)**
- **Turnover 13,6 M.€ (2017)**
- **Products:**
 - **Biogas for fuel, electricity and heat**
 - **Compost soil**
 - **District heating and electricity**
 - **Raw materials**



STORMOSSEN

- 1985 Founded
- 1990 Biogas production started
- 1994 Second Digester + gas-engine (330 kWe)
- 1995 Heating Botniahalli with biogas
- 2007 Landfill gas collection
- 2009 New gas-engine (730 kWe)
- 2012 Westenergy
- 2014 Agreement with the city of Vaasa to use bio-methane in public transport
- 2017 Upgrading and filling station



WESTENERGY

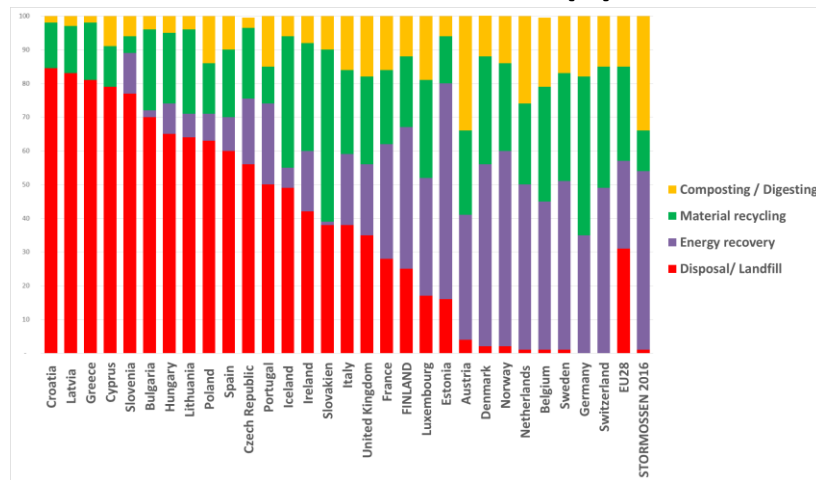
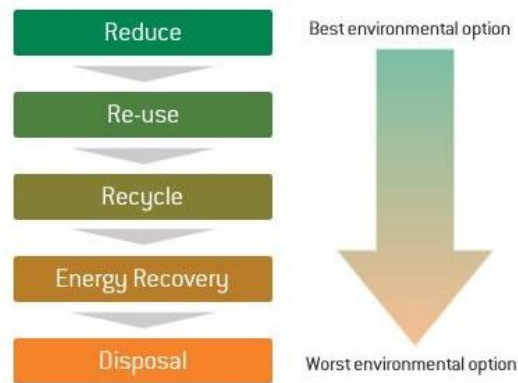
- Energy recovery
- 50 municipalities
- 400 000 residents in the area
- 150 000 ton/year = 20 ton/hour
- District heat 280 GWh = 1/3 of district heating in Vaasa
- Electricity 80 GWh = approx. 7000 homes



WASTE TREATMENT



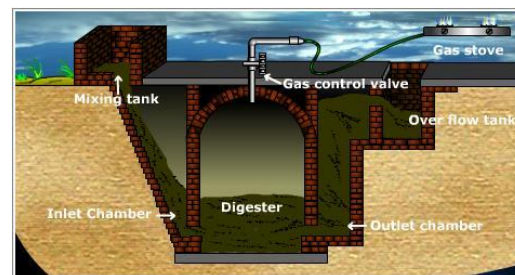
- National waste plan objectives
 - 50 % recycled as material
 - 30 % recycled as energy
 - 20 % maximum to landfill
- Stormossen 2017 (2016)
 - 49 % recycled as material (46)
 - 50 % recycled as energy (53)
 - 1 % maximum to landfill (1)



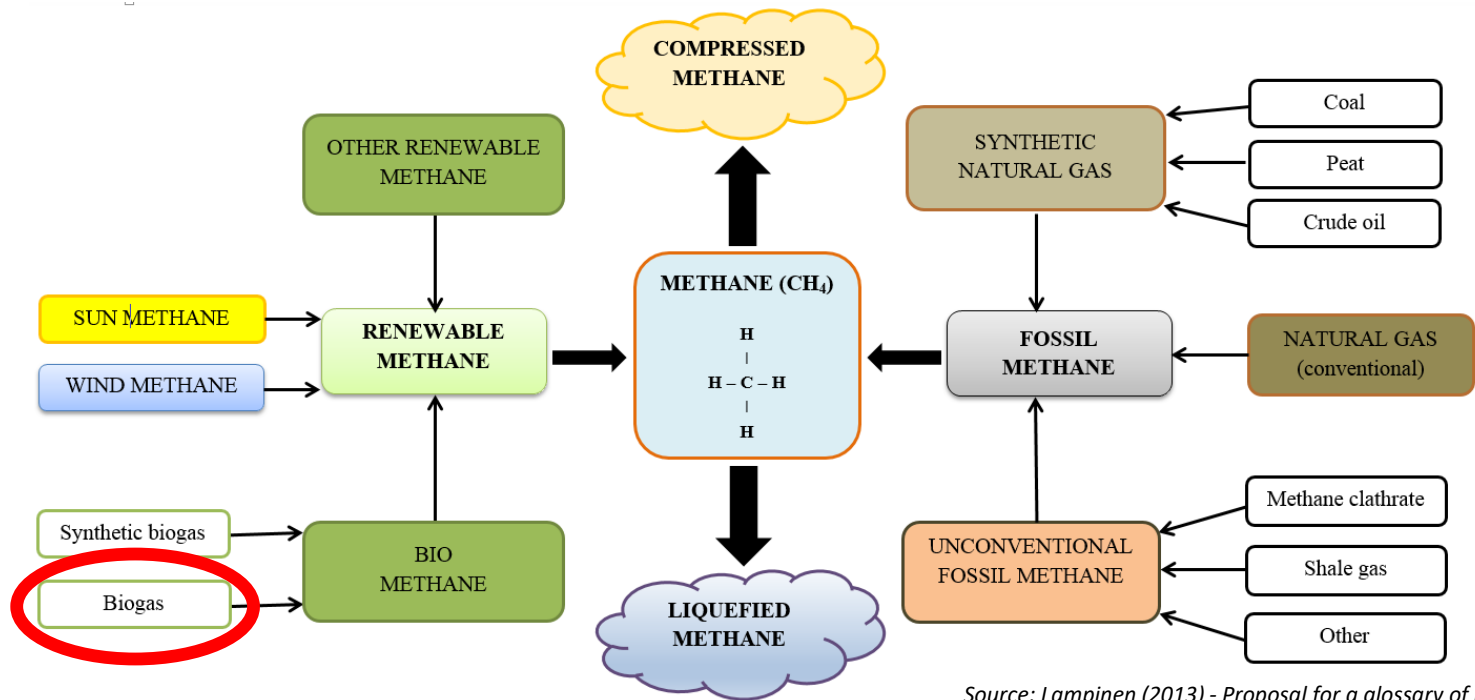
BIOGAS HISTORY



- 1859 First plant in India
- 1895 UK and Germany developed the process, for reducing sludge volumes and the gas was occasionally used as energy
- 19th and beginning of 20th century Town gas for lighting
- 1930s in India developed the process for farmers
- 1930s understanding the anaerobic bacteria producing methane gas
- 1940s Biogas plant and refueling in Helsinki and a biogas plant in Stockholm
- 1960s China and India as cooking fuel
- 1970s oil crisis slight increase in interest
- 1990s for treating organic waste streams



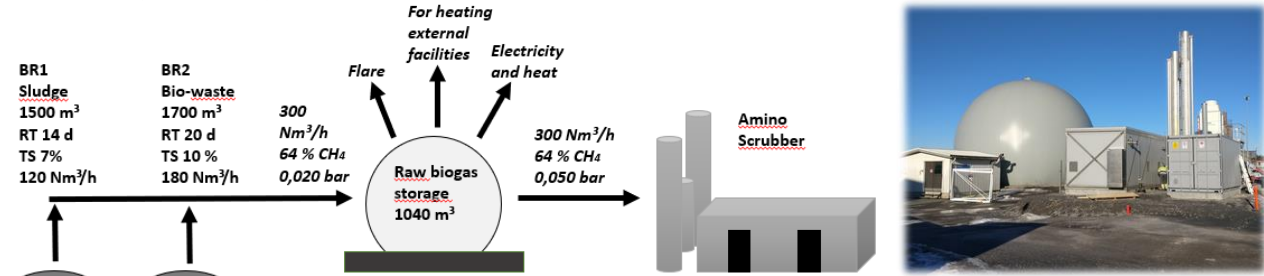
METHANE SOURCES



Source: Lampinen (2013) - Proposal for a glossary of methane fuels in transport.
Edited: Johan Saarela (2014)



PRODUCTION



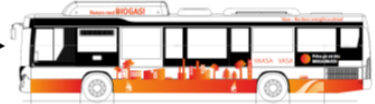
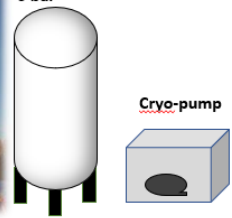
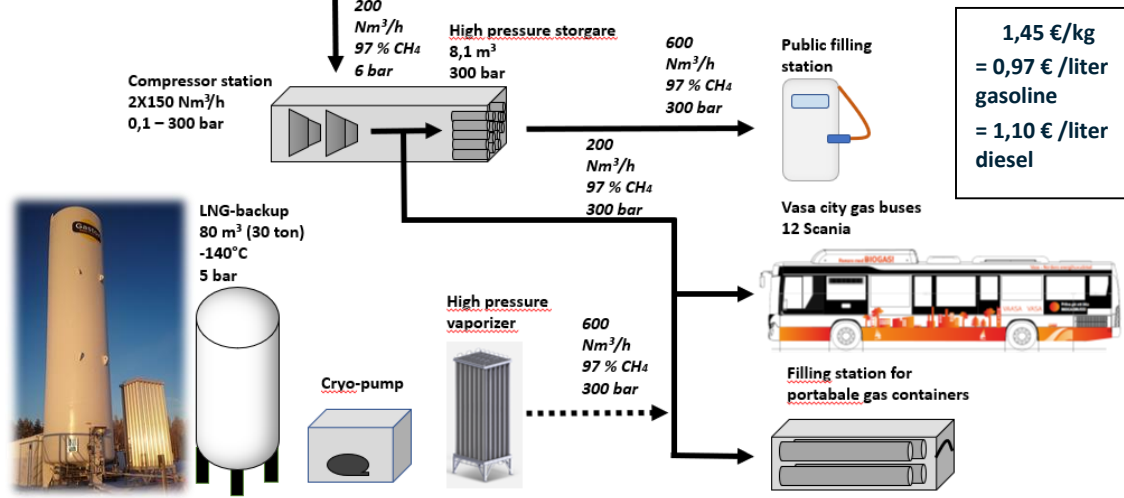
Raw biogas 63 % methane 2,4 million Nm³ =
Upgraded biogas 1,6 million Nm³ (97 % methane) = 16 GWh = 1,6 million liter diesel
= Enough for 12 buses + 1000 vehicles or 24 buses

16 000 ton
sludge (TS 20%)
= 46 000 ton
sludge-slurry
(TS 7%)

16 000 ton bio-
waste (TS 31%)
= 36 000 ton
bio waste-
slurry (DM
10%)

Digestate approx. 7000 ton
annually mostly used for
landscaping

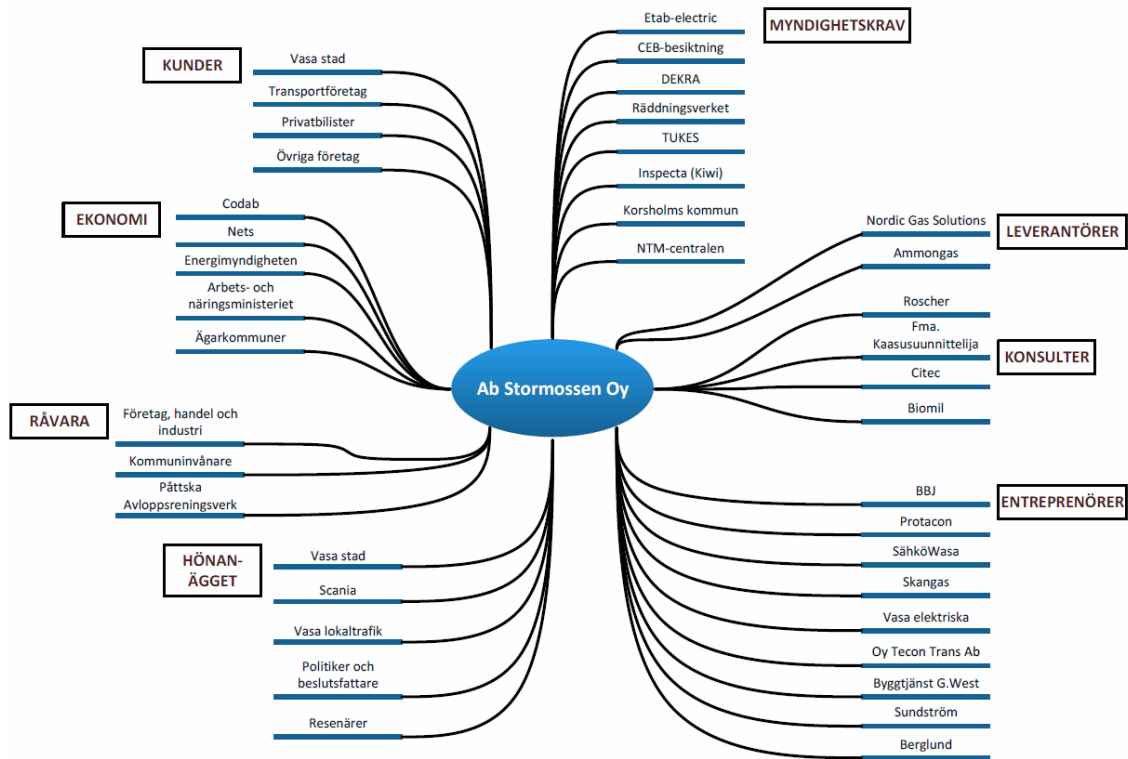
- 130 ton P
- 175 ton N



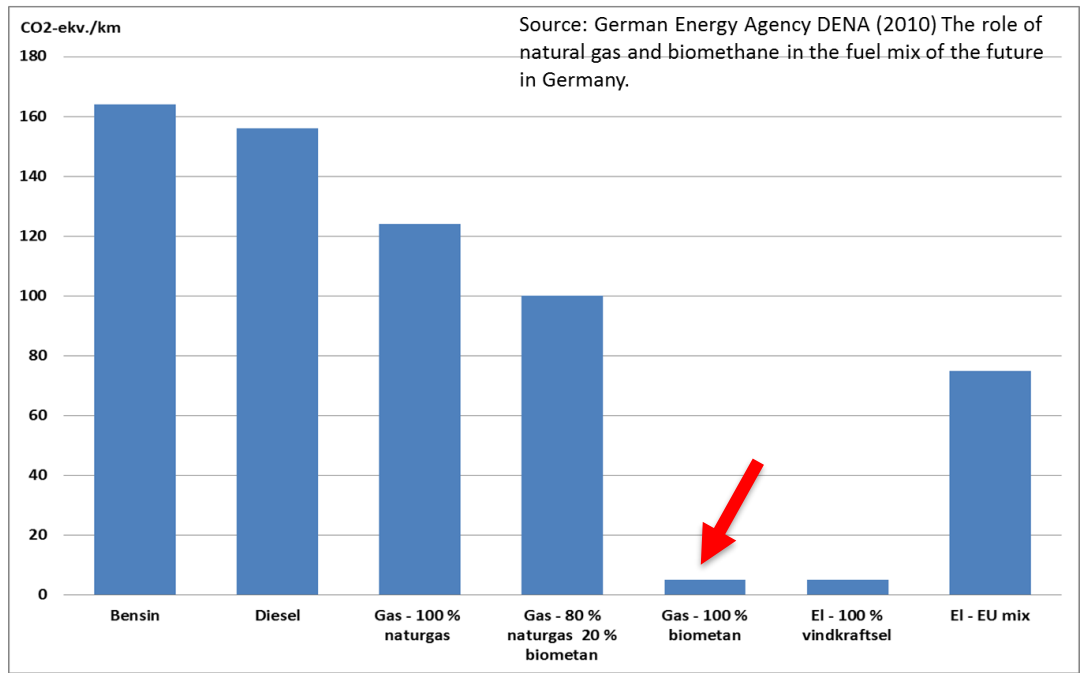
FILLING STATION



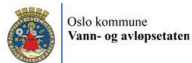
MAP OF ACTORS



BIOGAS AS FUEL



BIOGAS AS FUEL



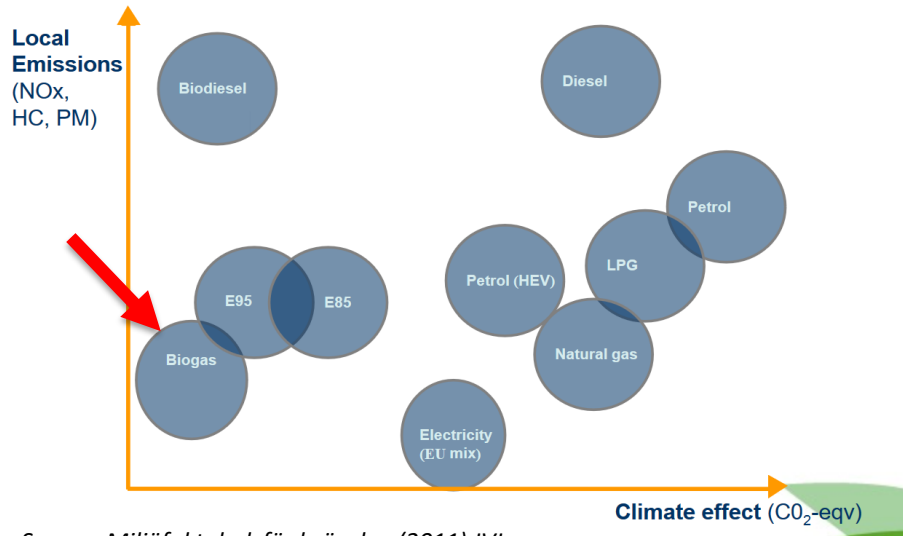
Exhaust emission and noise



S/N	Units	Diesel	Bio-methane	Reduction%
NO _x	g/km	8.1	1.9	78
Particulate matter	g/km	0.3	0.005	98
CO ₂	kg/km	2.6	0	100
Noise	dBA	111	100	92






Source: Rashid Abdi Elmi (2013) Oslo kommune Vann- og avløpsetaten



Source: Miljöfaktabok för bränslen (2011) IVL Svenska miljöinstitutet. Edited figure: Sylwia Klatka



BIOGAS AS FUEL

Vehicle								
	Urban	Short	Medium	Long	Short	Medium	Long	Short sea and ferries
Electricity								
Hydrogen								
Biofuels								
Biogas								LNG/LBG

Source: Biogas 2020 (2016) project

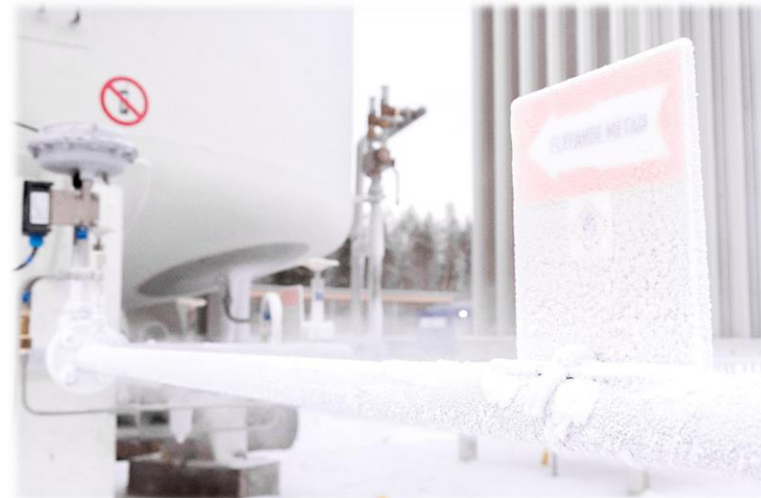


Photo: Stormossen (2016)



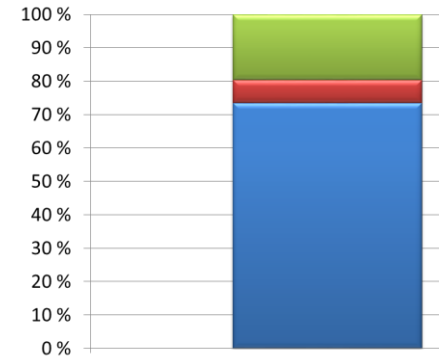
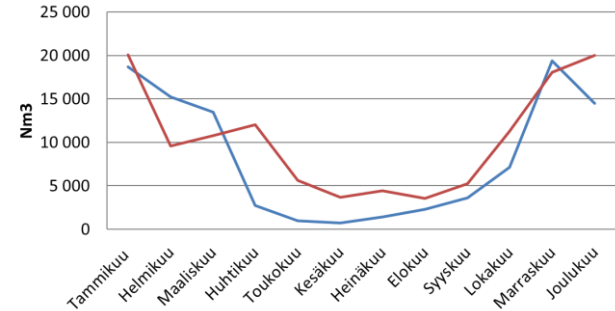
Source: EBA (2015) Statistics



VALUE CHAIN



- **Biogas upgrading**
 - Biomethane for transport sector
- **Less flaring**
 - Flaring is done by the gas engine
- **Reconstruction of pre-treatment and heating**
 - District heating from Westenergy
 - Less electricity consumption



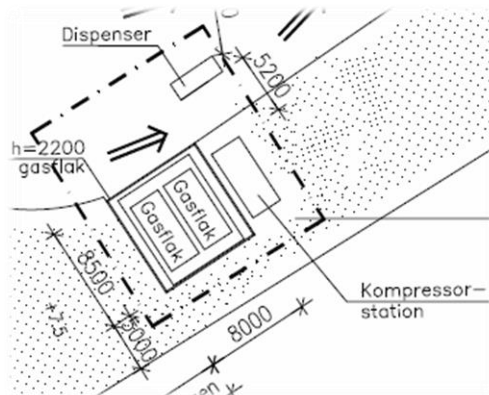
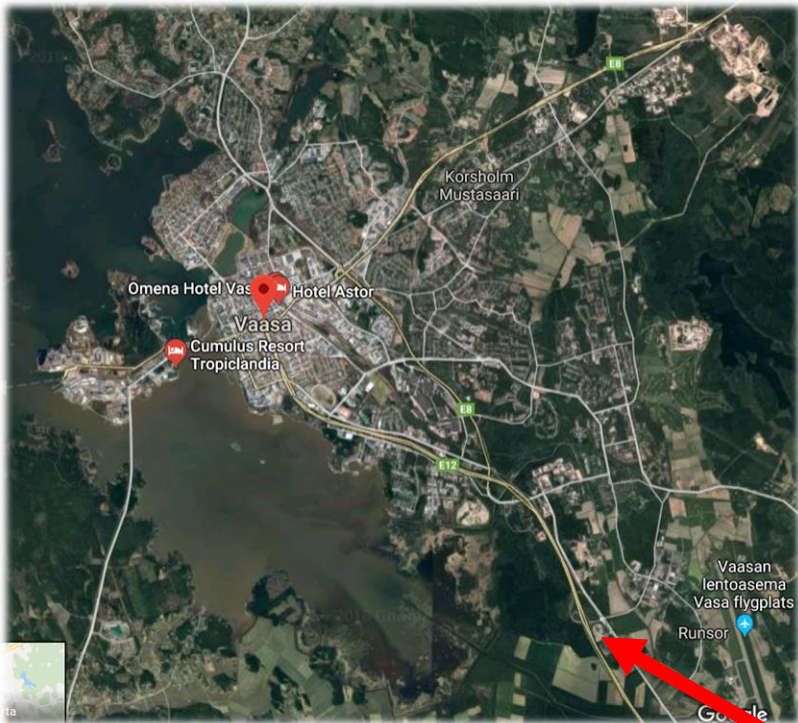
STRATEGY



- **First filling station for CNG-vehicles in the Vaasa region**
 - Upgrade biogas to bio-methane
- **District heating for process heat**
 - Optimize biogas production
- **Second filling station in the Vaasa region**
 - Increase substrate and biogas production
- **Third filling station in the Vaasa region**

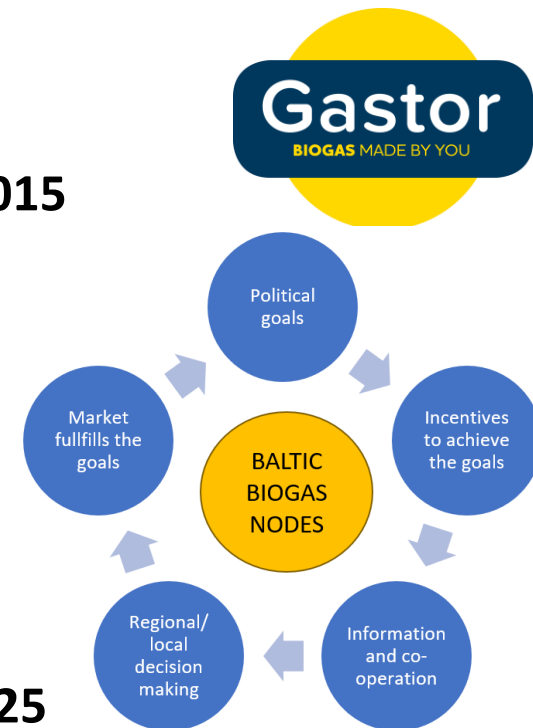


SECOND FILLING STATION

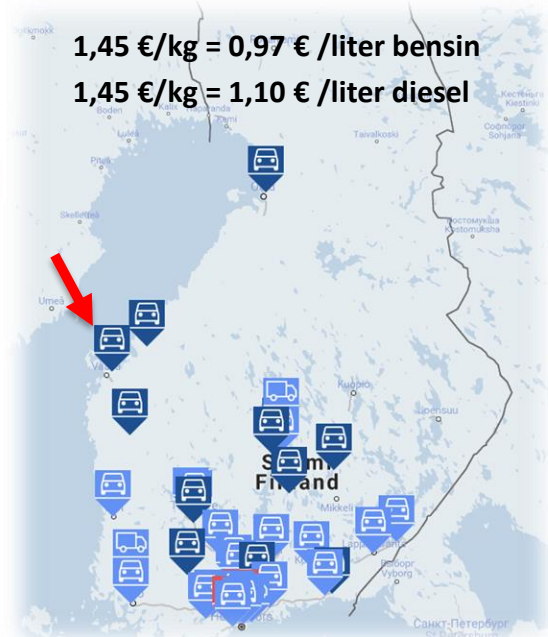
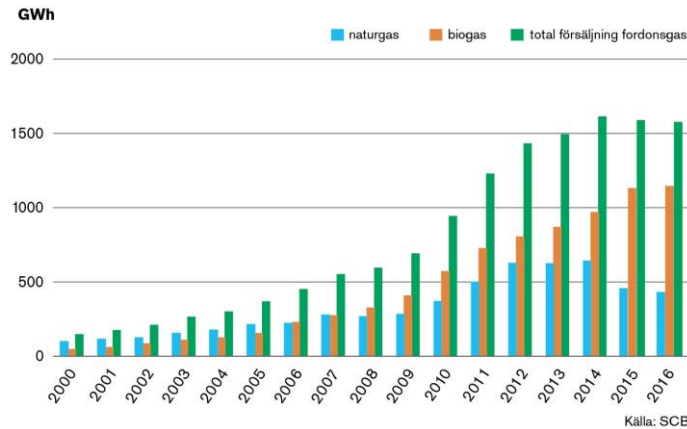
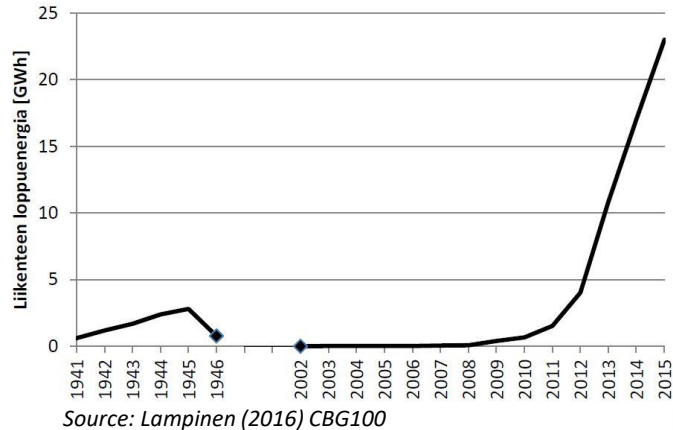


TARGETS

- **The Paris climate agreement adopted in December 2015**
 - Limit global warming to well below 2° Celsius
- **EU 2020 strategy, directive for renewable energy**
 - 10 % biofuel in transport
- **EU 2030**
 - 40 % cut of greenhouse emissions
 - 27 % share of renewable energy
- **EU 2050**
 - 80-95 % reduction & 60 % reduction in transport
- **DAFI - Directive on alternative fuels infrastructure 2025**
 - CNG/CBG fueling stations 150 km and LNG/LBG fueling station 400 km
- **Finland 50 000 CNG-vehicles by 2030**
- **City of Vaasa to be CO₂-neutral by 2035**



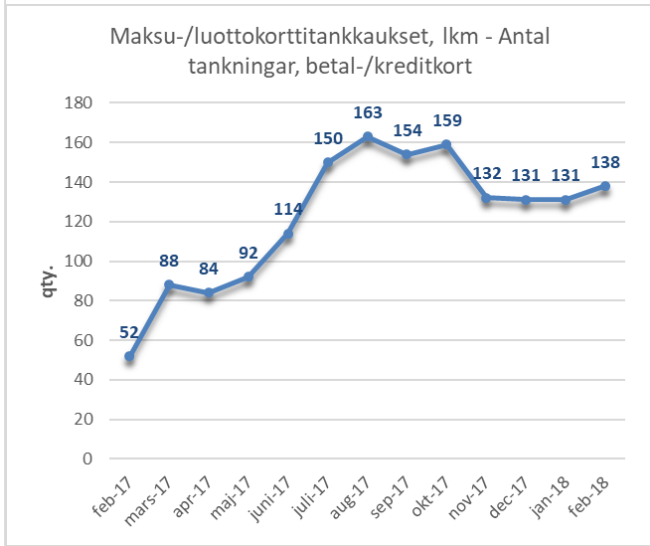
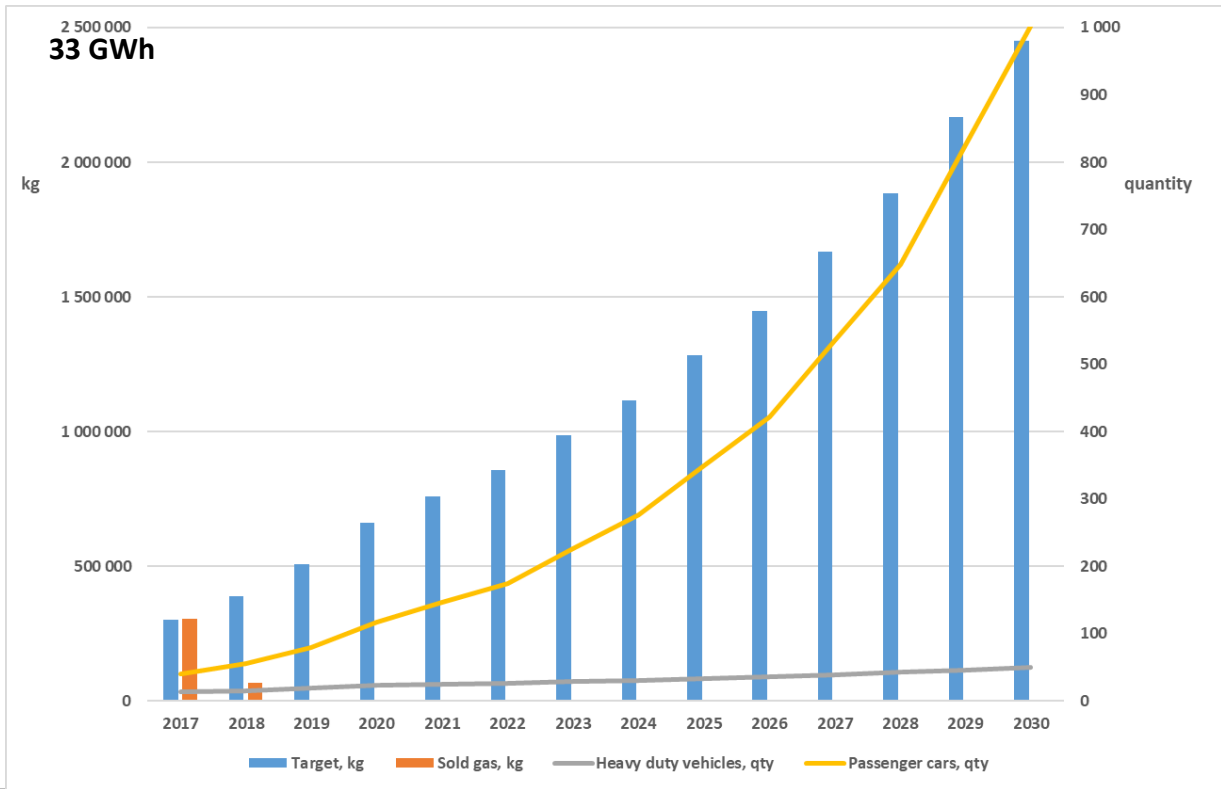
MARKET



Source: Gasum (2017)



MARKET



MARKET

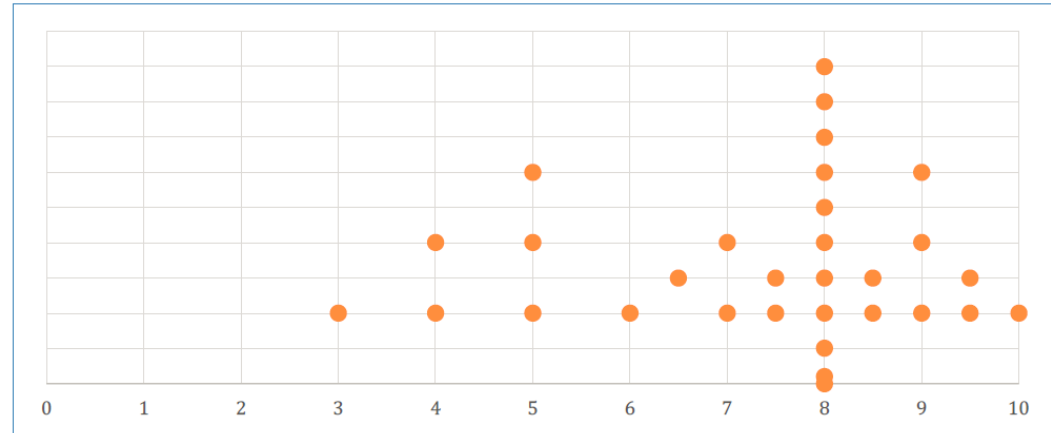
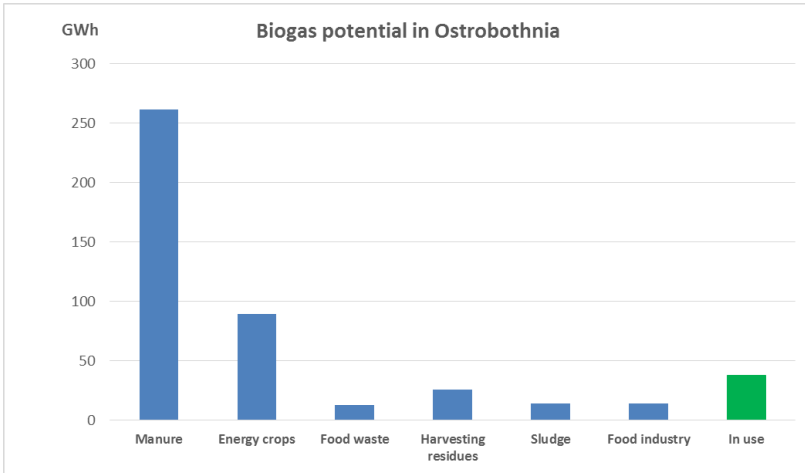


In use 9% of 420 GWh

Fuel demand in Ostrobothnia:

1465 GWh → 420 GWh = 29 %

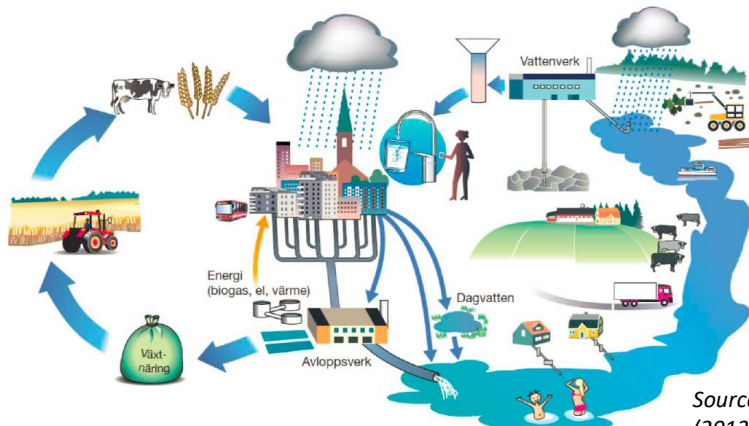
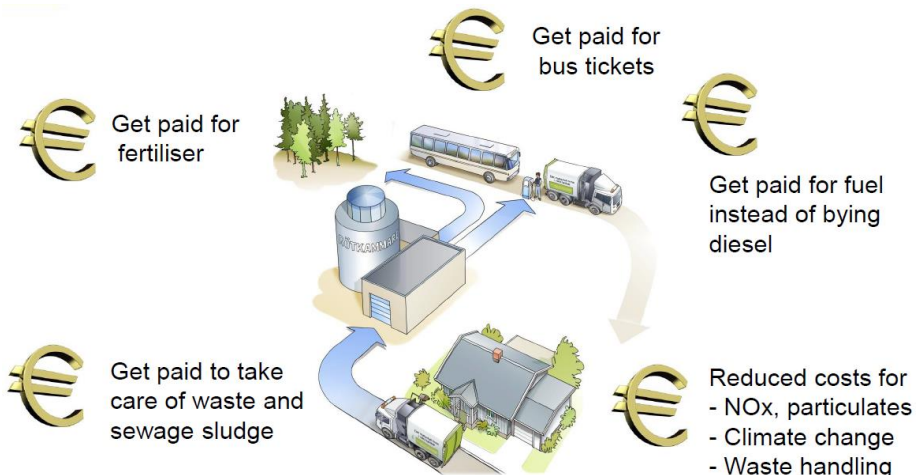
Attitude towards CBG-use in the Vasa region



MARKET



CIRCULAR ECONOMY



Source: Svenskt vatten (2013) Vattenvisionen

Source: BioGaC (2015) Skellefteå kommun and Biofuel region

Source: Biogas Botnia (2013) Samhällsekonomiska effekter av en utökad produktion och användning av biogas i Västerbottens län, Västernorrlands län och Österbottens län.

	Västerbotten	Västernorrland	Österbotten
GRP (BRP)-effect, million €	17	15	27
Earned income, million €	5	4	8
Disposable income, million €	3	2	5
Effect on tax revenue, million. €	2	2	3
Environmental effects, million €	3	2	3
Employment, persons	110	90	180



SUSTAINABLE DEVELOPMENT GOALS

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EnergyWeek
2018



Energy regulation
21 March 2018



STORMOSSEN

SUMMARY



- High quality fuel from waste, versatile, local and renewable
- Lots of unused potential and better than burning the organic waste
- Working technology with very low emissions
- Biomethane benefits from the development of LNG
- To achieve environmental goals biogas has to be strongly considered when planning use of natural gas
- Biogas can't be compared one to one in terms of energy production
- A possibility to replace artificial fertilizers
- System integration to create circular economies



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Thank you!

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