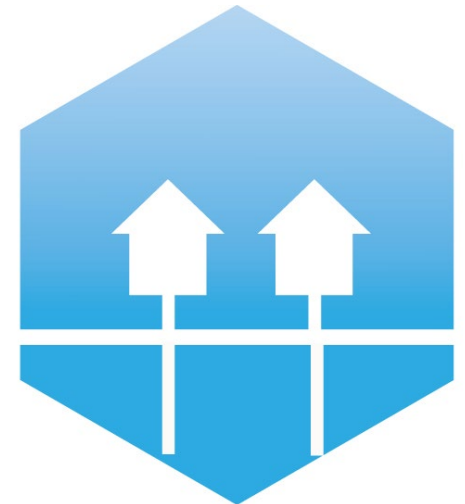
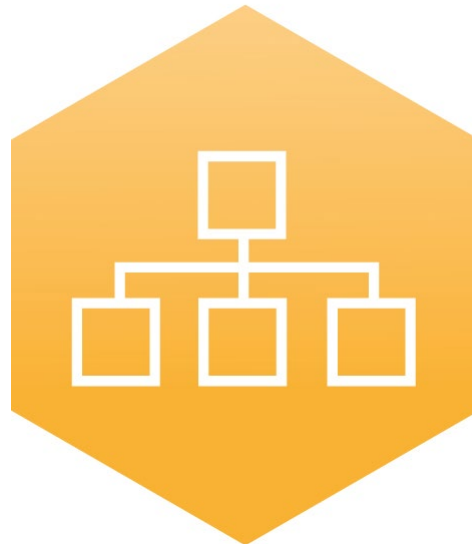


System perspective on biogas use for transport and electricity production.



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AALBORG UNIVERSITY
DENMARK

4th International Conference on Smart Energy
Systems and 4th Generation District Heating 2018
#SES4DH2018

4DH

**4th Generation District Heating
Technologies and Systems**

Starting point

- There is biogas production in Linköping municipality.
- There is not a gas grid in this area.
- How should this resource be used?



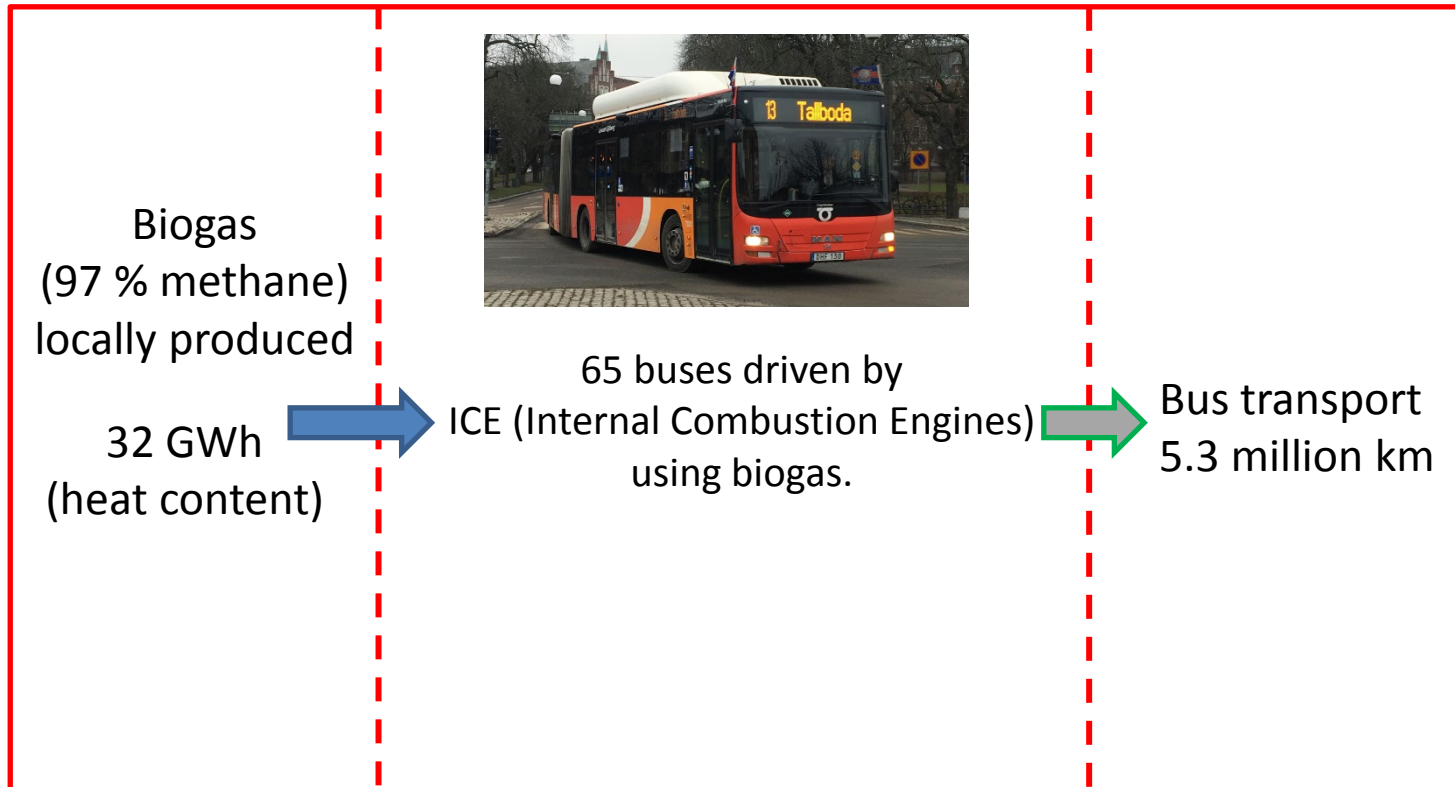
Linköping municipality
Regional energy system 1 – biogas driven buses



Fuel

Conversion

Service



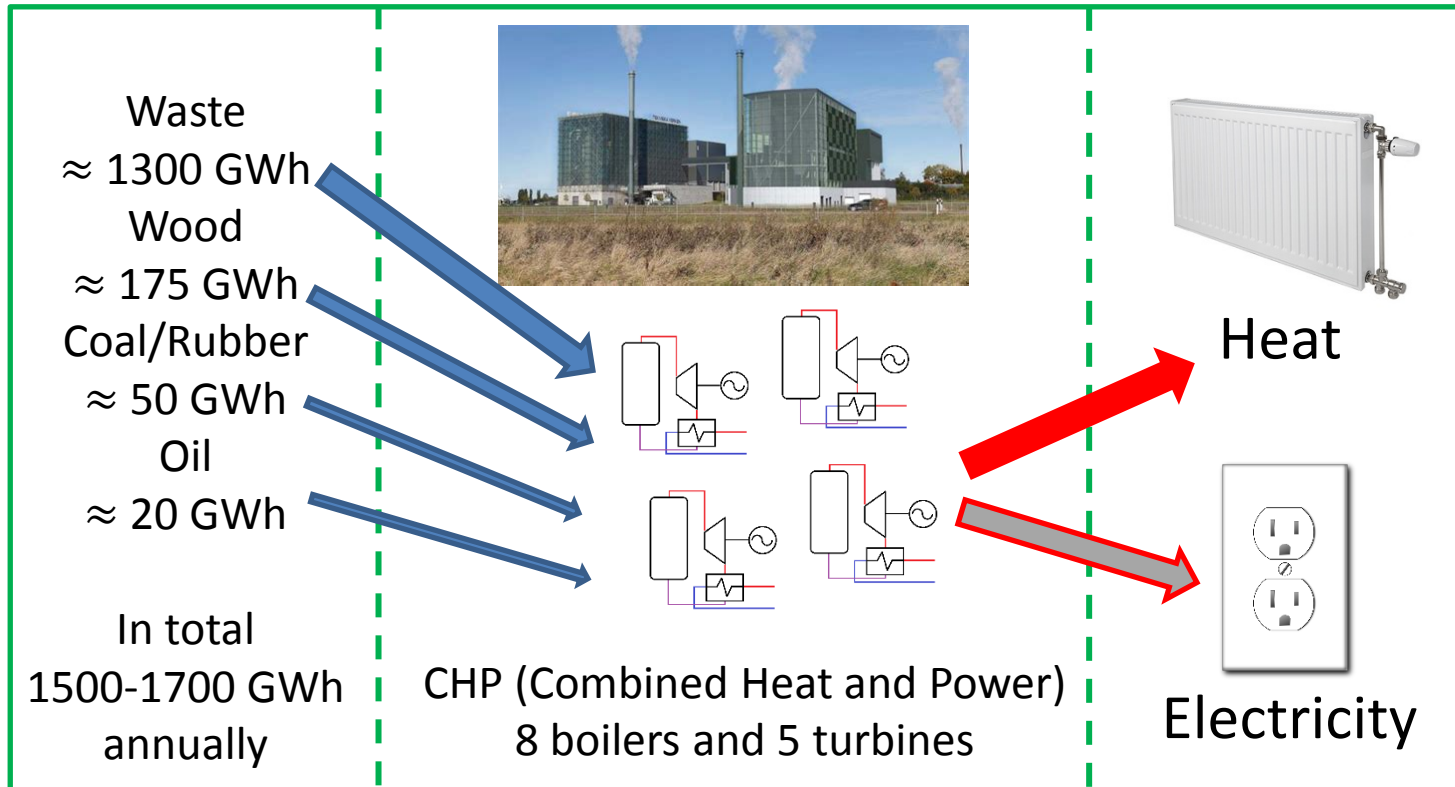
Linköping municipality
Regional energy system 2 – District heating with CHP



Fuel

Conversion

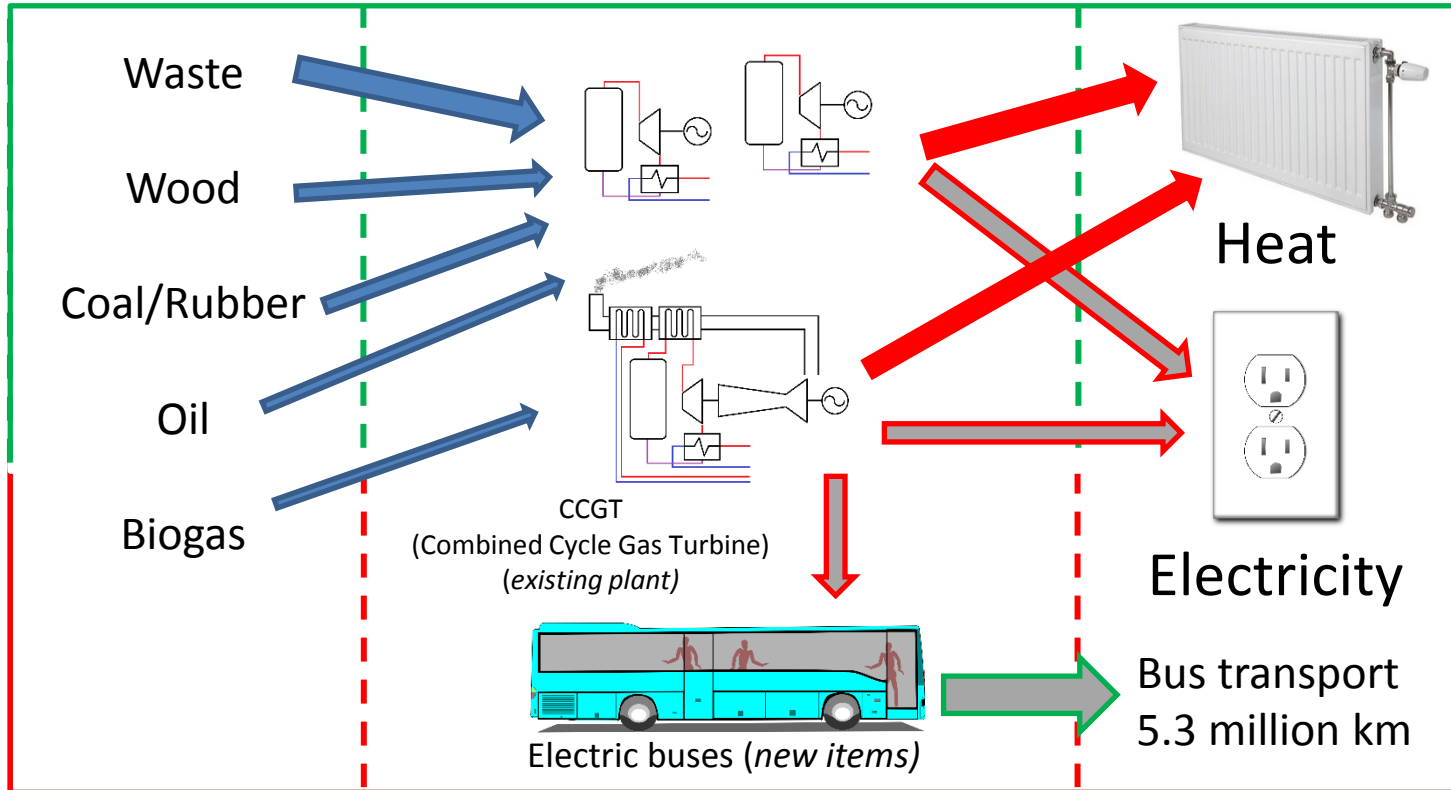
Service



Fuel

Conversion

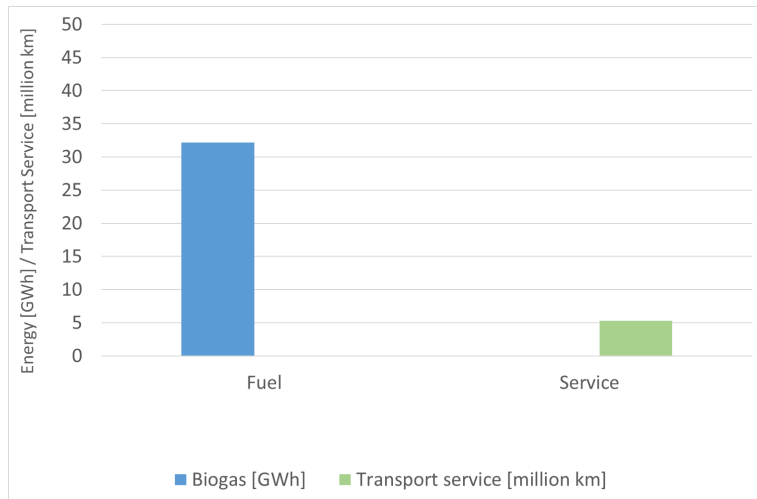
Service



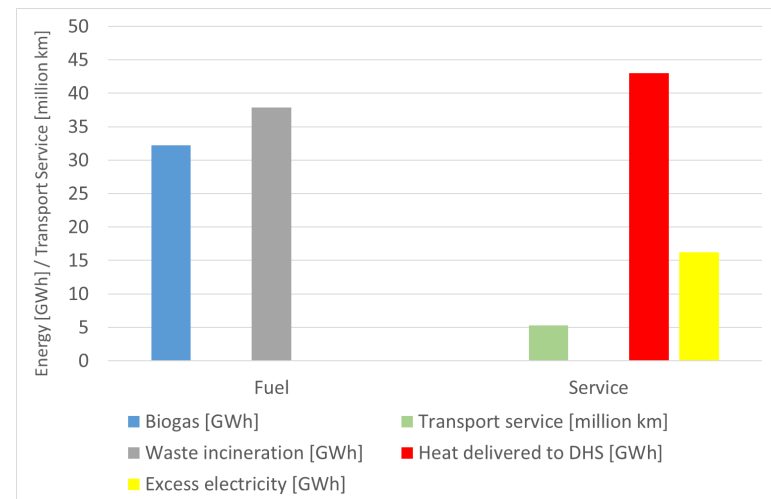
Biogas use for bus transport – system comparison



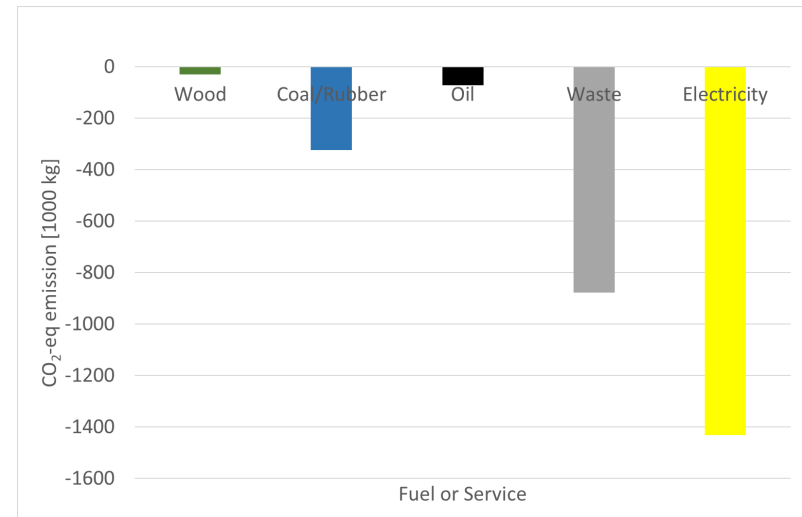
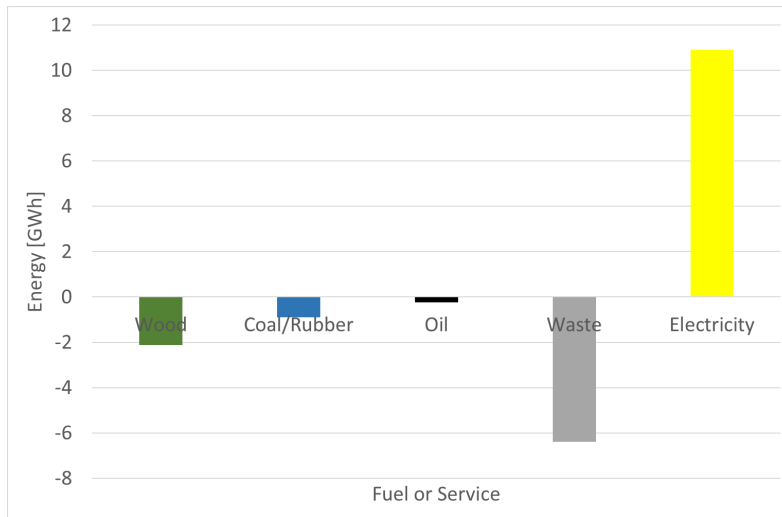
Biogas driven buses, ICE



Biogas used in CCGT, electric buses for transport



Changes in combined system after system integration



	Biogas driven buses, ICE	Biogas used in CCGT and electric buses for transport
Heat losses	Losses through engines and exhaust pipes, 65 major heat losses.	Losses through flue gas from CCGT. Losses through pipes in DHS.
Bus transport efficiency	5,9 kWh (biogas) /km	1 kWh (electricity) /km OR 3 kWh (biogas/waste) / km



Questions?



Changes in combined system after system integration. *Conservative efficiency for electric bus - 2 kWh/km*

