Assessing impacts of a regional collaboration on large-scale excess heat utilization

Erik O. Ahlgren, Akram Sandvall, Tomas Ekvall*
Dept of Energy and Environment, Chalmers Univ of Technology
*IVL Swedish Environmental Research Institute

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Smart heat synergies

- CHP waste incineration
- Heat storage
- Geothermal
- Intermittant electricity
- Transport biofuel production
- Industrial waste/surplus/excess heat

Industrial excess heat

Challenges

• Unknown energy system impacts
• Uncertain environmental impacts
• High investment cost
  – Lock-in effects?

➔ Sustainable?
Questions

• What are the impacts on the energy system and its CO₂-emissions of a large-scale excess heat utilisation?
• Is it economically sustainable?
• Is it sustainable from a broader perspective?
Methodology

- Case study
- Local and regional scales (regional biomass market)
Coincidence

Parallel processes

• Academic project/s
  — Industrial process engineering
  — Energy systems analysis
  — Energy market studies

• Actors
  — Chemical industries
  — DH utilities
  — The region

→ Project + reference/stakeholder groups
Common case

The Stenungsund case

Project:

West Sweden collaboration on industrial excess heat
The case - local

50-55 km

Stenungsund

Kungälv

Gothenburg & Partille

Mölndal
Västra Götaland (VG)
Industrial heat extraction

- Different levels requires various degrees of collaboration
- Extraction costs input to system calculations
DH today

DH in the region:

• Biomass
• Waste heat (MSW incineration + Refineries)
• NGCC
• Heat pumps
Unused biomass

- Co-combustion with coal (export)
- CHP elsewhere
- Biofuel production
Regional biomass supply curve

- Forest residues (Tops and Branches)
- Forest residues (Stumps)
Climate policy scenarios

- 450PPM or BASE (450 ppm)
- NEWPOL (New Policies)

Sensitivity analysis

- No NG (after 2030)
- REHD (reduced heat demand)
- LIC (50% lower pipeline cost)
- INTRATE
- REFINERY (cont’d operation)
- RES-S (cont’d el.certificates)
- NOSNG (NO alternative regional biomass demand)
Optimisation modeling

- MARKAL_West Sweden
- Time horizon: 2010-2050
- Load curves
- 37 DH system represented
  - Investment opportunities
- Transport biofuel production
Assumptions

• Marginal electricity
  — Short-term
  — Long term (built)
Results
Does the model build the pipeline?

- Is this solution providing more welfare (more cost-efficient) that any other solution to supply the heat demand?
Resulting cost-optimized excess heat capacity
Change - regional district heat delivery
System cost change (I)
Marginal cost change (Göteborg)
Change - CO2-emissions

- CO2 emissions from DH systems in VG
- CO2 from transport
- Net CO2 emissions with marginal electricity effects and transport included

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Other sustainability impacts?

- Acidification
- Eutrophication
- Job creation
- Risk
Conclusions

Investment profitable?

In most tested cases

Climate?

Dependent on perspective and marginal electricity

Generally?

Complex system effects

Resource efficiency!
Process learning

- Collaboration
- Round-table discussions
  - Energy system model
Will it be built?
Thank you!

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