Comprehensive Assessment of the Potential for the Application of High-Efficiency Cogeneration and Efficient District Heating and Cooling – “The Approach and Methodology used in Austria to Determine the District Heating Potential”

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Introduction

- As part of the EU Energy Efficiency Directive (EED) ("Directive 2012/27/EU of the European Parliament") all member states have to “develop a comprehensive assessment of the potential for the use of high-efficient combined heat and power (CHP) and efficient district heating and cooling by the end of 2015”
- Includes a country-level cost-benefit-analysis
- The directive gives suggestions on which regions have to be considered
  - Conurbations with a plot ratio of at least 0.3 (building floor area to land area)
  - Industrial sites with total annual demand >20 GWh
Methodology – Overview

Heat demand industrial sector

Heat demand residential sector (2025) (Space heating & domestic hot water)

Technical potential for district heating and CHP

Economical potential for district heating (CBA)

Relevant existing infrastructure (plants 2025 and networks)

Waste Heat Potential
Solar-thermal Potential
Biomass-Potential
Geothermal Potential
Existing plants
Waste Incineration
Natural-gas Potential
Heat demand in range of gas-pipeline

Project GeoEnergy 2050

Roof-space on big buildings
Forestry biomass (project RegioEnergy)
Methodology – “Relevant Regions”

• Suggested criteria of plot ratio of 0.3 led to only 7 regions with demand >10 GWh/a

• “Main Regions”
  – Heat density of raster element >10 GWh/km²
  – Plot ratio > (0.25 - energy demand)
  – Annual heat demand >10 GWh
  → 38 municipality-crossing main-regions (including 109 municipalities)

• “Secondary Regions”
  – Remaining 2367 municipalities
  – Classified to 30 types of secondary regions
    • Climatic aspect (sea level)
    • Distribution of heat density
    • Existing network infrastructure
    • Availability of technologies (Gas, Geothermal, Waste Heat)
Methodology – Cost-Benefit-Analysis

- CBA is done for the 38 “Main-“ and the 30 “Secondary-Regions”
- Each region
  - Divided into area w/ w/o existing network
  - Demand split into 5 different heat density classes
  - 10 sub-regions
- Merit order of all technologies (also local) including production-, transportation-, distribution costs and generated income
Results – Heat demand and relevant regions

Available soon: www.austrian-heatmap.gv.at
Results – Economic potential (Central scenario)
Results – Sensitivity analysis

Central Scenario
High CO₂-price
Low Gas-price
High Gas-price
Low connection-rate
High-efficient buildings

- Existing district heating capacities
- Additional efficient district heating potential
- Additional high-efficient potential for CHP in district heating
- Locally supplied demand

Existing CHP in district heating
Additional potential for district heating
Additional potential for CHP in district heating

International Conference on Smart Energy Systems and 4th Generation District Heating, Copenhagen, 25-26 August 2015
Results

• 40% of residential heat demand in “main-regions”
• Under central-scenario conditions DH has high potential
  – Economical feasible down to 10-20 GWh/km²
    • Depending on heat production costs
  – 90 % connection rate
  – Also potential in “secondary regions”
  – But less than 50% are “efficient” (rather in rural areas)
  – No potential for additional CHP under assumed conditions

• District heating has high sensitivity to connection rate
  – Limited potential when applying 45% connection rate
  → Energy planning or connection obligation is necessary
Conclusion

• No exact method in directive
  – Plot ratio not clear enough and maybe to simple
• Combination of exact (main regions) and aggregated method (secondary regions)
• No general method on how to determine “relevant” regions
• Only certain degree of detail in national assessments
  – No exact information about demand per building
  – Model limitations: (One model network, Size, Temp.-level, …)
• Local characteristics are important
  – Network size, ground properties, individual parameters
  – Cost of integration of waste heat/ geothermal heat etc.
• Availability of data is not as in some other countries
References


Thank you for your attention!

Questions / Discussion

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