Dynamic prices for heat delivered to district heating systems

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Phase I: 2015/16

WP1: Review of existing experiences with dynamic prices for heat supplied to district heating systems

WP2: Computation of hourly marginal values per node for Aarhus, Odense and Copenhagen district heating system

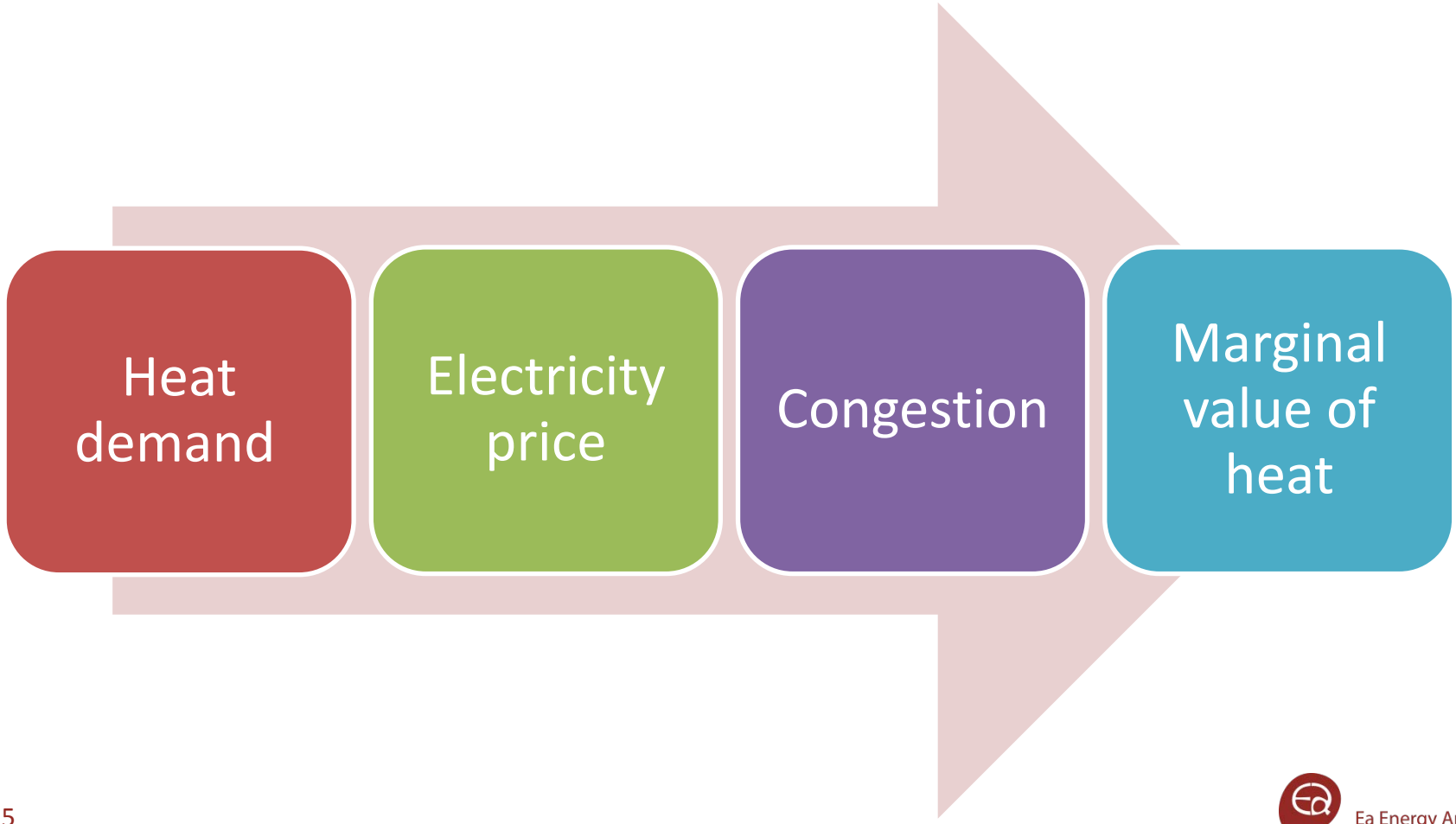
WP3: Development of practical contracts for heat supply

WP4: Summary of results and development of Phase II

Optimal dispatch

- In a vertical integrated district heating utility (producing heat on own units) optimal dispatch of heat generation is clear:
  - Use units with lowest marginal cost first, and add generation (increasing marginal cost) until demand is covered
    - Optimal use of heat storage
  - Respecting any transmission capacity limitations (bottlenecks) and the changing electricity price
- With independent suppliers a new interface is needed
  - Simplified contracts, tariffs

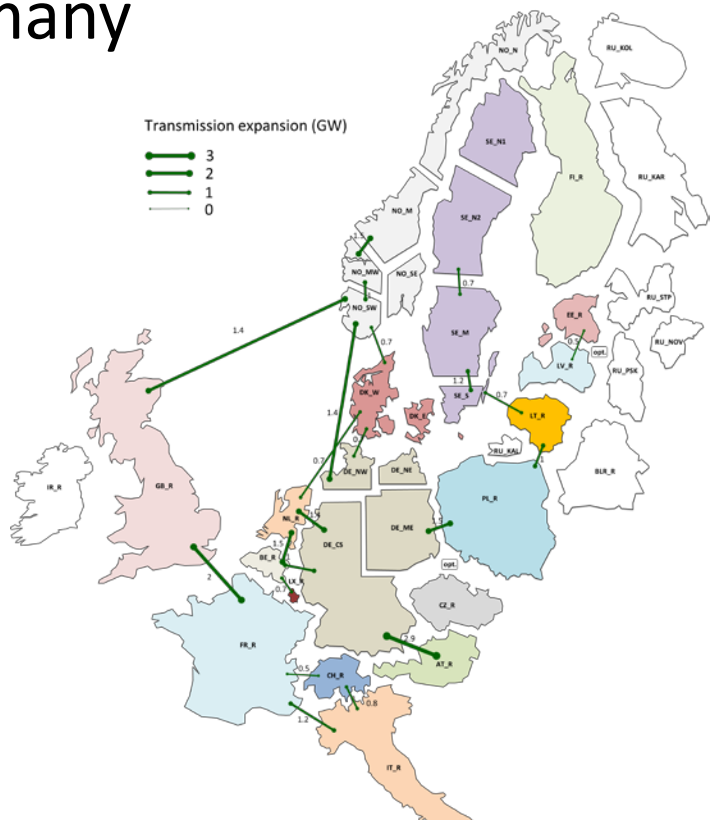
Marginal value of heat



- Congestions
  - In the future new generation may come online – and these may be placed ”inconvenient” compared to the original design of the district heating network
  - Congestion may become more frequent
- New resources
  - Industrial surplus heat, heat pumps based on sewage water, groundwater, seawater or district cooling (which can consume or deliver heat dependent on system design), geothermal energy, solar heating or even privately owned heat pumps and other resources

Balmorel

- Fundamental model
- Optimal dispatch in a large area
  - E.g. Nordic countries and Germany
- Heat and electricity



WP1: Review of existing experiences

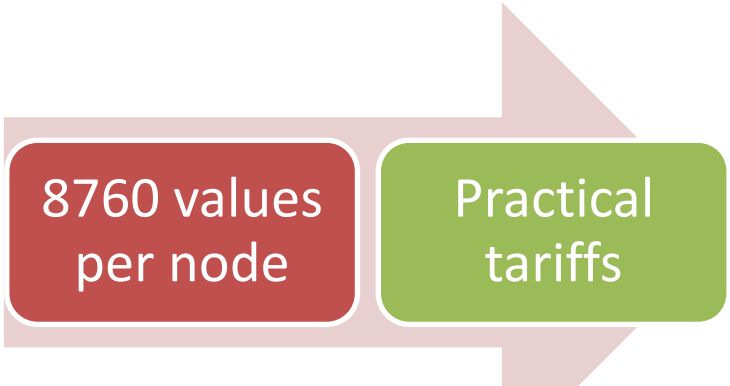
- State of the art, literature review
- Cases: Aarhus, Odense, Copenhagen, Gothenburg, Stockholm
  - Current practise
    - For large and small heat surpliers
    - The use of hourly, average prices in Aarhus
  - Analyses of congestion
- Current regime with price control
- Current tax system

WP2: Computation of hourly values per node

- Ideal values computed by Balmorel
  - Reference for 2015
  - Scenarios for 2025, 2035
    - For the electricity system
      - Generation and transmission
    - For the three district heating systems
      - Focus on new heat generators: Surplus heat, heat pumps and solar

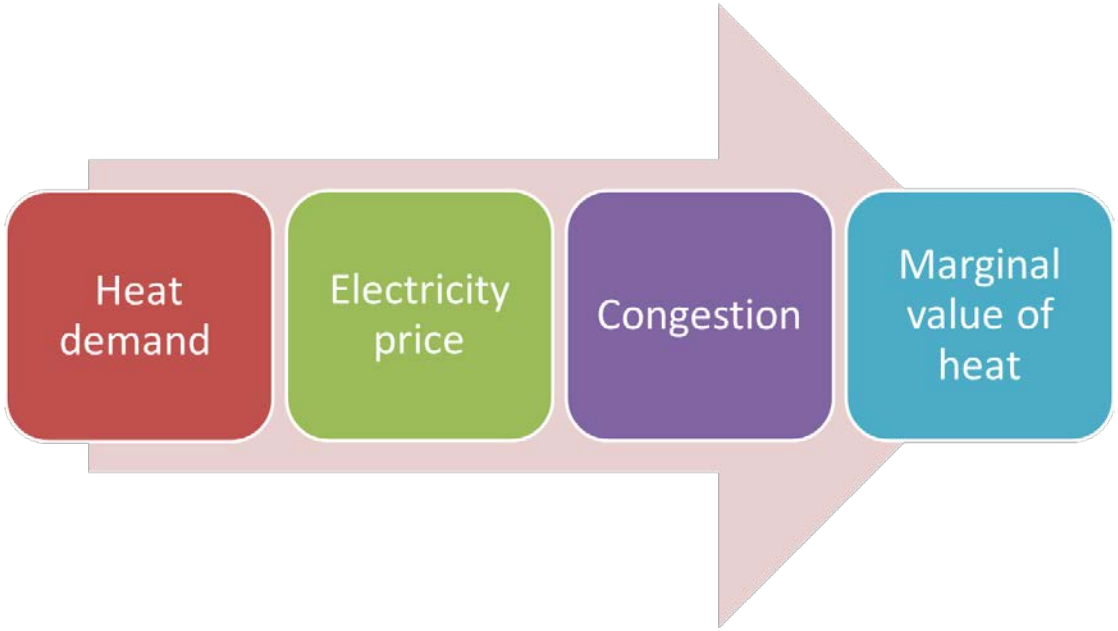
WP3: Development of practical contracts for heat supply

- Market or tariffs?
  - Day-ahead or realised costs?
- Contracts – or tariffs – may be very simple
  - Time-of-use (TOU)
  - TOU with seasonal variation
  - TOU with dispatch of expensive days, e.g. day-ahead



WP4: Phase II

- Define practical tests
- Describe tools needed
  - Prediction of marginal prices


Heat demand
Electricity price
Congestion
Marginal value of heat

THANK YOU!