LULEÅ UNIVERSITY OF TECHNOLOGY

DECISION TOOL FOR ENERGY PRODUCERS AND SYSTEM GRID OPERATORS IN SMART CITIES

SMARTGREENS 2015, LISBON, PORTUGAL, 21ST MAY 2015

Saguna
Luleå University of Technology

SEVENTH FRAMEWORK PROGRAMME

ORPHEUS

ORPHEUS DECISION TOOL

- Different conditions addressed within each control setup while designing the control algorithms:
  - Economic
  - Social and
  - Technical

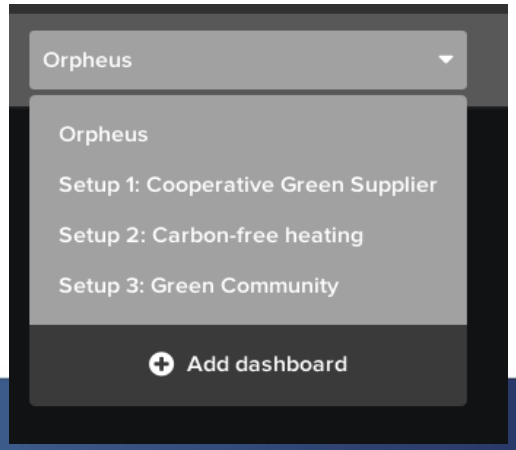
  *Basis for the design of the Decision Support Visualization Tool
- Target audience: energy producers and manufacturers in similar cities within Europe as the demo sites
- Visualizes outcomes for applying results in real products and plants across general smart cities concept
- Presentation of results in a form which facilitates easy gain of knowledge by stakeholders
- Adaptable for a multitude of similar situations in a wider European Smart city scale

ORPHEUS DECISION TOOL

- Decision Support Visualization Tool
  - In relation to control setups in
    - City of Skellefteå, Sweden and
    - City of Ulm, Germany
  - Both locations have hybrid energy systems
    - Skellefteå: CHP plant produces both DH and power using different fuels
    - Ulm: PV system, heat pumps and gas
  - Focused around cooperative control strategies integrating multi-utility optimization
  - Includes portfolios of future scenarios within today's business model space
  - Enables
    - Planning of investment and
    - System operation and maintenance

ORPHEUS DECISION TOOL

- 3 Control Setups exist:
  - Cooperative Green Supplier
  - Carbon-free heating
  - Green Community
- Some example of KPIs
  - Reduction of total system cost
  - Internal Rate of Return (IRR) of investments
  - Fossil Fuel Savings
  - Reduction of Green House Gas Emissions
- Example of possible dashboards for the decision tool

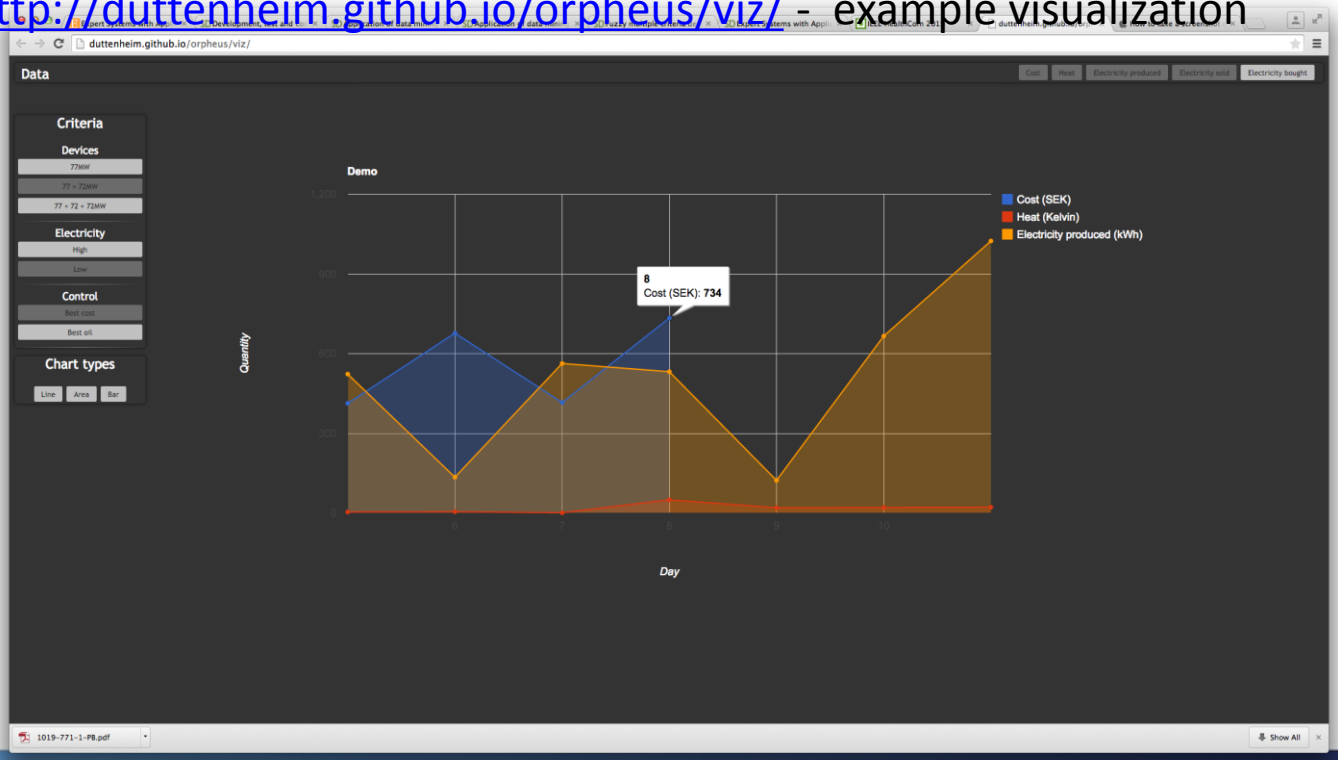


CONTROL SETUP 1 DETAILS

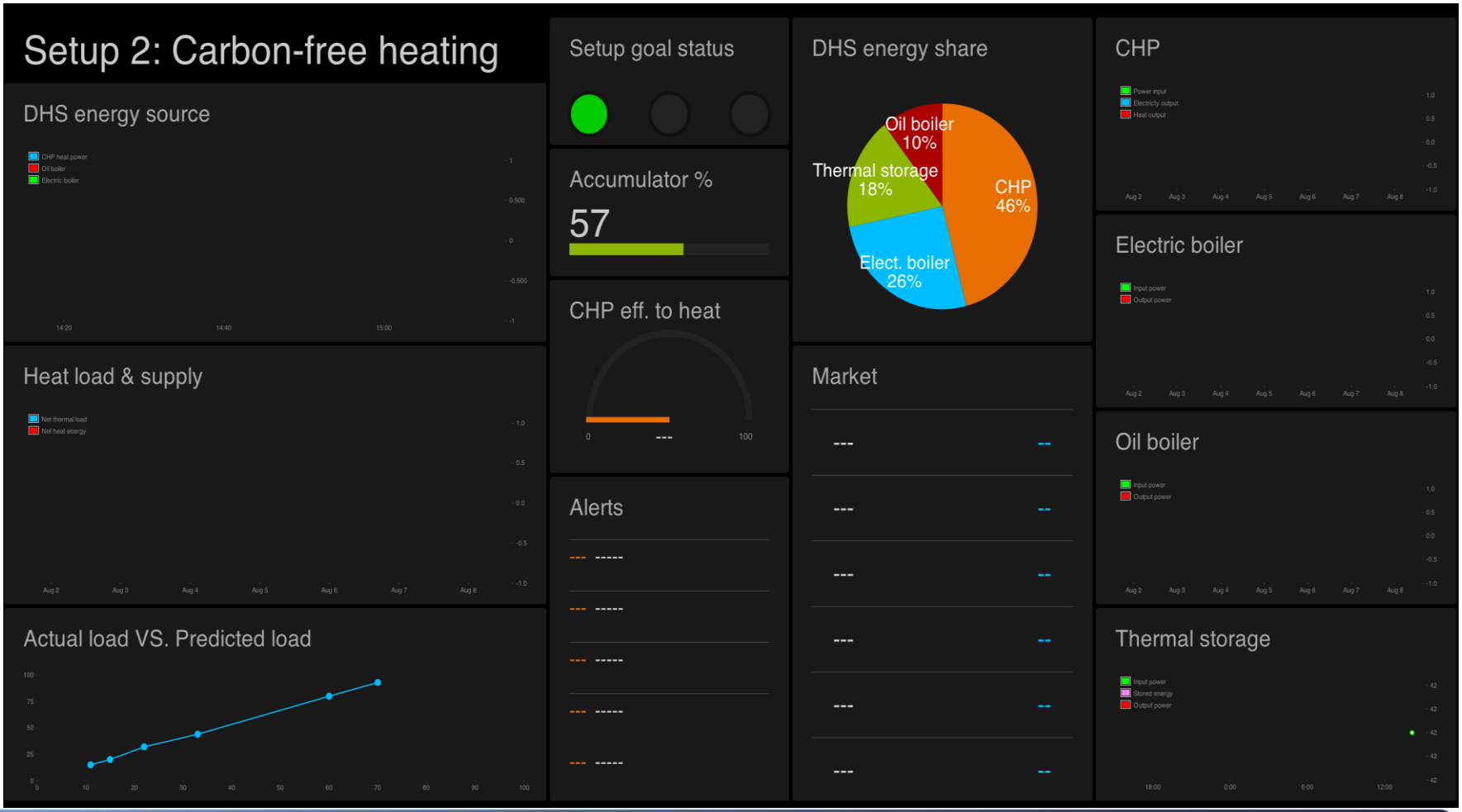
- For example,
  - Setup 1 – Cooperative Green Supplier
    - The outputs of various use cases formulated during the control setup simulations form the basis for visualization here
- Some example parameters for *Control Setup 1* are:
  - Heat output of CHP
  - Electric output of CHP
  - ESS stored energy
  - Energy stored in thermal storage
  - Heat power output of electric boiler
  - Power output of wind farm
  - Thermal load of DH grid
  - Electric load of DH grid
  - Output power from thermal storage
- Hundreds of simulation runs and outcomes within each use case

SAMPLE VISUALIZATION TO SUPPORT DECISION MAKING

- Visualization of results enables
  - Better decision making in different scenarios
  - Provides clarity while adapting results to different cities with similar scenarios
  - http://duttenheim.github.io/orpheus/viz/ - example visualization



CARBON-FREE HEATING CONTROL SETUP



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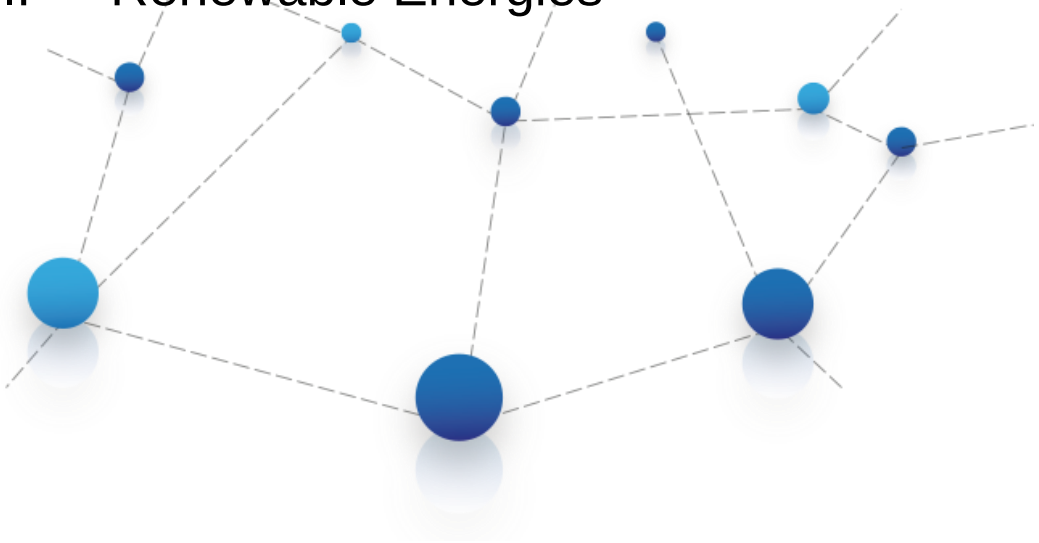

The OrPHEuS project is co-funded by the European Commission within the 7th Framework Programme 'Smart Cities' 2013. The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Commission. The European commission is not responsible for any use that may be made of the information contained therein.