District heating system optimization with RIVUS, Case study Salzburg

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AGENDA

1. RESEARCH STUDIO AUSTRIA – ISPACE
2. LIGHTHOUSE PROJECT: SPATIAL ENERGY PLANNING (SEP)
3. DISTRICT HEATING OPTIMIZATION RIVUS & HEATAPP (1)
4. DISTRICT HEATING OPTIMIZATION RIVUS & HEATAPP (2)
5. CASE STUDY: SALZBURG
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7. CONTACT DETAILS

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1. RESEARCH STUDIO AUSTRIA - ISPACE

- part of the RSA FG - pipeline between universities and industry
- RSA FG consists of 57 experts and has 38 ongoing projects
- ISPACE focuses on development and provision of methods with spatio-temporal components in the field of energy systems
- Core competencies:
  - Provide spatial analysis, simulation and visualisation to support decision making (private and public sector)
  - Energy systems: analysis of spatial and temporal demand patterns, optimization of energy systems
  - Development of interoperable geographic web information services, provision of standarised geodata, integration of live data sources and spatio-temporal data processing
- Project examples:
  - https://www.researchstudio.at/projekt/idee/?lang=en
  - https://www.researchstudio.at/projekt/enerspired-cities/?lang=en
  - https://www.researchstudio.at/projekt/eurofusion-19/?lang=en
- Website:
  - https://www.researchstudio.at/studio/smart-settlement-systems/?lang=en

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2. LIGHTHOUSE PROJECT: SPATIAL ENERGY PLANNING (SEP)

- https://www.urbaninnovation.at/en/Spatial-Energy-Planning-for-Heat-Transition
- Definition of SEP: use of energy planning as an instrument for urban planning and the decarbonization of heat supply
- SEP receives increased importance on the energy policy agenda:
  - Baden-Württemberg obliges local authorities to carry out spatial energy planning (https://www.energate-messenger.de/news/191691/baden-wuerttemberg-verpflichtet-kommunen-zur-waermeplanung)
  - Vienna creates climate protection areas by mid 2021. The authorities provide an spatial energy plan for each climate protection area (https://www.wien.gv.at/stadtentwicklung/energie/erp/uebersicht.html)
- Lever for the integration of innovative and sustainable heating technologies in the residential sector
- SEP as an instrument of public management can make a significant contribution to the necessary support, coordination and cost efficiency in the decarbonization of the residential sector
- District heating optimization is one tool of SEP that can support local authorities

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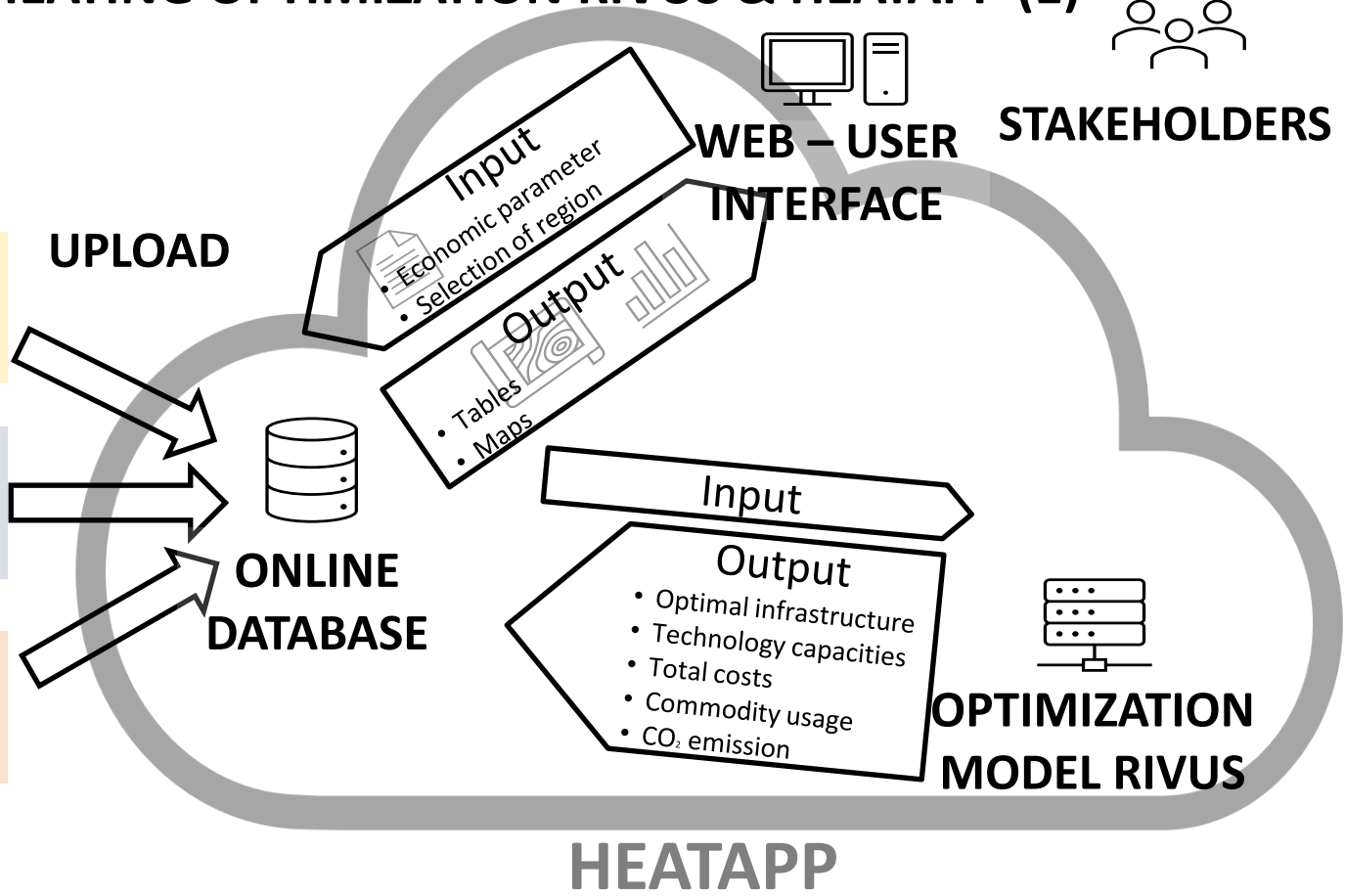## 3. DISTRICT HEATING OPTIMIZATION RIVUS & HEATAPP (1)

STAKEHOLDERS

DATA

WEB – USER INTERFACE

UPLOAD

Input
- Economic parameter
- Selection of region

Output
- Tables
- Maps

Energy Modelling Data
Data source: internal, project partner

GIS Network Data
Data source: Open street map, project partner

Economic Data
Data source: stakeholder, project partner

ONLINE DATABASE

Input

Output
- Optimal infrastructure
- Technology capacities
- Total costs
- Commodity usage
- CO_2 emission

OPTIMIZATION MODEL RIVUS

HEATAPP

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energy CLUSTER DENMARK

sEEnergies

Innovation Fund Denmark

reINVEST

midt regionmidtjylland

DEN EUROPÆISKE UNION
Den Europæiske Fond for Regionaludvikling
Vi investerer i din fremtid

GRØN ENERGI

kamstrup

LOGSTOR

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4. DISTRICT HEATING OPTIMIZATION RIVUS & HEATAPP (2)

RIVUS

- RIVUS finds the cost-minimal distribution network to satisfy a set of demands for energy carriers through Mixed-Integer-Linear-Programming (MILP)
- Open source and implemented in Python (https://github.com/tum-ens/rivus/)
- Contains the complete process chain (generation-transformation-transport-consumption) including related efficiencies and costs
- Several grid and non grid-based energy carriers (oil, gas, district heating, electricity) can be modeled together for one area
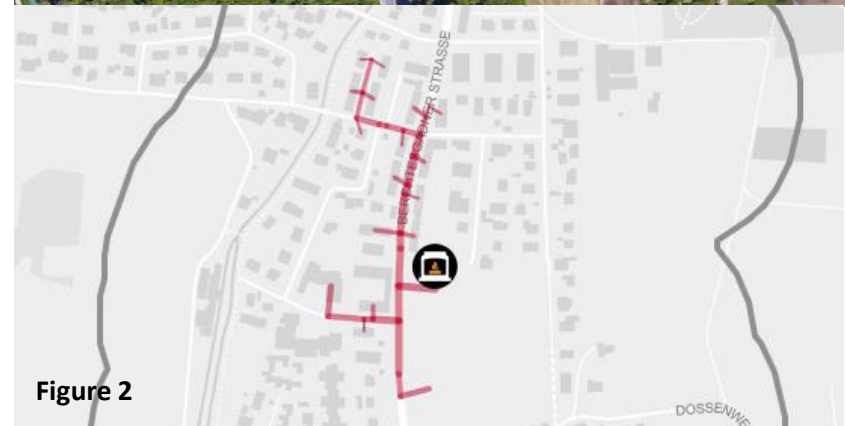
HEATAPP

- The basics of HEATAPP were developed in the IDEE project (https://www.researchstudio.at/projekt/idee/?lang=en)
- Makes it possible to adapt relevant parameters in the grid-bound heat supply based on personal experience or regional specifics
- Allows stakeholders to develop scenarios and to evaluate them cartographically, graphically and in tabular form
- Semi-automated pre-processing reduces the effort to add new geographical regions to the HEATAPP

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5. CASE STUDY: SALZBURG

- During a new construction project (dashed line), a district heating network with an associated heat plant (circles) is planned (figure 1)

- Currently, the heat demand in the project area is exclusively covered by oil and gas – high need for decarbonization

- RIVUS provides the most cost-efficient location of the potential heat plants (number 1) and district heating network to satisfy the demand (figure 2)

- Output of RIVUS changes depending on the variation of the parameters and enable the identification of interdependencies and sensitivities of the district heating network

- Stakeholder (energy contractors, energy supplier, project planner) can develop practice-oriented scenarios (exclude houses with gas connection, 50% of the houses in the project area connect to the district heating network,…)

Figure 1

Figure 2

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6. OUTCOME & OUTLOOK

OUTCOME

- Successful integration and application of the HEATAPP in the planning phase of a construction project
- Scenarios served as a basis for decisions on further tenders
- Access to HEATAPP increased planning certainty for stakeholders
- HEATAPP is a useful tool for SEP

OUTLOOK

- Feedback of stakeholder indicated possible extensions of HEATAPP
  - Information about the probability that household connect to the district heating network
  - Interactive selection of buildings potentially connected to the district heating network
  - adjustment of the economic parameters to key figures customary in the industry
- Next case study: Zell am See (city in federal state Salzburg)

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7. CONTACT DETAILS

- Further details and access to HEATAPP please contact me
- Open for new collaborations and project partners

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- Website: https://www.researchstudio.at/studio/smart-settlement-systems/?lang=en

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