



Integrated District Heating and Cooling Systems: Overview of the results of the international cooperation project IEA DHC Annex TS3

7th International Conference on Smart Energy Systems
21-22 September 2021; #SESAAU2021

This presentation was done in the framework of the international cooperation program IEA DHC Annex TS3 „Hybrid Energy Networks“.

More information at <https://www.iea-dhc.org/the-research/annexes/2017-2021-annex-ts3>

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 Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology



Motivation

- **Integrated energy systems/ sector coupling / integration is considered one of the key measures for decarbonizing the energy system.**
 - District heating and cooling (DHC) networks are **traditionally linking the heating & cooling and the electricity sector** (+ the gas sector) through combined heat and power (CHP) plants.
 - However, **the role of CHP plants will significantly change**
 - competition for renewable fuels with hard-to-decarbonise sectors
 - increasing share hydro, wind and PV, less CHP electricity required
- **We will need other heat (and cold) sources**
- **We will need other coupling points to provide flexibility**

Relevant sector coupling technologies

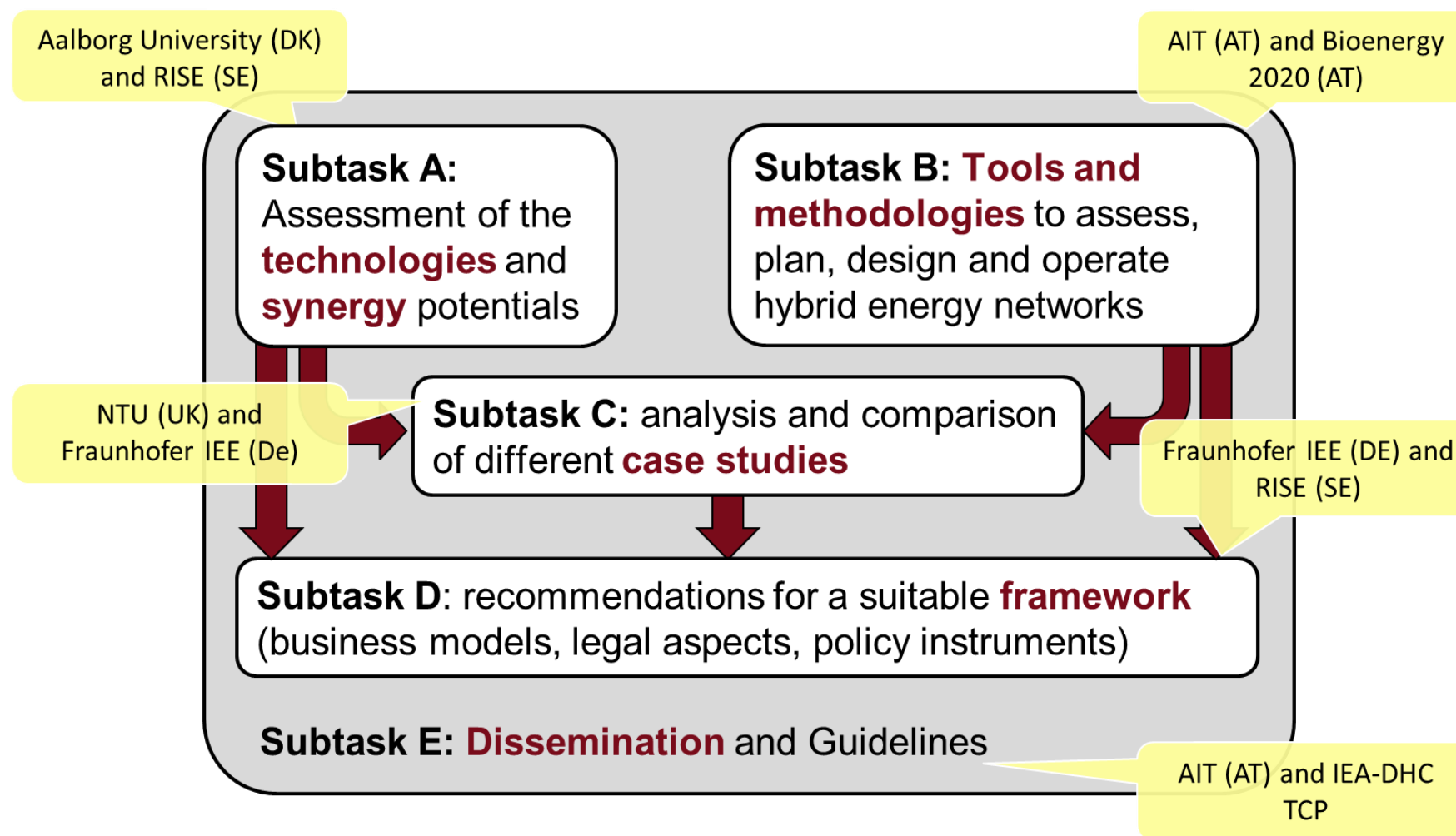
- Waste and ambient heat, solar and geothermal energy often require **heat pumps** (HPs) for upgrading their temperature level;
- **electric boilers** (eBs) enable high temp. heat generation at fast gradients and low costs;
- **power-to-gas** (PtG)¹ processes generate fuels, that can be used in
- **CHP** plants for generating electricity and heat.

¹ PtG process itself generate significant amounts of waste heat, so a proper term would be power-to-gas&heat (PtG&H) or combined heat and gas (CHG) plants

IEA DHC Annex TS3: Hybrid Energy Networks

- **Aim:** To promote the opportunities and to overcome the challenges for district heating and cooling (DHC) networks in an integrated energy system context
- **Funded** through a task-sharing approach (participants contribute resources in-kind)
- **Coordination team:** Ralf-Roman Schmidt (AIT, lead); Dennis Cronbach (Fraunhofer IEE, Subtask D), Anton Ianakiev (NTU, Subtask C); Anna Kallert (Fraunhofer IEE, Subtask C); Daniel Muschick, (BEST, Subtask B); Peter Sorknæs (Aalborg University, Subtask A), Inger-Lise Svensson (RISE, Subtask C), Edmund Widl (AIT, Subtask B)
- **Runtime:** Fall 2017 – March 2022
- **More information at** <https://www.iea-dhc.org/the-research/annexes/2017-2021-annex-ts3>

IEA DHC Annex TS3: structure



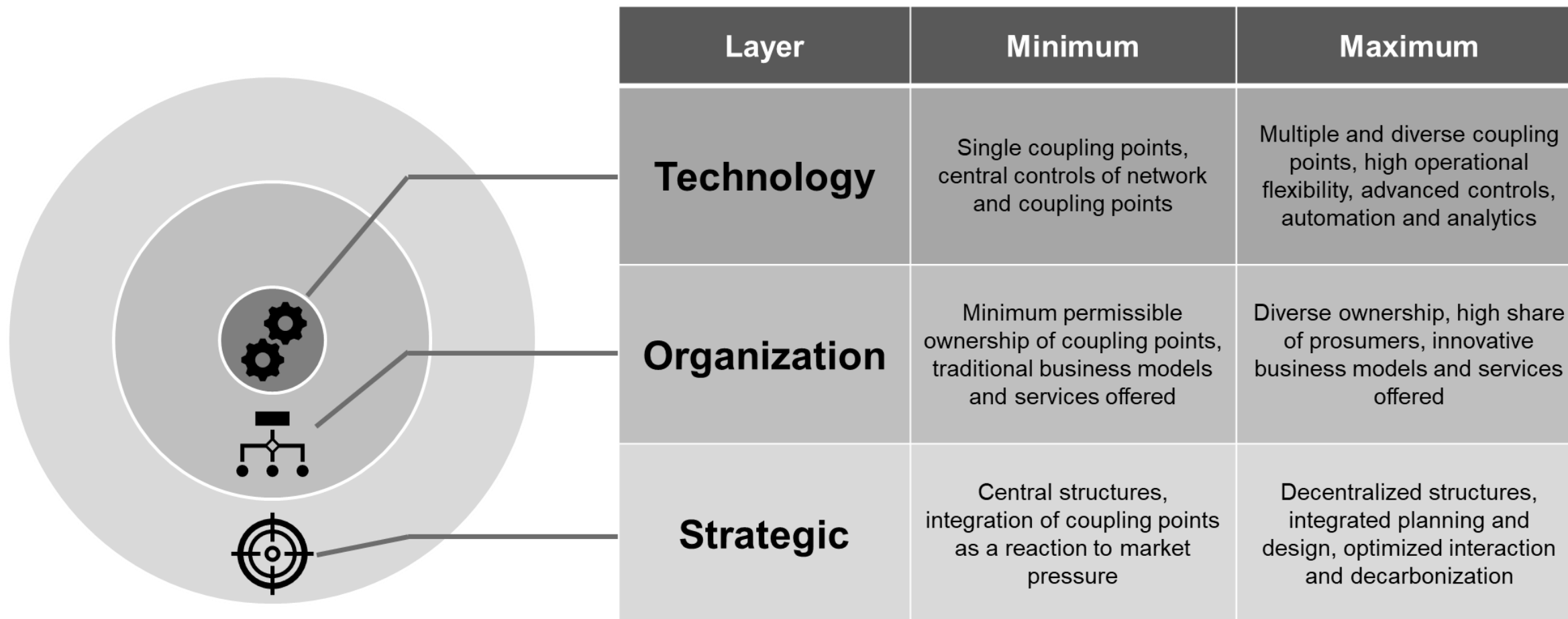
IEA DHC Annex TS3: Schedule

Definition phase	Preparation phase		Working phase					
2017 /Fall	2018 /Spring	2018 /Fall	2019 /Spring	2019 /Fall	2020 /Spring	2020 /Fall	2021 /Spring	2021 /Fall
Austria	Stockholm	Berlin with Industry WS	Stockholm shared WS with ISGAN	France – on invitation by CEA	Online TelCo and public Webinar	Online TelCo and public Webinar	Online a side event to the https://missioninnovationaustriaweek.at	Nottingham/Denmark – part of the symposium/SES

more information (previous webinars, presentations, publications ...) at <https://www.iea-dhc.org/the-research/annexes/2017-2021-annex-ts3>

reporting phase
2022 /Spring
tbd

Hybrid Energy Networks: a classification approach*



**This classification differs from the 4G DHC networks concept (Lund et. al=) → the main characteristic of a HEN is the integration between the different networks, and not the supply temperature or the time period where the different generations were dominating.*

Hybrid Energy Networks: a SWOT assessment

See also: Ralf-Roman Schmidt; Benedikt Leitner: **A collection of SWOT factors (strength, weaknesses, opportunities and threats) for hybrid energy networks**; Energy Reports, special issue for the 17th International Symposium on District Heating and Cooling, 6th–9th September 2021, Nottingham, UK; <https://doi.org/10.1016/j.egy.2021.09.040>

STRENGTH

- Higher degrees of freedom for planning/ operation;
- higher security of supply, resilience, flexibility
- counteract limitations of the el. network + reduce losses
- New business models (ancillary services, markets)
- decarbonization of DHC network
- (booster) HPs support Integrate low temp. heat sources
- economic added value (investment in coupling points)

OPPORTUNITIES

- More research, products, demo projects, trainings etc.
- improved performance of coupling points/ controls
- Digitalization supports handling of the complexity
- Increasing PV and wind → more flexibility required
- Green financing options
- tendency for the reduction of DHC temperatures

WEAKNESSES

- additional investments into coupling points
- increasing level of complexity
- Present electricity tariffs and taxes are a barrier
- regulatory restrictions for electricity grid operators
- seasonality of the heat demand
- supply competition in DHC (especially in the summer)
- Only renewable, if fossil-free electricity is used

THREATS

- a possible disruptions of existing business models;
- overall higher electricity demand
- Changing regulatory framework / market design
- market development (alternative flexibility providers)
- availability of waste heat as a source for HPs
- Availability of suitable DHC infrastructures?

Outlook

- **Finalizing the work in the Annex and reporting in winter/ spring**
 - Contribution still possible!
- Presentation of selected results in a **journal papers**
- Development of a short **fact sheet/ summary for policy makers + recommendations + a guidebook!**
- **(national) workshop** on the TS3 results in Spring 2022 (ISEC conference?)

Further presentation in the Special Session of the 7th International Conference on Smart Energy Systems

- **Peter Sorknæs: Energy system synergies of hybrid energy network technologies**
- **Edmund Widl: Categorization of tools and methods for modeling and simulating hybrid energy systems**
- *Anton Ianakiev: Hybrid Energy Networks - Demo Case studies*
- *Dennis Cronbach: On business models and the regulatory framework of hybrid grids*

PROGRAMME COPENHAGEN – with the sessions taking place in Copenhagen

ONLINE PROGRAMME – including both live sessions and recorded presentations.

We are hiring!

- *AIT has a job position open*
- *„research engineer for renewable heating technologies“*
<https://jobs.ait.ac.at/Job/149763?culture=en>
- *Focussing on modelling, simulation and optimization of district heating networks*
- *Currently the job position is in German, but we can discuss this 😊*

Survey on SWOT factors

Join at
slido.com
#689 719



A stylized world map in shades of blue, centered on the Atlantic Ocean, with a grid of latitude and longitude lines.

Thanks for your participation!

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More Information at

<https://www.iea-dhc.org/the-research/annexes/2017-2021-annex-ts3>