IEA DHC Strategic Planning -
IEA DHC Annex TS 5 Concept

Proposed Title	**IEA DHC Annex TS5 - Integration of Renewable Energy Sources into existing District Heating and Cooling Systems (RES DHC)**

Scope:

Integration of high shares of renewable energy sources (RES) into existing DHC systems with focus on large-scale solar thermal, large heat pumps, renewable P2H-systems, biomass, geothermal and large heat stores in combination with CHP and surplus heat.

Problem and situation:

- Worldwide countries have defined ambitious objectives for the reduction of greenhouse gas emissions and the transition of their energy systems. Reaching these objectives implies a strong increase of the share of renewable energies and efficiency technologies in the heat sector, combined with a reduction of the heat demand by building refurbishment. Here, district heating plays an important role as an efficient and flexible, organizational and technical solution for the energy transition in the heat sector. In particular, it enables a relatively fast introduction of high shares of RES.
- The integration of RES and in particular their combination with traditional DHC heat generation technologies, however, require new and advanced technical and operational concepts, since:
  - Heat sources with fluctuating production need to be integrated into DHC networks (solar thermal, RES P2H) as well as heat generators with operating times depending on the electricity market (CHP, P2H, heat pumps), thus the dynamic behaviour of heat generation and heat demand needs to be considered for suitable operation concepts.
  - Heat stores need to be integrated for various purposes: short-term heat storage, peak shifting, long-term or seasonal storage of RES, flexible operation of multiple heat producers.
  - Feed-in points of RES heat can be in distributed locations of the DHC network.
  - The integration of RES heat sources and heat stores often requires an optimized design and operation of the whole DHC network and substations, as e.g. efficiencies depend on temperatures and hydraulics and as operating ranges of some technologies are limited.

  The effects of these specific integration aspects on the DHC networks need to be analysed and researched. Advanced technical and operational solutions need to be developed and demonstrated. Technical and non-technical barriers to the application of RES DHC need to be addressed.
- The level of knowledge about the integration of fluctuating renewable heat sources is still low in the DHC sector. Transfer and capacity building measures are necessary in order to overcome the reluctance of DHC enterprises and to ensure well working system integrations.

Aims of the project:

- Gain knowledge about and develop enhanced solutions for the technical and operational integration of RES plants into existing traditional and modern DHC systems
- Provide practical know-how on RES DHC project development, technical solutions and business cases to the DHC market actors
- Develop and show-case innovative demo cases driven by DHC market actors and in cooperation with RES market actors (for both, technical and organizational solutions)
- Develop advanced instruments addressing non-technical market barriers and opportunities
- Get in place renewable heat sources as environmentally friendly and emission free heat generation technologies for the DHC sector

Methodology:

The concrete R&D content of the IEA DHC project work program will result from the process and outcomes of the TS definition phase. Potential subtasks are:

- Subtask A: Integration of RES heat plants into DHC systems (technical and operational), in particular large-scale solar thermal, large heat pumps, renewable P2H-systems, biomass, geothermal and large heat stores in combination with the traditional DHC heat sources CHP and surplus heat (e.g. concepts for fluctuating heat sources and minimal CHP displacement, DHC flexibility gains through large-scale heat stores)
- Subtask B: Decentral integration of RES heat into DHC systems: technical solutions for substations, effects on the network operation (e.g. distributed solar thermal systems, prosumer models)
- Subtask C: Innovative instruments addressing non-technical aspects: economics, life cycle analyses, legal framework, business models, area availability for RES
- Horizontal subtask: Dissemination and know-how transfer to the DHC sector

Demo cases shall be integrated in the thematic subtasks.

In all subtasks of this IEA DHC project, the general approach shall be, that R&D activities are “DHC sector-driven”, i.e. they shall be based on the technical and organizational framework of the DHC sector and on the needs of the DHC enterprises. Subprojects of this IEA DHC project shall be owned or led by DHC companies, being active partners in the respective consortia.

Target audience (receptor) for the project outcome:

- Heat suppliers and DHC network operators (as knowledge receptors, owners and investors of demo cases)
- Technology suppliers, planners and service providers of the DHC sector
- National and regional Authorities (legal framework, support instruments) and local authorities
- Citizens and DHC-end users

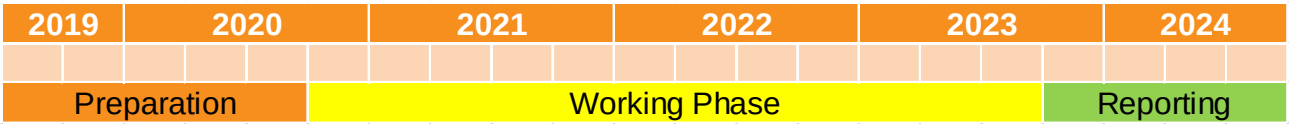
Relation to the IEA DHC Strategic Plan:

Theme #1: Cost Reduction in District Heating & Cooling
RES heat technologies have often high upfront investment cost, but low operation cost. I.e. that heat cost are more predictable and stable during the live time of the heat generation plant. E.g. solar heat cost are known at the first day of operation. In general this reduces the financial risk of the operating enterprise.
The overall set-up of RES heat plants includes large heat stores, which again allows to the operator an optimized and flexible and thus cost-effective operation of all his heat generation plants, including CHP and P2H applications.

Theme #2: System Transformation from High to Low Temperature District Heating Operation
Most RES heat technologies require a holistic optimization of the DHC system as a whole (generation, network, substations) as low supply and return temperatures are a crucial aspect for their efficiency and the use of large heat stores. I.e. solutions developed in this project will demonstrate feasible concepts for the transformation of DHC networks to lower network temperatures.

Theme #3: Resource Planning and Business Development
In the future, strategic decision making for local district energy planning will be more and more linked to ensuring long-term low primary energy factors, shares of RES and reducing financial risks. Already today, these are the main reasons, why DHC enterprises invest in RES heat technologies.

Time schedule:



May 2019:	**approval to annex concept** by IEA DHC ExCo Meeting
October 2019:	start of **preparation phase**
October 2020:	start of **working phase** (final annex text available)
October 2023:	start of **reporting phase**
September 2024:	end of the Annex

Preparation team:

Thomas Pauschinger
Steinbeis Research Institute Solites
Stuttgart, Germany
pauschinger@solites.de
+49-711-6732000-40
www.solites.de

Dr. Heiko Huther
AGFW
Frankfurt, Germany
h.huther@agfw.de
+49-69-6304-206
www.agfw.de

National IEA DHC Executive Committee member

Dr. Carsten Magass
Projektträger Jülich

Updated October 2019