Technology Collaboration Programme
by iea

IEA DHC Annex TS 4:
Digitalization of District Heating and Cooling:
Optimized Operation and Maintenance of District Heating and Cooling Systems via Digital Process Management

- Presentation of the international cooperation activity

Dr. Dietrich Schmidt (TS4 co-ordinator)

Fraunhofer IEE, Germany

Fraunhofer IEE

Status: Nov. 15, 2021

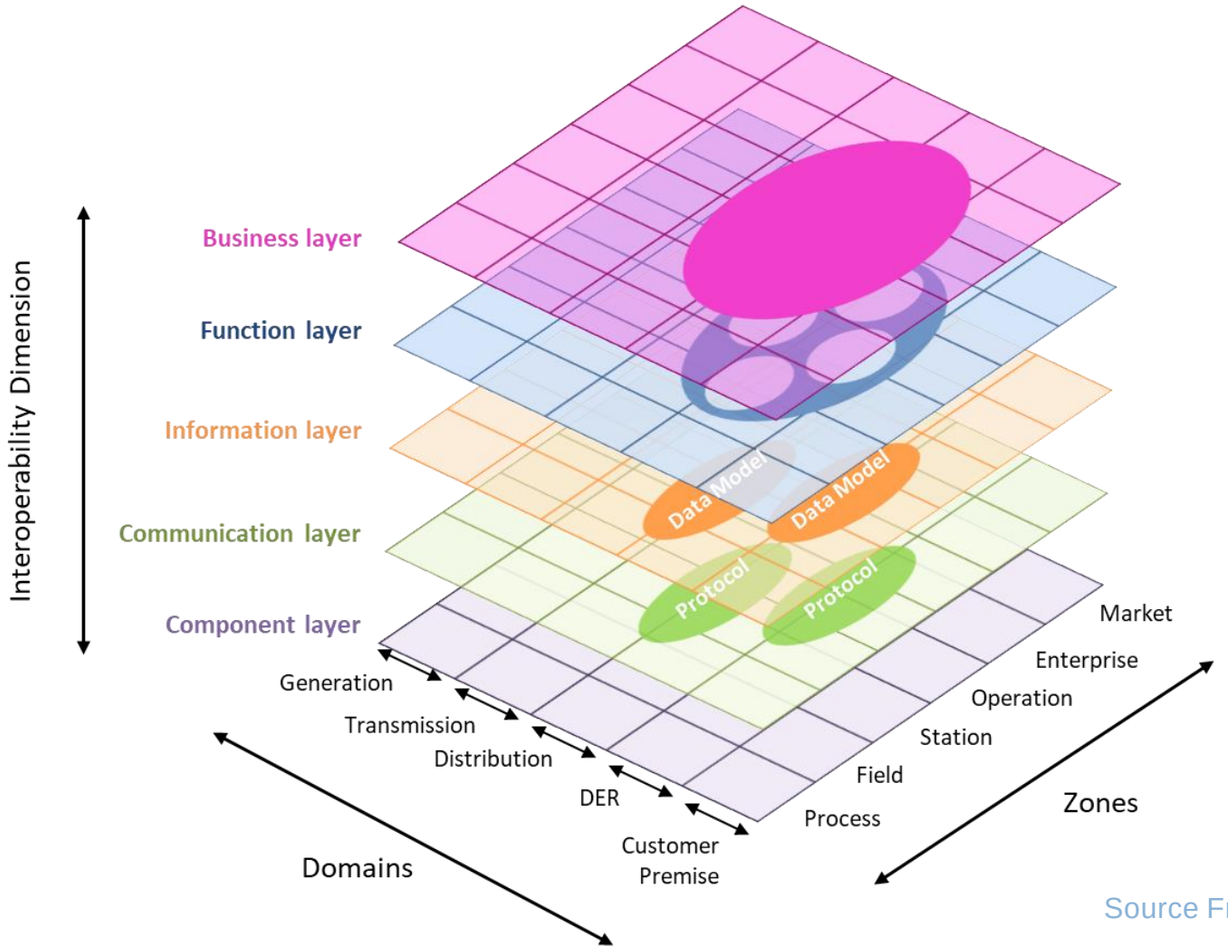
Aims of DHC Annex TS4

- The project aims at **promoting the opportunities** of the integration of digital processes into DHC schemes and to clarify the role of digitalisation for different parts within the operation (and maintenance) of the district heating and cooling system.
- Furthermore, the implementation of these technologies is going to be **demonstrated**.
- On the other hand **new challenges** need to be tackled, such as data security and privacy as well as questions about data ownership

Goals of DHC Annex TS4

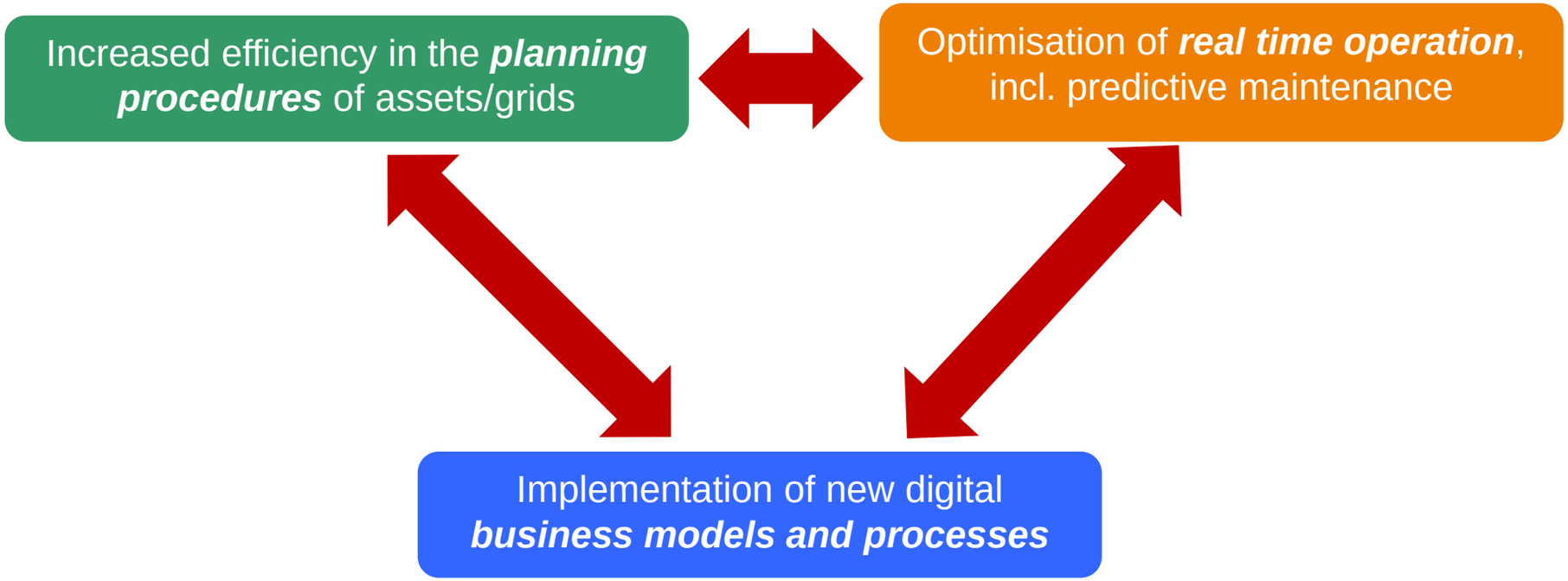
- **Create** awareness for the advantages of the implementation of digital processes to the various stakeholders and users
- **Provide** a state-of-the-art overview of the digitalization of district heating schemes in terms of R&D projects, demonstrators and case studies
- **Evaluate** non-technical barriers and enablers for digitalizsation processes in district heating and cooling schemes such as business models, legal aspects and policy instruments

Digitalization concepts

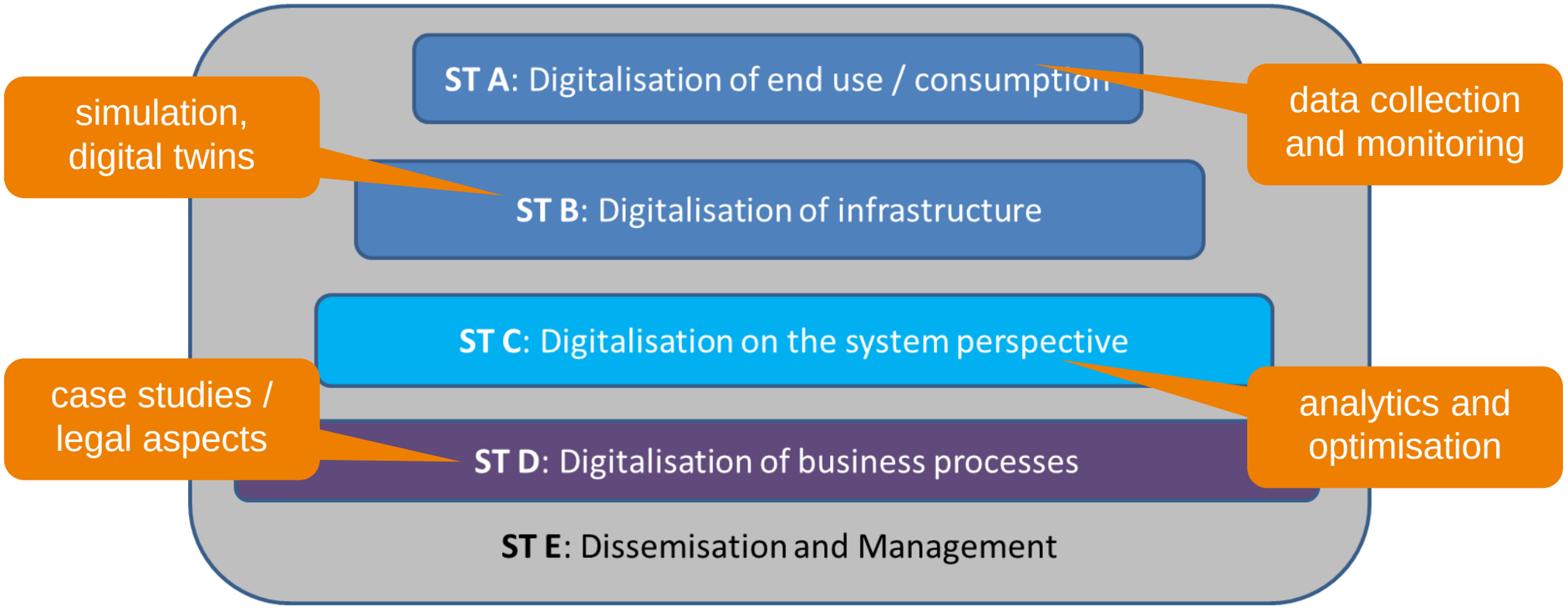


Source Fraunhofer CINES Cluster

Our focus areas for a digitalization in DHC



DHC Annex TS4 working structure



Digitalisation of end use / consumption

Improved control of heating system with focus on lowering:

- Supply temperature
- Return temperature
- Peak load

⇒ Large potential as the actual heat demand is much lower than the design load

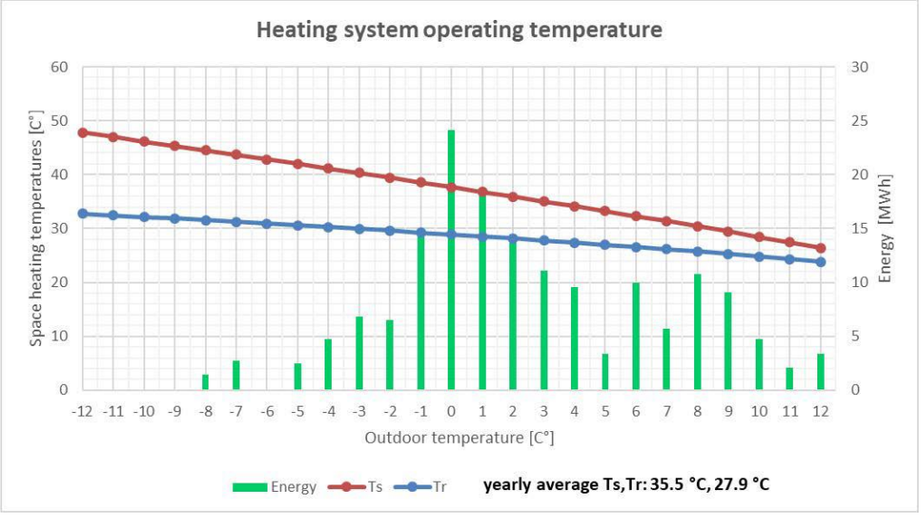
Strategy for developing the building service package:

a. Define the potential for lowering the temperatures in the building

b. Stimulate the use of all radiators

c. Data mining to identify anomalies in the SH operation

d. Troubleshooting and improved hydraulic balance of the system



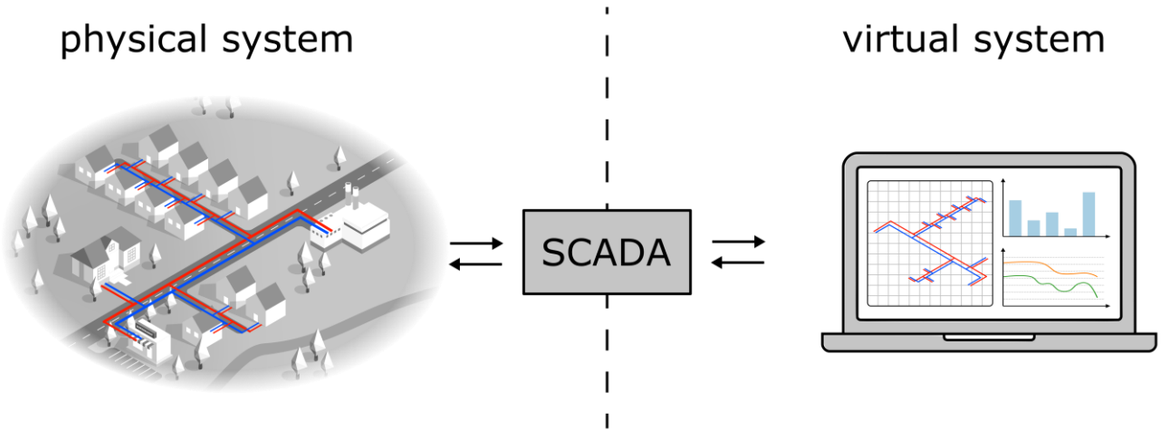
Digitalisation of infrastructure / digital twins

„A digital twin is a connected, virtual replica of a physical product, asset, or system.”

A. Rasheed et al., Digital Twin: Values, Challenges and Enablers (2019)

Interdisciplinary topic including

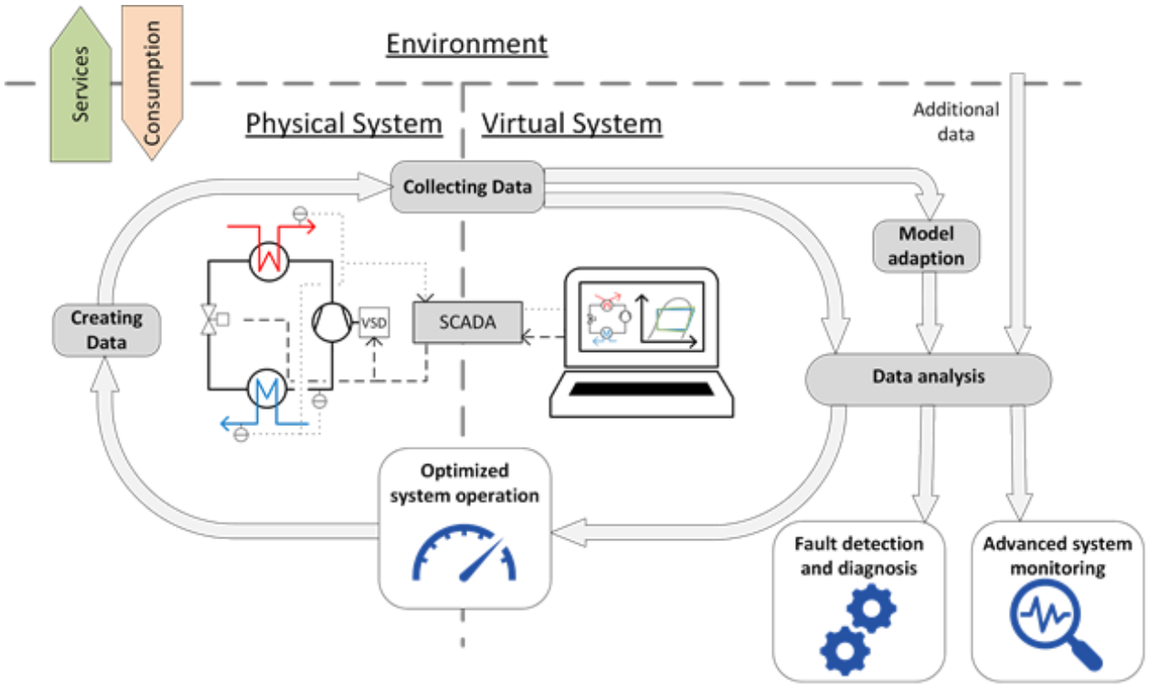
- Data-driven modeling
- Machine learning
- Numerical modeling
- Simulation
- Analytical models
- Internet of things
- DHC domain knowledge



Digitalisation of infrastructure / digital twins

Possible use cases

- Optimization of operation and control
- Fault detection and diagnosis
- Scenario evaluation / What-If Analysis
- Predictive maintenance / Asset management
- Visualization / Virtualization



From project „Digital twins for large-scale heat pump and refrigeration systems" http://digitaltwins4hprs.dk/

Digitalisation on system perspective

OPERATIONAL OPTIMIZATION

= CONTROL = ONLINE

Active interaction with the network, i.e. real interventions in the operation of the network. Think of **modifying the control of temperatures or flow rates** in the network in order to achieve a certain **objective on the network or energy system scale** (e.g. peak shaving or increasing the share of renewable energy in the energy system).

ANALYTICS

= DIAGNOSIS = OFFLINE

No active intervention in the direct operation of the network. These tasks however relate to the **analysis** of the network performance in order to optimize the efficiency and sustainability of the network.

Digitalisation of business processes

The core issues are to

1. Examine the **cost drivers for operating and maintaining** a DHC network and qualify the economic potential for improvements based on tools and insights provided by digitalisation.
   Best **practice examples** are to be included to give proof and validate the ROI model.

2. Collect thoughts and ideas for **new potential business models** that can be enabled through digitalisation. This can be the energy provider offering services to the end-user.
   It could also be business models that put demand response and thermal storage capacity in buildings into play.

Annex TS4 Time schedule

2019		2020		2021		2022		2023		2024
X	x	x	x	x	x	x	x	x	x	x
Defin	Preparation			Working Phase					Reporting	

Nov. 2018: approval to start the definition phase (DHC ExCo Meeting)
Jan. 2019: start definition phase
April 2019: definition phase WS in Frankfurt
May 2019: approval to start preparation phase (ExCo meeting in Nantes)
July 2019: start preparation phase (1 year)
July 2020: start working phase (annex text available)
July 2023: start reporting phase
May 2024: end of the Annex

cooperation with other initiatives

- **German Heat & Power Association (AGFW)**
- **DHC+**
- **Danish Board of District Heating (dbdh)**
- **IEA EBC Annexes on:**
  “Demand Response of Buildings in DHC networks / Annex 84**” &**
  “Data-Driven Smart Buildings / Annex 81**”**
- And others…
  as **IEA HPT Annex 57** „Flexibility by implementation of heat pump in multi-vector energy systems and thermal networks“

Conclusions

Digital technologies are **believed to make** the whole energy system:

- smarter,
- more efficient, and
- reliable and
- to boost the efficiency and
- the integration of more renewables into the system.

- In the future, digital applications might enable district energy systems to **fully optimize their plant and network operation** while **empowering the end consumer**.
- For a wider integration of digital processes challenges such as **data security and privacy** as well as questions about data ownership need to be handled and solutions need to be worked out.
- A key question is where is the way from the **buzz word digitalization to real business models**, products and market ready services.
- The strength of the presented project is the **very close exchange** between system manufacturers, utilities and service providers with the research community.

Contact us!

Contact:

Dr. Dietrich SCHMIDT

Fraunhofer Institute for Energy Economics and Energy Technology / Germany

+49 561 804 1871

dietrich.schmidt@iee.fraunhofer.de

www.iea-dhc.org/the-research/annexes/2018-2024-annex-ts4/