EBC

Energy in Buildings and Communities Programme

IEA EBC Annex 84:

Webinar on Local Strategies for Demand Management of Buildings in Thermal Networks - Examples from Germany

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Structure

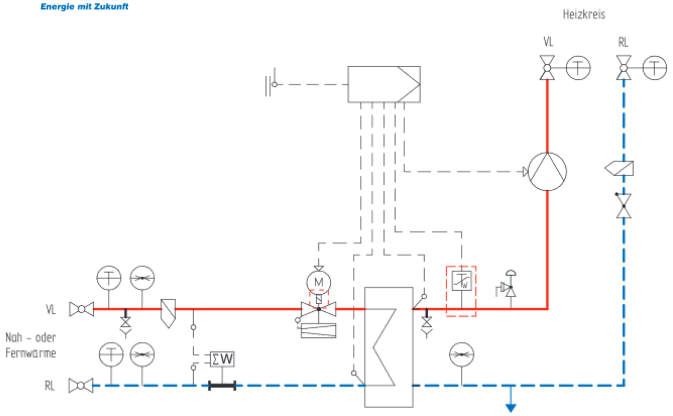
- General requirements: legal and technical
  (Clemens Felsmann, TU Dresden)

- Project example for existing buildings and new approach low temperature networks
  (Tobias Schrag, TH Ingolstadt)

- Digitalisation of heat supply structures in a virtual heat power plant
  (Anna Kallert, Fraunhofer IEE)

Recent legal framework

- A German regulations on energy saving will come into force by November 1, 2020 (EnEV+EEWärmeG → GEG)
- Obligation on operators of building heating systems with centralized heat supply (e.g. buildings connected to district heating):
  - Limit or switch off heat supply + electric actuator depending on ambient weather conditions (or any suitable command) and time
  - Building owners have to retrofit a controller to limit/switch off the central heat supply by September 30,2021
  - If a building is connected directly to the DH-system (no HX available) the DH system has to fulfil the above requirements
  - Single-room control is mandatory for most of the buildings (only few exceptions)
  - Energy efficiency measures for circulators in heating systems >25kW nominal heat load (→ automated on/off switching, adaptation of pressure and speed)



Technical connection requirements (TAB)

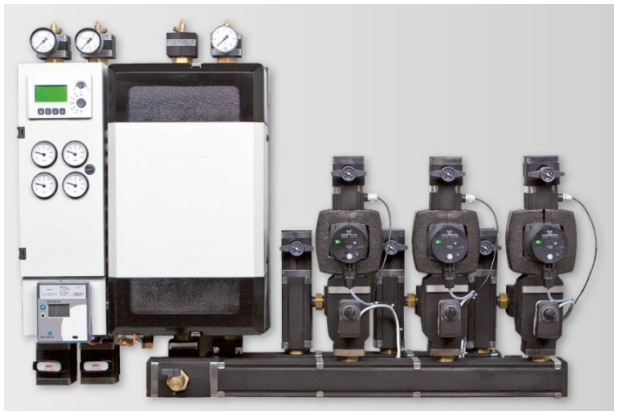
- In general: Limitation of return temperature
  → managing or limitation of heat supply to the substation is needed
  → special heat supply tariffs or penalty payments if return temperature is too high
- In general: max Limitation of DH hot flow rate according to nominal heat load

- Further DH regulations or incentives with respect on demand side load management is uncommon so far

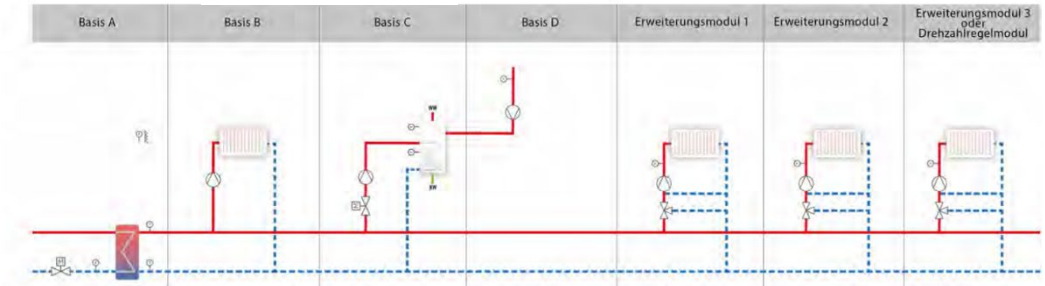
Technical features available

(just an example)

Pewo: modular configuration of DH heating controllers



Basic equipment | Extensions (optional)



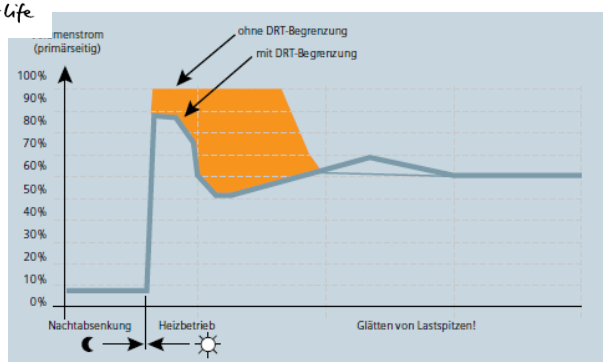
Nr.	Varianten Basismodul A	Varianten Basismodul B	Varianten Basismodul C	Varianten Basismodul D	Varianten Erweiterungsmodul 1	Varianten Erweiterungsmodul 2	Varianten Erweiterungsmodul 3
0	Nicht vorhanden	Nicht vorhanden	Nicht vorhanden	Nicht vorhanden	Nicht vorhanden	Nicht vorhanden	Nicht vorhanden
1	Fernwärme*	Heizkreis vorgeregelt*	WW-Registerspeicher im Pumpe oder Durchgangsventil*	WW-Registerspeicher mit Pumpe oder Durchgangsventil	Heizkreis geregelt*	Heizkreis geregelt*	Heizkreis geregelt*
2	Temperaturregelung für Basis B / Pumpe 1	Raumregelung ohne Optimierung	Umschaltventil WW-Ladung über Pumpe 1	Umschaltventil WW-Ladung über Pumpe 1	Raumregelung ohne Optimierung	Raumregelung ohne Optimierung	Raumregelung ohne Optimierung
3		Raumregelung mit Optimierung	WW-Lademodul vorgeregelt über Pumpe 1	WW-Lademodul vorgeregelt über Pumpe 1	Raumregelung mit Optimierung	Raumregelung mit Optimierung	Raumregelung mit Optimierung
4		Raumthermostat	WW-Lademodul geregelt auf erweiterungsmodul 1	WW-Lademodul geregelt auf Erweiterungsmodul 2	Raumthermostat	Raumthermostat	Raumthermostat
5		externe sollwertvorgabe 0-10V	Heizungsspeicher	Heizungsspeicher	externe sollwertvorgabe 0-10V	externe sollwertvorgabe 0-10V	externe sollwertvorgabe 0-10V
6		Zwischenkreis Fernwärme ohne Pumpe	Differenzregler Solar	Differenzregler Solar	WW-Lademodul geregelt für Basis C	WW-Lademodul geregelt für Basis D	Drehzahlregelmodul*
7		Zwischenkreis Fernwärme mit Pumpe	WW-Zirkulationspumpe	WW-Zirkulationspumpe*	WW-Zirkulationspumpe für Basis C	WW-Zirkulationspumpe für Basis D	WW-Zirkulationspumpe für Basis C
8		Rücklauf-Anhebung mit Ventil 45	Freigabe für externe WW-Ladung	Freigabe für externe WW-Ladung	Umschaltventil für zusätzliche Wärmeerzeuger	Umschaltventil für zusätzliche Wärmeerzeuger	Umschaltventil für zusätzliche Wärmeerzeuger
9			Sonderprogramm	Sonderprogramm	Anforderung von zusätzlichem Wärmeerzeuger	Anforderung von zusätzlichem Wärmeerzeuger	Anforderung von zusätzlichem Wärmeerzeuger
10					Zwischenkreispumpe	Zwischenkreispumpe	Zwischenkreispumpe

*Werkskonfiguration **Für mengengeregelte Speicherladung ab Fernwärme und/oder Solaranlage

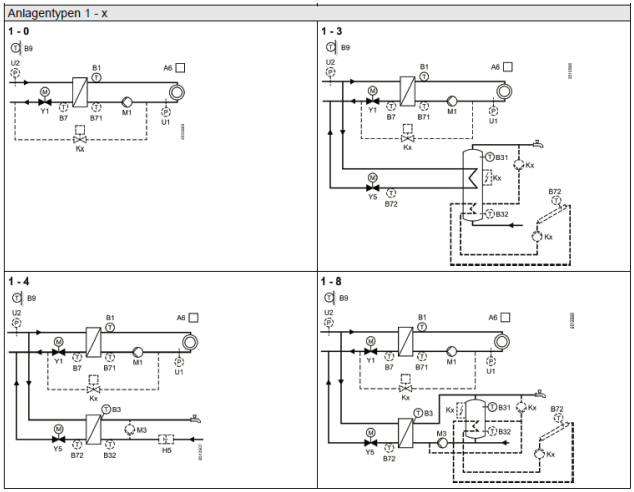
Technical features available (just an example)

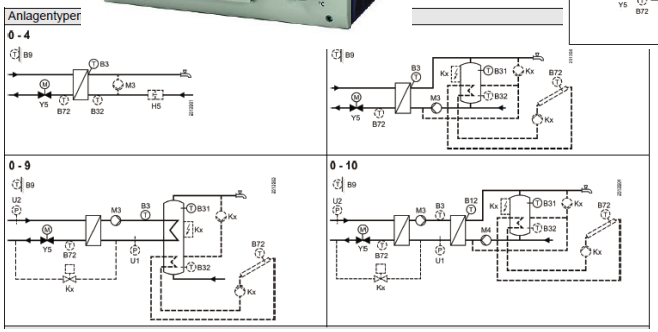
Siemens: combination of products from a portfolio depending on building complexity

SIEMENS
Ingenuity for life



Control parameter:
DRT=difference between return temperatures on secondary and primary side of the DH HX





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Orewa-Project

Institut für neue Energie-Systeme

Orewa-Project (running since 12/2019) :
How to refurbish small rural existing biomass DHN, to reduce losses?

Comparison and optimisation of substations
in simulation &
In laboratory &
field (if feasible from an economic point of view)

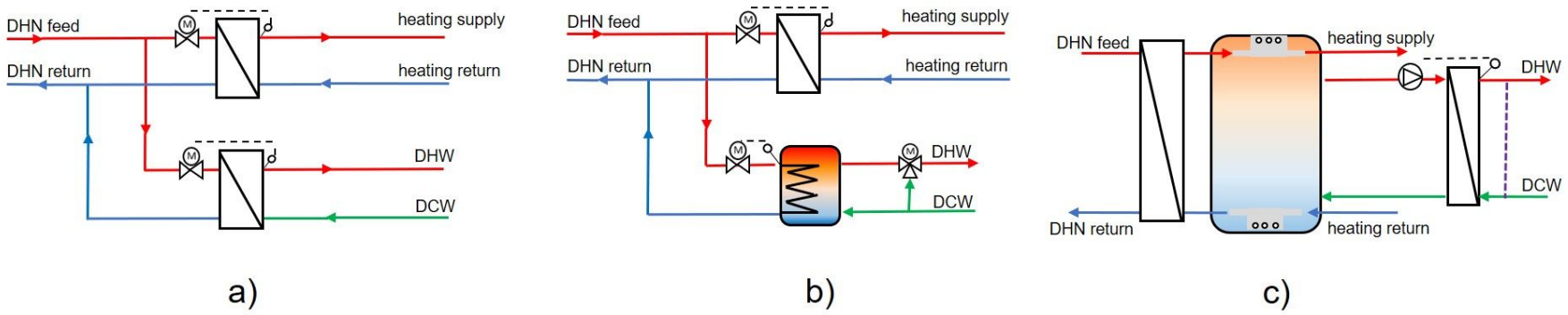
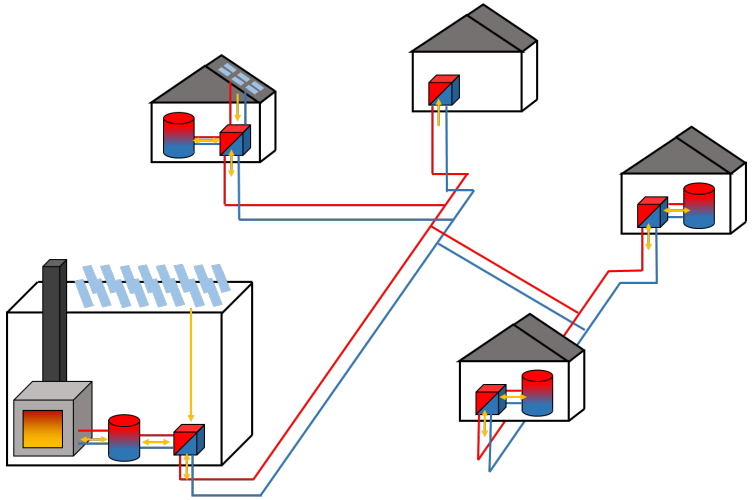


Figure 1: a) Continuous-flow system, b) Storage system, c) Storage district heating substation

Orewa-Project

Institut für neue Energie-Systeme

Is it feasible to enhance the substations to enable a central storage management for central & decentral storages in the buildings?
The running project focusses on substations and their implications for the central operation strategy. Results could be supplied to Subtask B, if optimisations are realised also to Subtask D



Project in preparation

Institut für neue Energie-Systeme

Energy storage in buildings for the optimisation of a heatpump driven DHN

Focus:
Extremely low to low temperature networks facilitate the integration of renewable energy or waste heat, but need decentral heat pumps to supply the required temperatures.
The possibility to store heat in buildings has implications for the consumption of electrical energy as well as for the consumption of thermal energy from the low temperature DHN. Any control optimisation has to include restrictions of both energy grids/sources.

The project in planning involves a small realisation project and would be related to Subtasks C and Subtask D

Research project „Smart Heat“

Digitalisation of heat supply structures in a virtual heat power plant (VHPP)

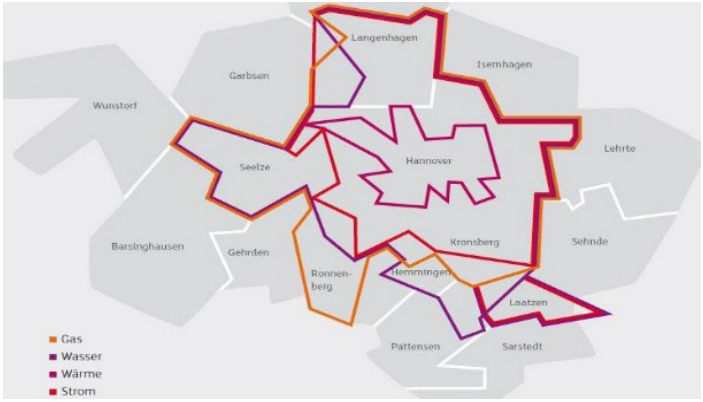
Main target is to investigate/test potentials and possibilities of **digitalisation of the heat supply** in district heating systems of the **enercity Netz GmbH** in Hannover:

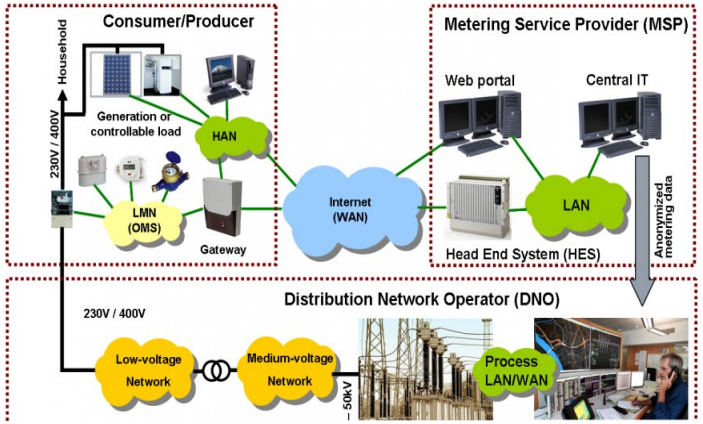
Increased efficiency of the heat supply

- Utilisation of the heat storage effect of buildings as **flexible demand**
- Increase the quality of **heat demand prediction** via secondary side data
- **Matching** of heat and power production (CHP)
- Data supported analysis of **flexibility- and other efficiency potentials**
- Automatic analysis of operational modes for **optimised operation** and **predictive maintenance**

New **supplier-customer-relation**

- Interconnection for data exchange and control
- Check of variable tariff systems
- Test new service products, e.g. optimisation of consumer installations

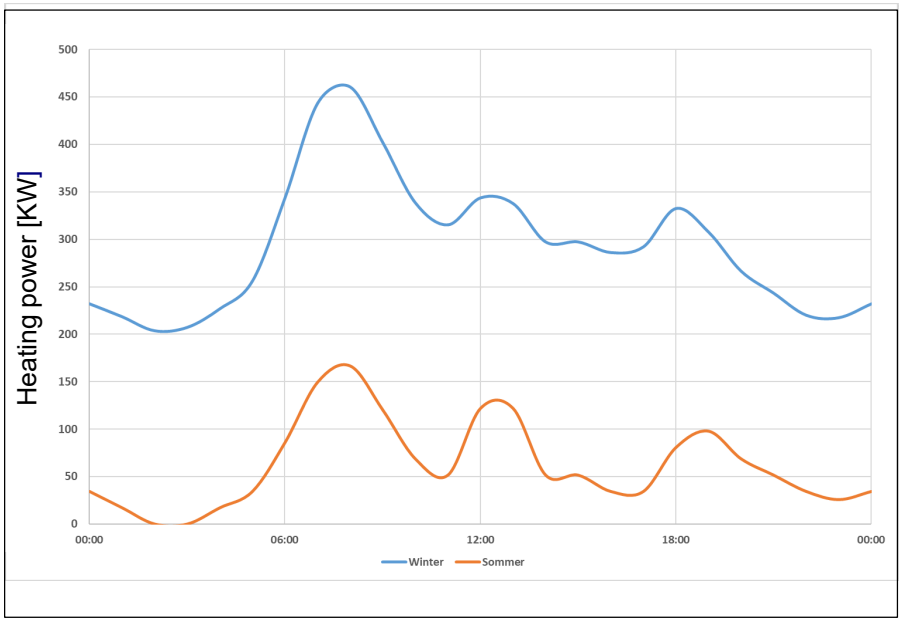




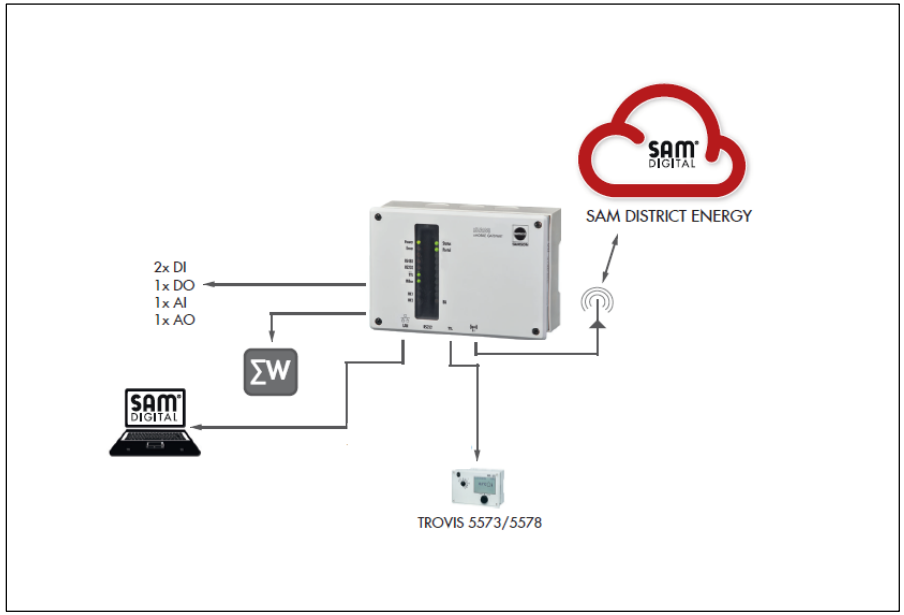
Research project „Smart Heat“

Approaches used for flexibilisation

Exemplary load reduction through load flexibility

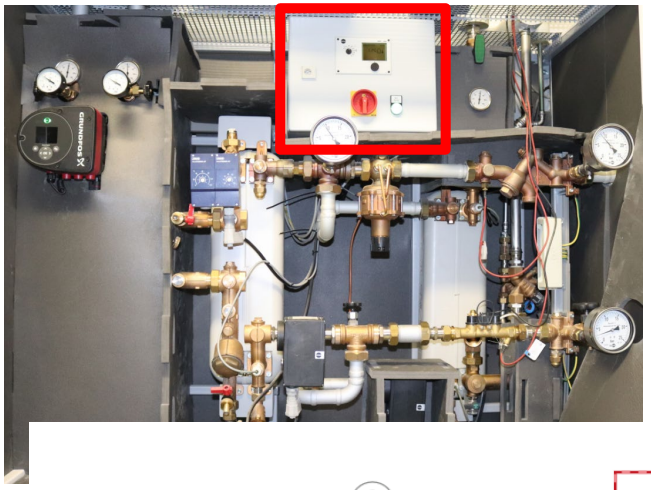


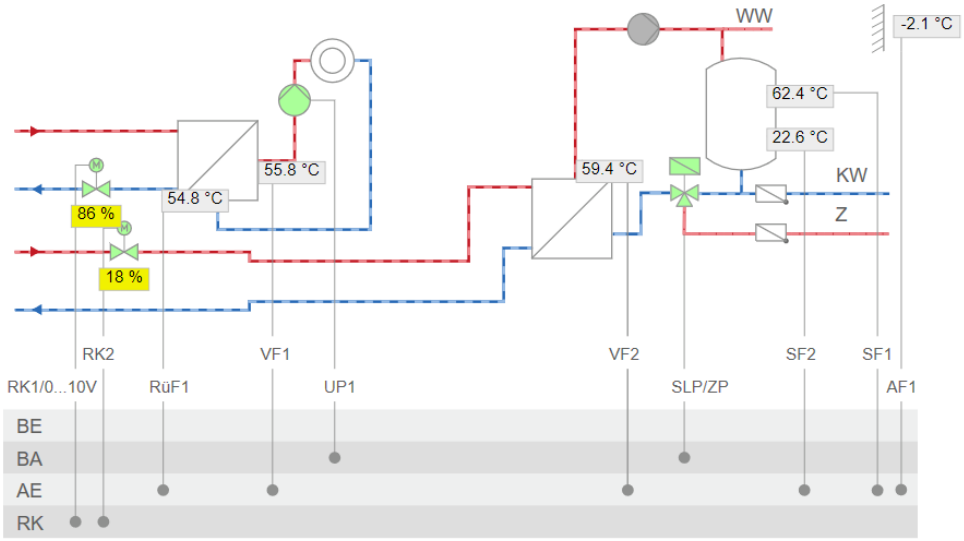
Communication units for implementation of load flexibility



Research project „Smart Heat“

Approaches to building supply by DH





Chosen test buildings

- Day-care-centre
- Dwellings
- office- and commercial buildings
- Hotels
- Residential- and retail buildings

Central aspects

- The amendment of the legal framework for building energy supply provides a framework for more efficient supply with thermal networks
- Several system solutions are available for optimized supply of buildings in the context of demand-side management
- Project example show possibilities for realization of demand management of buildings in thermal networks (e.g. Storage, Heat pump and digitalization)