Challenges and opportunities for solar thermal in a rapidly transforming DHC sector

Thomas Pauschinger, AGFW

IEA SHC Solar Academy | 14 March 2024

AGFW | Energy efficiency association for heating, cooling and CHP
www.agfw.de

Energy Efficiency Association for Heating, Cooling and CHP

- **AGFW** is an independent, impartial German association promoting energy efficiency, (district) heating, cooling and CHP – Combined Heat and Power – at national and international levels
- **AGFW** comprises more than 670 regional und municipal energy suppliers, consultants, experts manufacturing companies including component and system manufacturers, assembling companies and testing institutes within Germany and Europe
- **AGFW** represents approx. 95% of the heat load connected to German district heating systems – the largest scale in Western Europe
- **AGFW** with over five decades of expertise in the district heating sector covers the entire process chain of efficient district heating, district cooling and CHP

AGFW @ SDH

- **Since 2009: more than 10 national and international SDH market introduction projects**
- **Since 2015: Close collaboration with the SDH supply enterprises „IniSW“**
- **Services for our members (guidelines, tendering templates, etc.)**
- **Present project „SolnetPlus“**
  - Activiation of municipalities and heat suppliers, permission procedures and communication
  - AGFW SDH Working Group (heat suppliers only)
  - AGFW training courses and advice services

The new role of the DHC sector in Germany

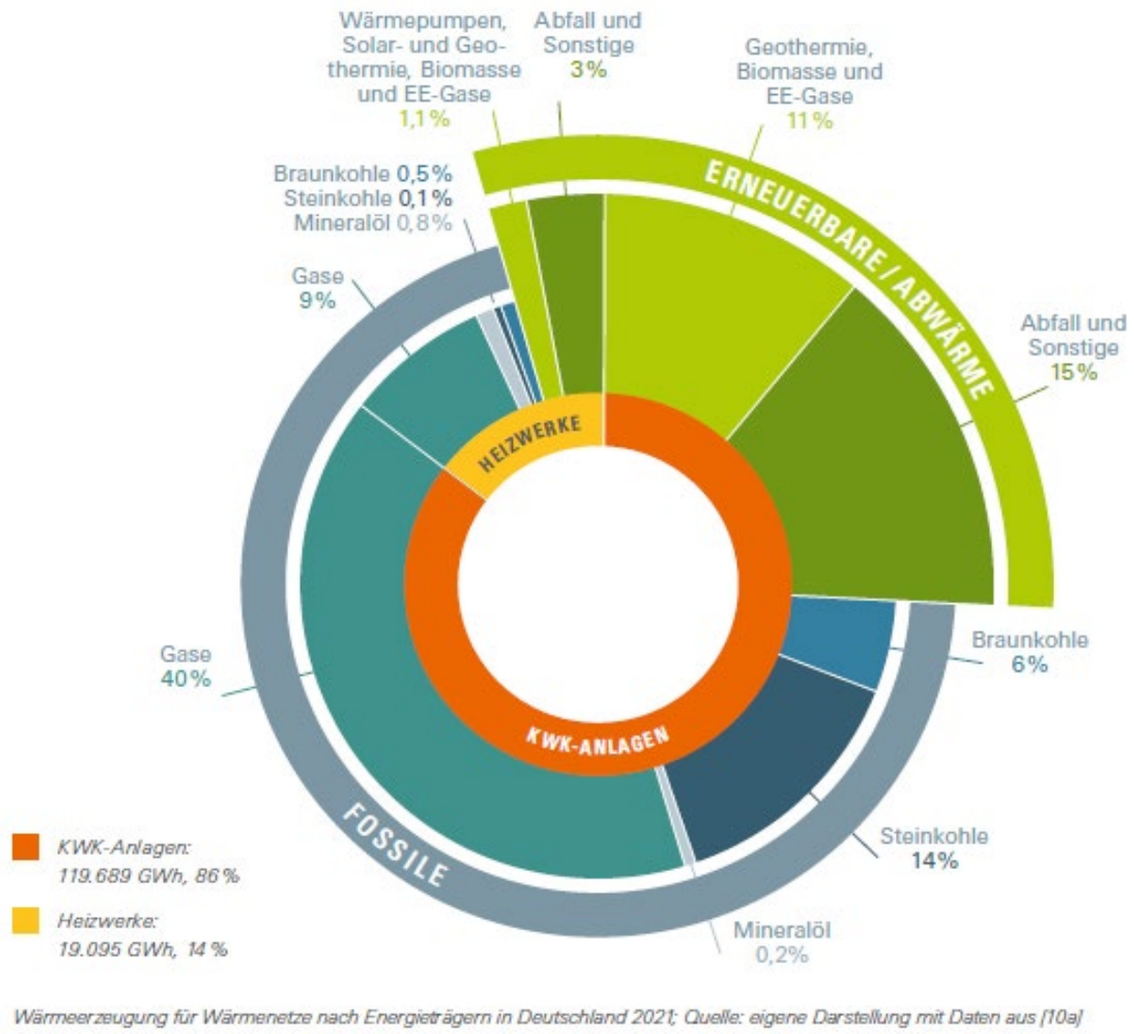
DHC has never had such a high significance in Germany!

DHC Summit 2023: „More speed in the climate neutral transformation and expansion of DHC“

- By 2045: tripling the number of buildings connected to DHC
- Connection of at least 100,000 buildings per year to heating networks in the medium term
- Share of 50 % RES and unavoidable waste heat in the average of all DHC networks by 2030
- High level process to adapt and improve framework conditions accordingly

Success and new challenges for the branche

DHC status quo in Germany



Quelle: AGFW-Hauptbericht 2022

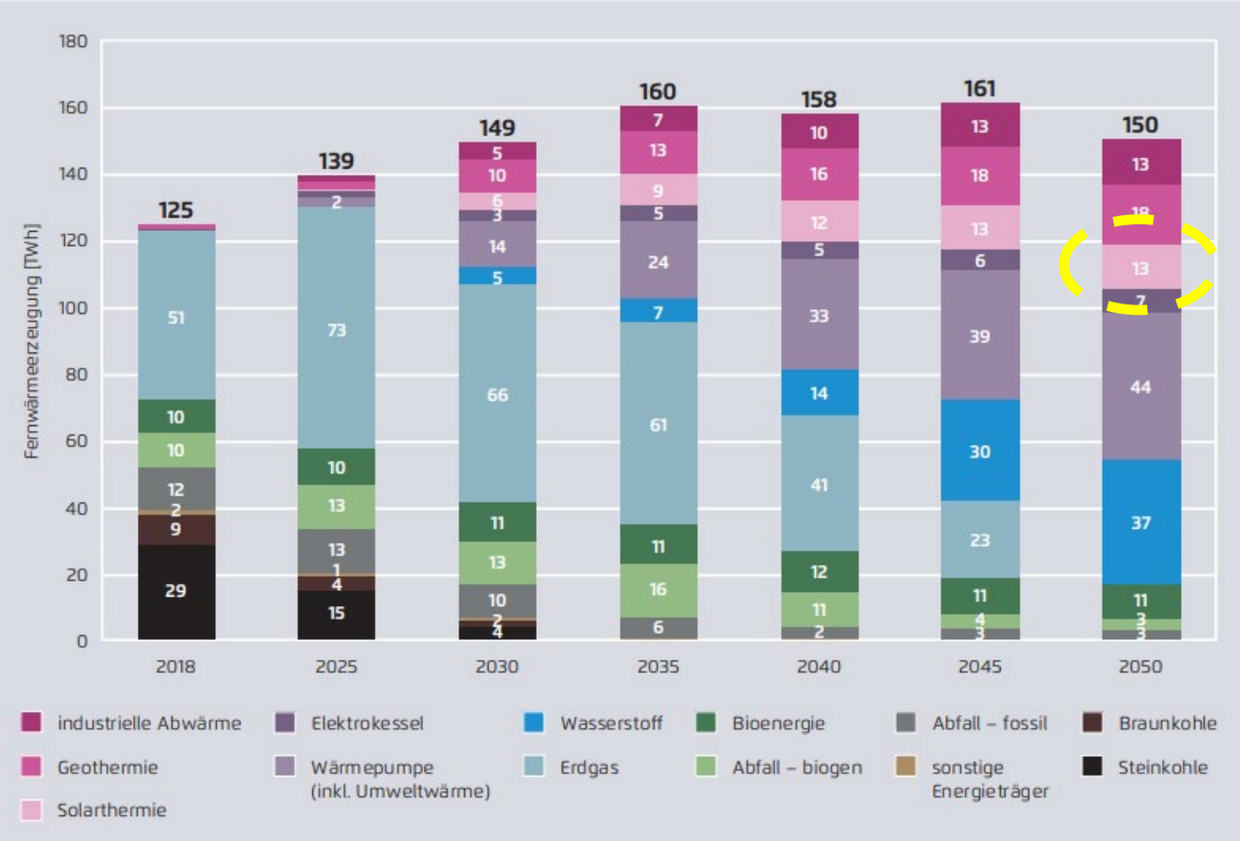
DHC key data for Germany

- 4100 DHC systems with 34,000 km network
- 50 GW_{th} installed capacity
- 140 TWh heat production
- 14 % of the heat demand for the building sector
- 86 % CHP
- 30 % climate neutral heat (RES, waste heat, waste incineration)

Projections for future DHC production in Germany from external studies

» Study „Klimaneutrales Deutschland“ by Agora Energiewende & Prognos (2021)

- Detailed projection for future DHC production in Germany for target years from 2018 until 2050



» DHC Sources in order of appearance

- Industrial waste heat
- Geothermal
- Solar thermal
- E-boiler
- Heat pump (including ambient heat)
- Hydrogen
- Natural gas
- Bioenergy
- Waste – biological
- Waste – fossil
- Others
- Lignite
- Coal

» In 2050: diverse mix of renewable sources & waste heat will fully cover DHC production

What Policies/Strategies have been developed at a National level?

"...We will advocate comprehensive municipal heat-planning and the expansion of heating networks. We are aiming for a very high proportion of renewable energies for heating and we want to generate 50 percent of the heat in a climate-neutral manner by 2030..."

Municipal heat planning

Heating network expansion & transformation
50 % climate neutral heating in 2030;
30 % heating networks

Federal funding for efficient heating networks (BEW) and efficient buildings (BEG)

Relief measures
- Gas procurement contribution,
- storage contribution,
- VAT reduction,
- heat price reduction

Replacement Power Plant Availability Act (EKBG), Energy Security Act (EnSiG)

Start 2020: Coalition contract

Quelle: iStock 1301770011

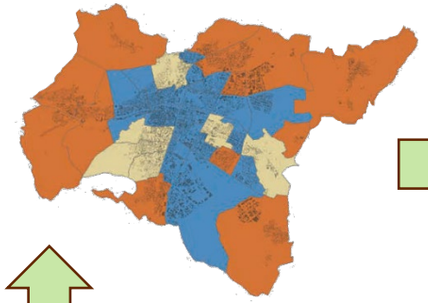
Combination of WPG and GEG

Climate Protection Act – German Climate Neutrality by 2045

EU - EED

Heat Planning Act

Local heat planning for
- cities
- municipalities



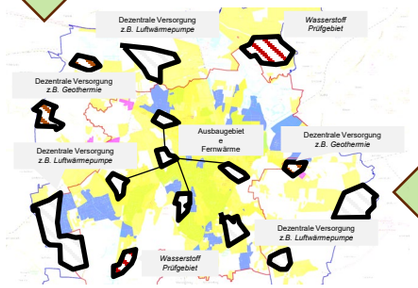
until 2026/2028

Building Energy Act
- building owners

- Switch to renewable energies for buildings
- climate-neutral heating technologies

- Organised on site with local conditions in mind
- Binding plans/ certainty for providers

Transformation plan:
- Utilities: for DHC & gas



Possible option: DHC

BEW: DHC operators | Funding programmes | BEG: building owners

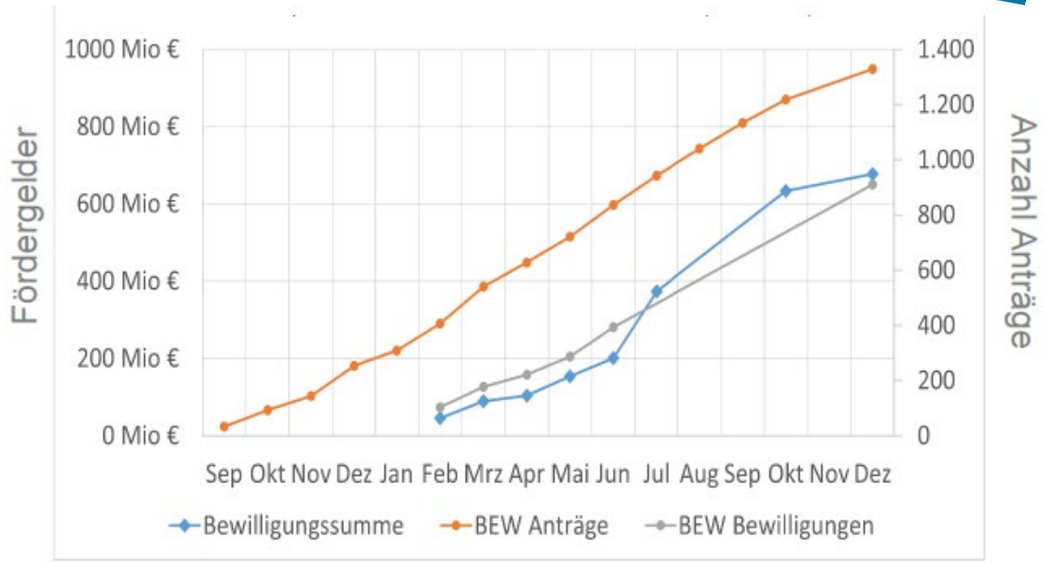
BEW funding programme

» **Published in September 2022**
- 4 bn € for 2022-2026
- So far more than 1300 applications
- 677 Mio. € approved

» **Climate neutral heat supply until 2045**
- RES and surplus heat in DHC systems
- increase of efficiency of DHC systems
- Extension of RES DHC systems

» **Flexible funding of**
- Transformation and expansion of DHC
- Investment and operation

The sector recognizes and utilizes the potential



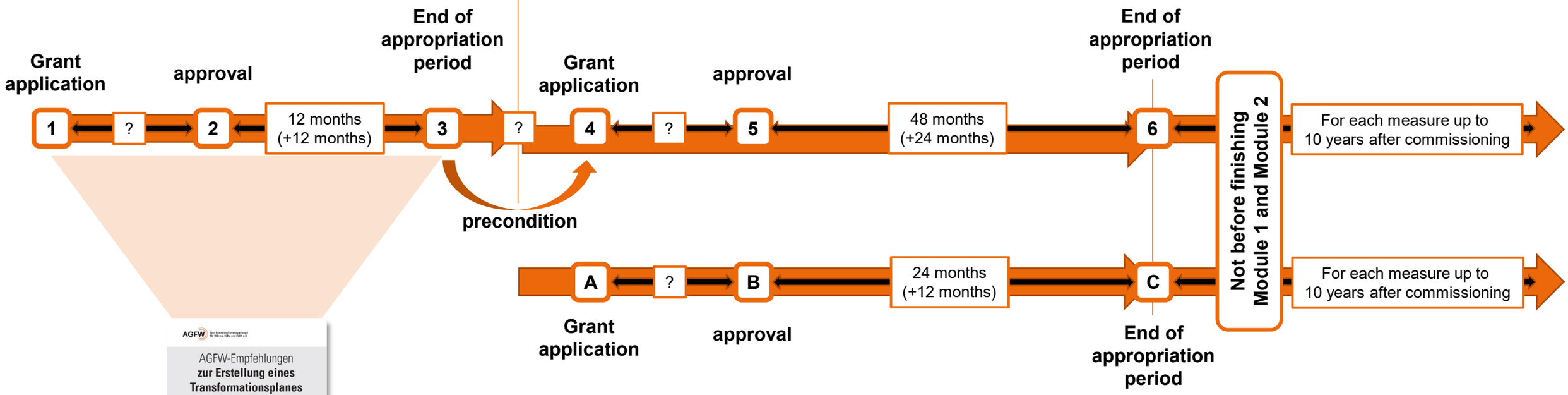
Datenbasis: BAFA, BMWK, 12/2023

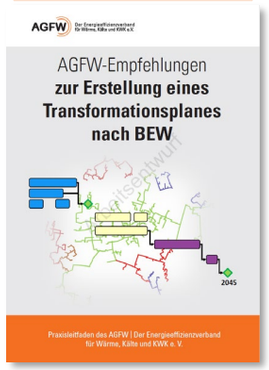
BEW: Federal Funding for Efficient District Heating Networks

Module 1
-feasibility study or transformation plan support-
payment after ending

Module 2
-systemic investment aid-
payment based on annual verification

Module 4
-operating aid-
payment based on annual verification





Module 3
-specific measure aid-
payment after ending
Temporarily limited for the first 36 months

Branch investments in lighthouse projects

15 Mio. €

River heat pump, 20 MW
Mannheim (MVV AG)

40 Mio. €

Solar thermal plant, 46 MW
(2025, Stadtwerke Leipzig)

iCHP plant at a
sewage plant
(STW Duisburg)

27 Mio. €

XXX Mio. €

Large-scale heat pump
150 MW, in planning
(Cologne, RheinEnergie AG)

Challenges and opportunities of solar thermal in the DHC sector

Solar thermal‘s role as DH generation technology

Security of supply
- Controllability
- Planability
- Availability

!

DHC generation technologies

Ecology
- CO_2-emissions
- Primary energy factor
- Land use
- Noise emissions

Economics
- Capex
- Opex
- Subsidies
- Risk

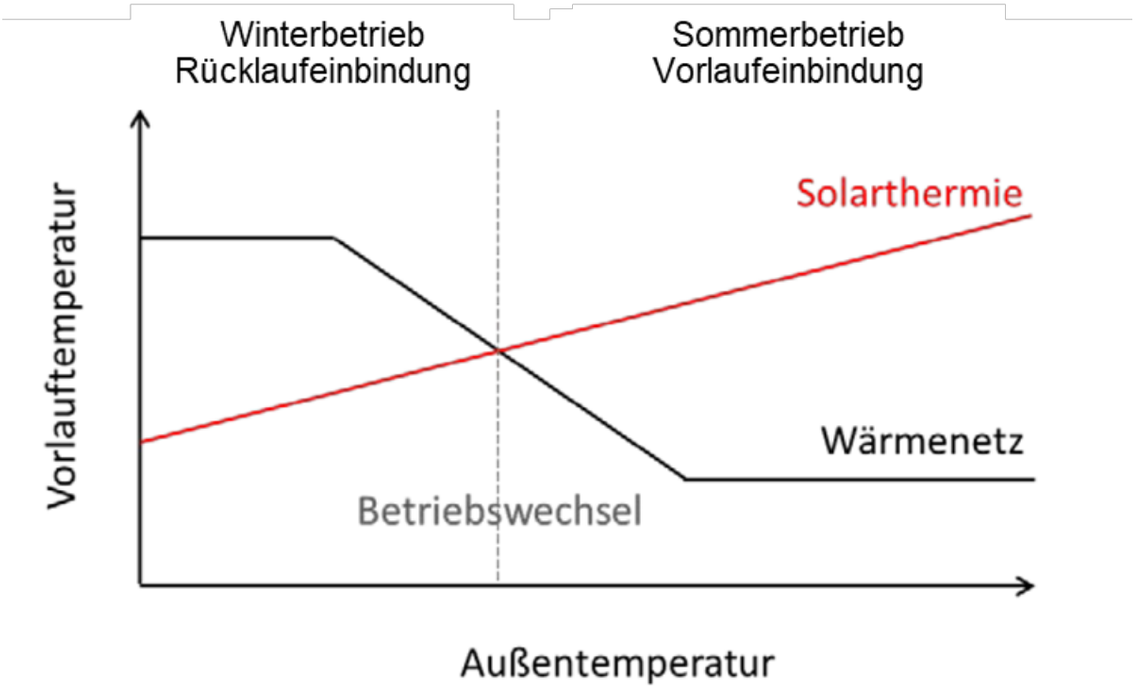
» **With higher share of RES generation, focus on security of supply increases**
- Summer / winter operation
- Base, mid or peak load
- Integration into operational planning

» **So far no „seasonal storage“ for mid or large DHC systems .**

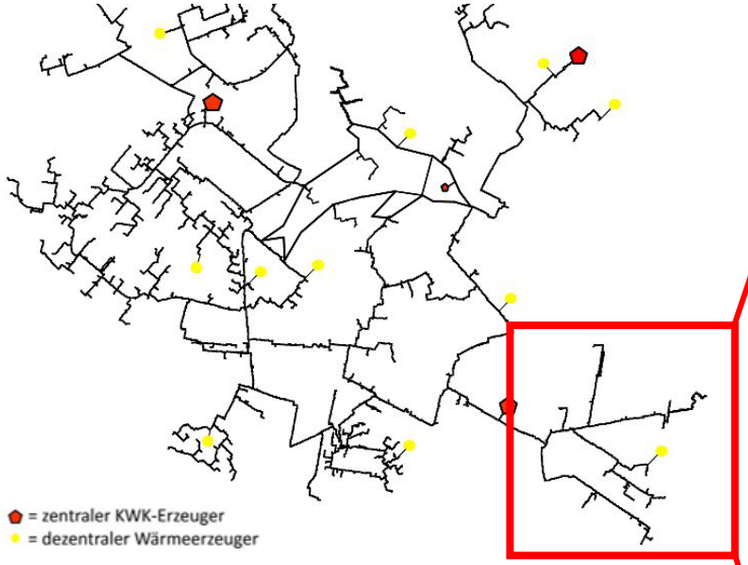
Foto: Guido Bröer

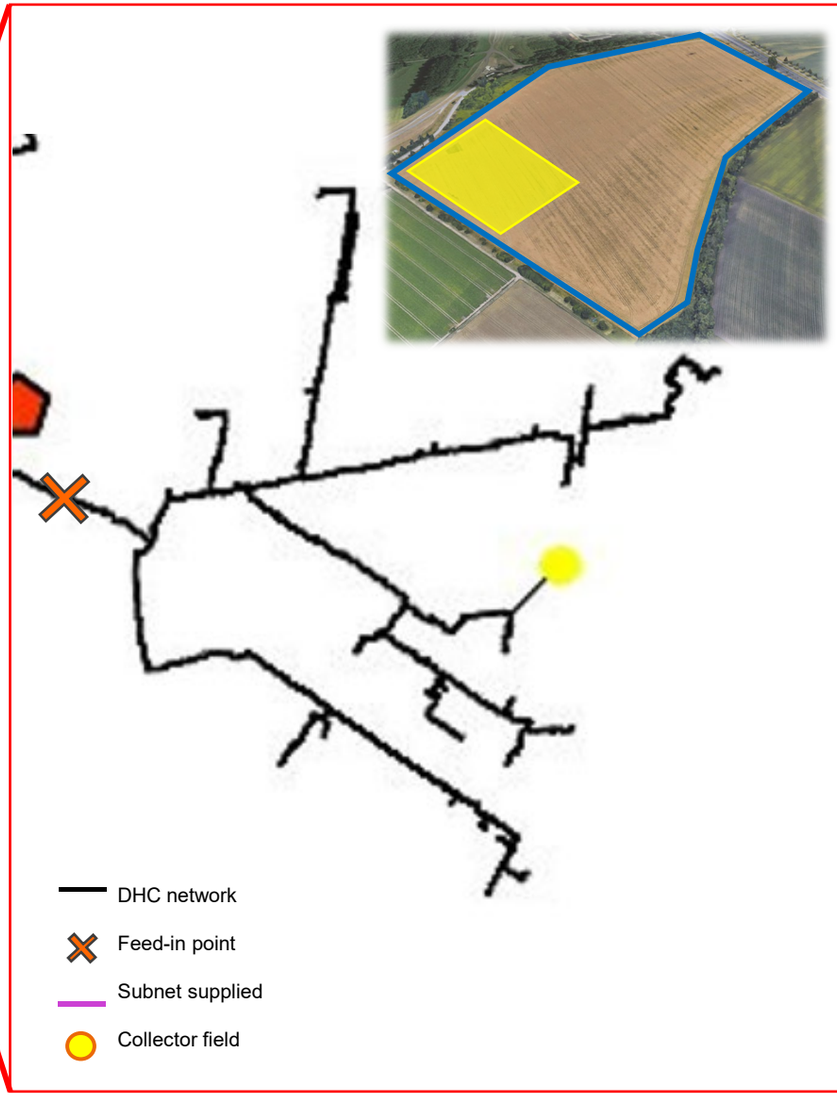
Expect high temperatures still in the medium term

- **Until 2030, a high share of DHC capacity in Germany will still operate at high supply temperatures.**
- **Lowering temperatures to e.g. 90 °C already requires substantial efforts (measures at buildings, heating systems and substations).**
- **Substantial lowering of tempertures is a complex, costly and long term process.**



Solar thermal in remote network areas





Load at feed-in point	30 GWh

Available land area	75,000 m²
Max. collector area	30,000 m²
Max. capacity	21 MW
Potential	15 GWh

Load of the subnet	30 GWh
Solar fraciton	20 %
Solar yield	6 GWh
Collector field	12,000 m²
Nominal cacpacity	8,4 MW
Land area	3 ha
Storage	2,400 m³

Harvest and seed „low hanging fruit“

- Small DHC systems, „energy villages“ in rural areas
- Medium size DHC systems
- Combination with biomass and biomass CHP
- New: combination with biogas / biomethane CHP
- Areas on e.g. landfill sites

Foto: Guido Bröer

Areas … areas … areas

- Consideration in spatial and land use planning
- Consideration in heat planning
- Simplified and uniform authorisation procedures
- Promote „solar energy regulations“ instead of „PV regulations“
- Support DHC operators in finding and negotiating areas

Foto: Arcon-Sunmark

Conclusions

- DHC transformation and extension is a very dynamic but long term process with big challenges and high cost.
- SDH development should adapt to this process and to the specific requirements of DHC systems.
- Regulatory obstacles need to be addressed and solved, urgently and as soon as possible.

- But … in the present situation, the sector's demand for solar district heating is already growing strongly today.
- Many doors are open now! We need to speed-up and find pragmatic solutions!

darum fernwärme ...

fernwärme
rein ins haus.

denn sie ist stubenrein und hilft,
CO_2 zu vermeiden.

www.fernwaerme-info.eu

Thomas Pauschinger
t.pauschinger@agfw.de
AGFW – F&E

Building Energy Act (2023)

» Aim of the Law

- economic and socially acceptable measures for the efficient use of energy as well as the **increasing use of renewable energies or unavoidable waste heat for the energy supply of buildings**
- **General rule: 65% minimum quota for renewable energies and waste heat for heating systems put into operation.** Also applies to existing buildings when heating systems are replaced. Requirements can be fulfilled by:
  - **Connection to district heating**
  - Usage of heat pumps
  - Usage of direct electric heating
  - Usage of solarthermal heating
  - Usage of biomass and hydrogen
  - There are specific requirements for each technology (e. g. characteristic efficiencies)

» Specific requirements for DH

- Regulated in Heat Planning Act (WPG)

Heat Planning Act (2023): requirements for DHC operators

» **Requirements** for shares of renewable energies and waste heat **in existing DHC networks for** annual net heat generation:

- From 2030: at least **30 % from renewable energies and/or unavoidable waste heat**
- From 2040: at least **80 % from renewable energies and/or unavoidable waste heat**
- By 2045: **Complete climate neutrality of the heating networks**
- **New DHC networks:** 65 % from renewable energies and/or unavoidable waste heat **by 2025**

» **Rules for specific DHC fuels**

- In theory: **all sources of renewable energy and unavoidable waste heat are allowed**
- **Biomass**: limit for larger DHC networks, only 25% biomass in DH networks above 50 km allowed
- **Waste incineration**: fully recognised for DHC. Biological part of the waste as biomass and therefore renewable heat; non-biological waste as „unavoidable waste heat“.

Heat Planning Act (2023): local heat planning

Target scenario

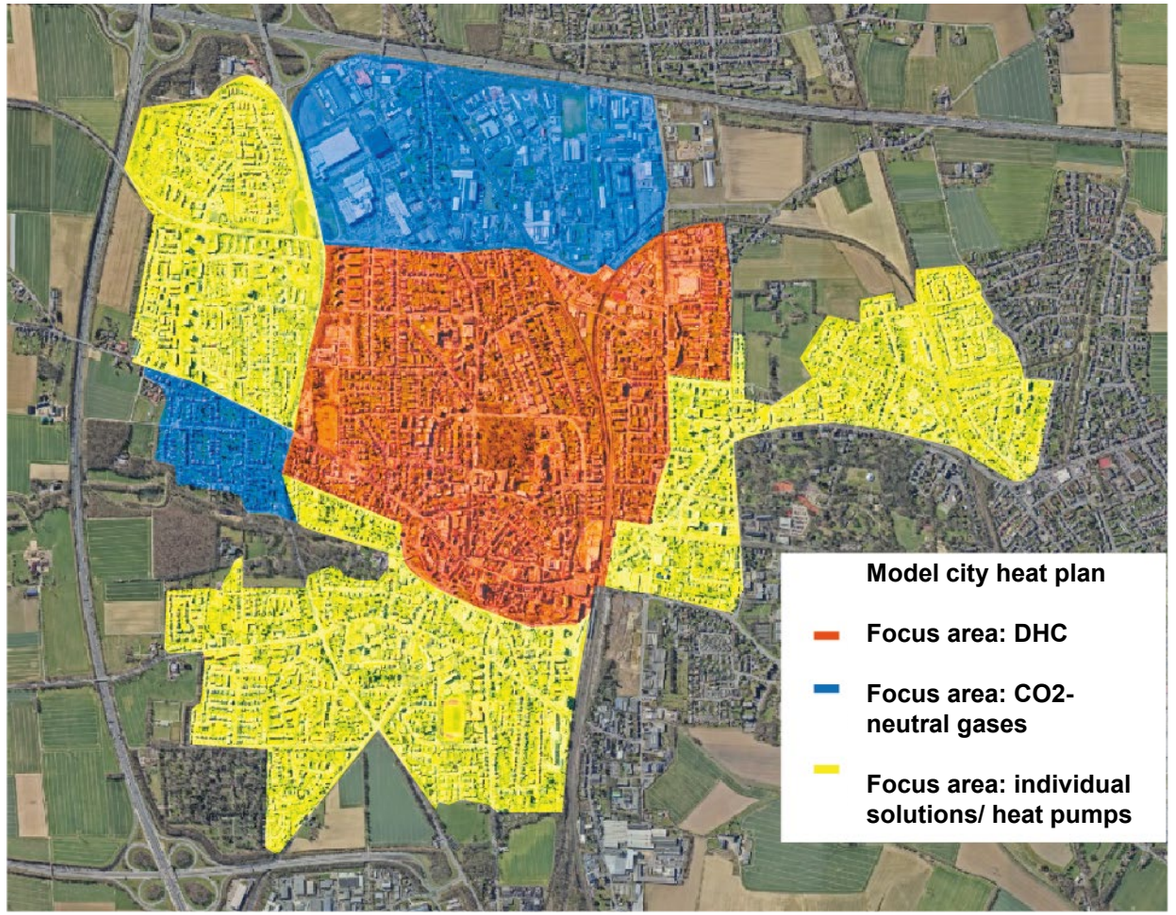
All German municipalities: **must formulate heat planning for future target scenario of climate neutrality by 2045**

Deadlines for municipalities for heat plans:

- June 2026 (above 100.000 inhabitants)
- June 2028 (below 100.000 inhabitants)

How can the target be achieved?

- Identify conditions and measures
- Outline of different sub-areas (focus areas)
- Formulation of an implementation strategy



BEW: Federal Funding for Efficient District Heating Networks

Funding possibilities:

- **Module 1 (feasibility study or transformation plan)**
  - Max. contribution per application 2 million €
  - Covers up to 50% of costs
- **Module 2 (systemic investment aid)**
  - Max. contribution per application 100 million €
  - Covers up to 40% of the eligible investment costs
  - Max. amount limited to funding gap
- **Module 3 (specific measure aid)**
  - Max. contribution per application 100 million €
  - Covers up to 40% of the eligible investment costs
  - Max. amount limited to funding gap
- **Module 4 (operating aid)**
  - Max. funding period: 10 years
  - Max. amount limited to funding gap (annual monitoring)

Supported items:

- **Module 1 (feasibility study or transformation plan)**
  - Newbuild and extension of heat grids
- **Module 2 (systemic investment aid)**
  - Facilities of renewable heat generation
  - Integration of waste heat
  - (heat) infrastructure (piping, fittings, …)
  - Optimisation measures (heat storages, measurement and control technology, …)
- **Module 3 (specific measure aid)**
  - Facilities for heat generation (solar thermal or heat pumps)
  - Piping to integrate or distribute renewable heat and optimisation measures
- **Module 4 (operating aid)**
  - Operating costs for solar thermal or heat pump heat generation

Programme runs until August 2028 with 4 bn Euro reserved until 2026