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

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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 and 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.
» 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“
  • Activation 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 key data for Germany

- 4100 DHC systems with 34,000 km network
- 50 GWth 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)

Quelle: AGFW-Hauptbericht 2022
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

Start 2020: Coalition contract

Replacement Power Plant Availability Act (EKBG), Energy Security Act (EnSiG)
Combination of WPG and GEG

Climate Protection Act – German Climate Neutrality by 2045

Heat Planning Act

- Local heat planning for
  - cities
  - municipalities
- Organised on site with local conditions in mind
- Binding plans/ certainty for providers

Transformation plan:
- Utilities: for DHC & gas

Building Energy Act
- building owners
- Switch to renewable energies for buildings
- climate-neutral heating technologies

Possible option: DHC

BEW: DHC operators

Funding programmes

BEG: building owners

EU - EED

Heat Planning Act

Transformation plan:

Combination of WPG and GEG

BEW: DHC operators

Funding programmes

BEG: building owners

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

1. Grant application
2. Approval
3. End of appropriation period
4. Grant application
5. Approval
6. End of appropriation period

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

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

Module 4
-operating aid-
payment based on annual verification

Not before finishing Module 1 and Module 2

For each measure up to 10 years after commissioning

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Module 1 precondition

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

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

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

Module 4 - operating aid - payment based on annual verification

Not before finishing Module 1 and Module 2

For each measure up to 10 years after commissioning

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Branch investments in lighthouse projects

- **River heat pump, 20 MW**
  - Mannheim (MVV AG)
  - **15 Mio. €**

- **Solar thermal plant, 46 MW**
  - (2025, Stadtwerke Leipzig)
  - **40 Mio. €**

- **Large-scale heat pump**
  - 150 MW, in planning
  - (Cologne, RheinEnergie AG)
  - **XXX Mio. €**

- **iCHP plant at a sewage plant**
  - (STW Duisburg)
  - **27 Mio. €**
Challenges and opportunities of solar thermal in the DHC sector
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.

Solar thermal’s role as DH generation technology

Security of supply
- Controllability
- Planability
- Availability

DHC generation technologies

Ecology
- CO₂-emissions
- Primary energy factor
- Land use
- Noise emissions

Economics
- Capex
- Opex
- Subsidies
- Risk

Foto: Guido Bröer
» 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 temperatures is a complex, costly and long term process.
Solar thermal in remote network areas

- Load of the subnet: 30 GWh
- Solar fraction: 20%
- Solar yield: 6 GWh
- Collector field: 12,000 m²
- Nominal capacity: 8.4 MW
- Land area: 3 ha
- Storage: 2,400 m³

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

Load at feed-in point: 30 GWh

Diagram elements:
- DHC network
- Feed-in point
- Subnet supplied
- Collector field
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
» 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
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 ...

denn sie ist stubenrein und hilft, CO₂ zu vermeiden.

Any more questions?

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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)
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“.
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
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