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"Progression of District Heating – 1st to 4th generation"

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Energy efficiency / temperature level

1G: STEAM

Steam system, steam pipes in concrete ducts

DH flow < 200 °C

DH return < 80 °C

Energy efficiency

2G: IN SITU

Pressurised hot-water system
Heavy equipment
Large "build on site" stations

> 100 °C

< 70 °C

3G: PREFABRICATED

Pre-insulated pipes
Industrialised compact substations (also with insulation)
Metering and monitoring

< 100 °C

< 45 °C

4G: 4th GENERATION

Low energy demands
Smart energy (optimum interaction of energy sources, distribution and consumption)
2-way DH

50-60 °C (70 °C)
(ULTDH < 50 °C)

~ 25 °C

District heating grid

District cooling grid

Steam storage

Coal Waste

Local District Heating

1G / 1880-1930

Heat storage

CHP coal
CHP oil

Coal Waste

District Heating

2G / 1930-1980

Heat storage

CHP waste
CHP coal
CHP oil

Gas, Waste
Oil, Coal

District Heating

3G / 1980-2020

Heat storage

Industry surplus

CHP waste
incineration

Centralised district cooling plant

Centralised heat pump

Also low energy buildings

District Heating

4G / 2020-2050

Development
(District Heating generation) /
Period of best available technology



Data center

Seasonal heat storage

Large scale solar

Biomass
CHP Biomass

Industry surplus

Heat storage

CHP waste
CHP coal
CHP oil

Gas, Waste
Oil, Coal

Large scale solar

Geothermal

PV, Wave
Wind surplus
Electricity

Heat storage

Industry surplus

CHP waste
incineration



Future energy source



Biomass conversion



2-way District Heating
e.g. supermarket



CHP biomass



Centralised district cooling plant



Centralised heat pump



Also low energy buildings



Cold storage