

# Energy Supply Systems and LTDH

## 1 Energy Supply Systems

### 1.1 Energy sources

- Oil
- Gas
- Coal
- Nuclear energy
- Solar energy
- Geothermal energy
- Water
- Biomass
- Waste heat
- ...



Figure 1: Wind energy. Source: Al3xanderD [1]



Figure 2: Solar energy.  
Source: RoyBuri [2]

### 1.2 Facts and numbers

- Heating accounts for more than half of total energy consumption in households
- DH networks can have high heat losses:
  - Advanced networks 5-15%.
  - Old networks up to 30% or beyond.
- The energy supply systems have changed significantly over the last 100 years
- Trend towards sustainable and more efficient systems
- District heating makes up 25% in new homes in Germany, compared to 14% in all German homes

#### Current Standard

- still predominantly use of fossil fuels
- long transport routes of high temperatures lead to heat loss  
= lower efficiency than locally generated heat
- Possible monopoly position of suppliers (lack of competition, long-term contractual obligations, ...)
- Not adapted to higher energy efficiency standards in buildings

## 2 Low Temperature District Heating

### 2.1 District Heating History

Generation	Temperatures	Sources	„Consequences“
1st Generation 1880-1930	steam < 200°C	Coal steam boilers and some CHP plants	
2nd Generation 1930-1980	> 100°C	Coal and oil-based CHP and some heat-only boilers	
3rd Generation 1980-2020	< 100°C	Large-scale CHP, distributed CHP, biomass and waste incin- eration	Lower pressure, integration of several sources possible
4th Generation	below 50 - 70°C	More renewable sources and sur- plus heat	Well insulated buildings, low temp heating installations, new ways of hot water production

### 2.2 Currently expanding LTDH 4<sup>th</sup> Generation

- LT heat supply network with reduced feed (55 ° C to 70 ° C) and return temperatures (25 ° C to 40 ° C)
- Low-temperature district heating networks can make a significant contribution to the sustainable and efficient use of energy resources
- Adaptation to the requirements of lower heating temperatures in the areas of energy-efficient buildings, which means a considerable reduction of heat demand
- Optimized integration of renewable energy sources (geothermal and solar energy) and industrial waste heat
- Reduced heat loss in pipes through improved insulation and lower network temperatures

## 3 Research and Potential

- Horizon 2020 – European Union funding for research and projects
- Heat Roadmap Europe – open access data for heating and cooling demand in Europe
- LowTEMP – Baltic Sea Region
- Aalborg University – Research center for district heating

## 4 References

- [1] Al3xanderD. Pixabay. <https://pixabay.com/de/photos/windrad-feld-getreide-himmel-4550711/>
- [2] RoyBuri. Pixabay. <https://pixabay.com/de/photos/solar-dach-sonnenenergie-2666770/>