JUNE, 3RD 2025
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WITH FOCUS ON BIOMASS AS ENERGY SUPPLY

DR. PETER HEUSSER

Agenda

- DH – Basic development
- Bioenergy – Best fit and practice in Gen 4 DH
- CHP – First step towards integrated energy system
- Q&A

District Heating:
A Pillar of the Energy Transition

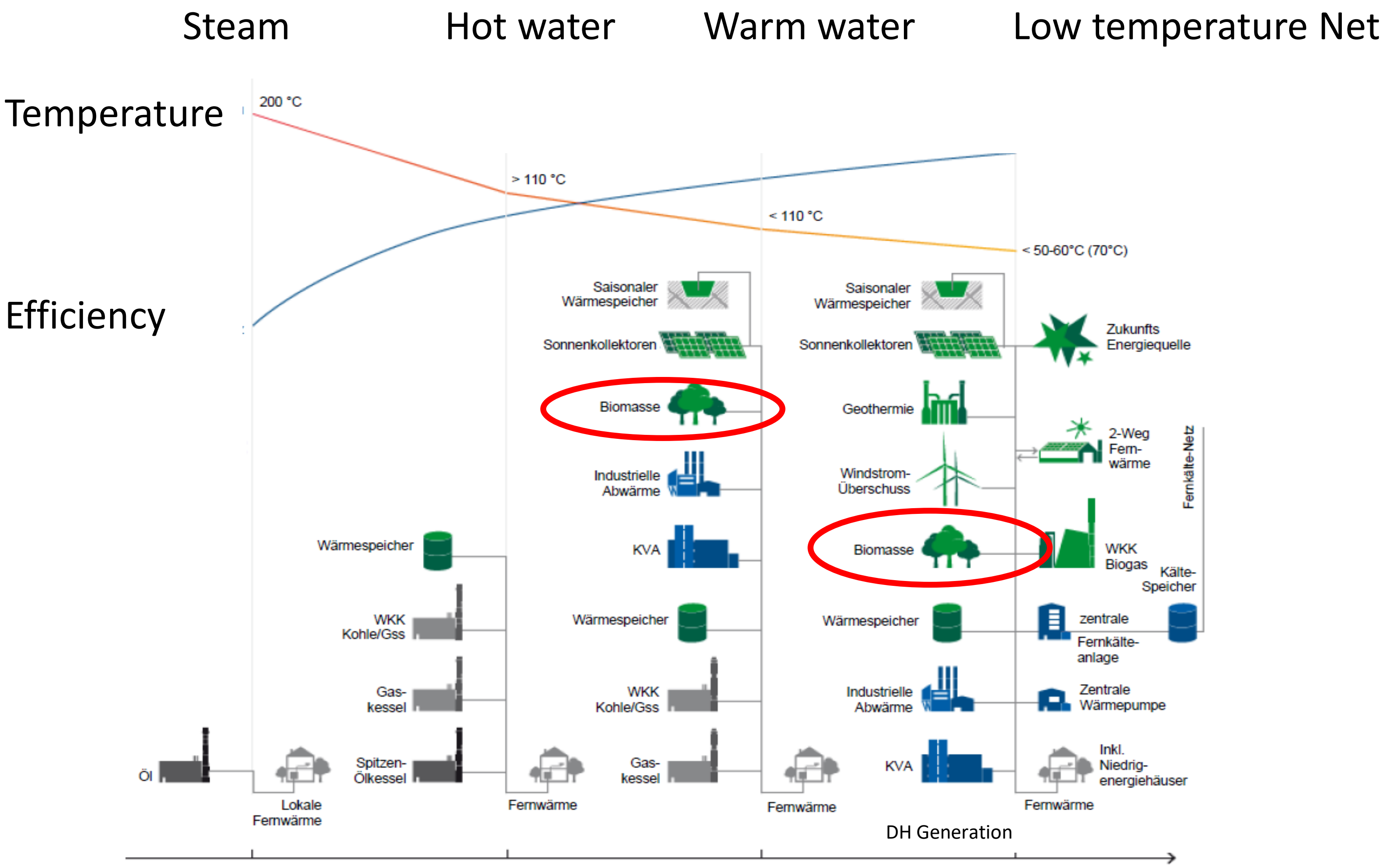
- Efficient use of heat in urban and rural areas
- Reduces dependency on fossil fuels
- Enables integration of renewable and waste heat sources
- Grid-friendly, scalable infrastructure

How District Heating Works

- “Centralized” heat production
- Hot water/steam distributed via insulated pipes
- Heat exchangers at user level

3. Generation	ca. 1970–today	Hot water ca. 80–120 °C Reduced heat loss (insulation) energy efficient (floating temperature)
4. Generation	In development	Low temperature (< 70 °C) renwable energy bi-directional network

Future DH


Steam
Hot water
Warm water
Low temperature Net
Temperature
Efficiency
200 °C
> 110 °C
< 110 °C
< 50-60°C (70°C)
Saisonaler Wärmespeicher
Sonnenkollektoren
Biomasse
Industrielle Abwärme
KVA
Wärmespeicher
WKK Kohle/Gss
Gas-kessel
Saisonaler Wärmespeicher
Sonnenkollektoren
Geothermie
Windstrom-Überschuss
Biomasse
Wärmespeicher
Industrielle Abwärme
KVA
Zukunfts Energiequelle
2-Weg Fern-wärme
Fernkälte-Netz
WKK Biogas
Kälte-Speicher
zentrale Fernkälte-anlage
Zentrale Wärmepumpe
Inkl. Niedrig-energiehäuser
Wärmespeicher
WKK Kohle/Gss
Gas-kessel
Spitzen-Ölkessel
Öl
Lokale Fernwärme
Fernwärme
Fernwärme
Fernwärme
DH Generation

Biomass Energy

- Wood chips, pellets, forest and agricultural residues
- Biogenic waste streams
- CO_2-neutral under sustainable sourcing
- Forms: solid, liquid (bio-oil), gas (biogas, syngas)

Biomass – A Natural Fit for DH

- Reliable base-load heat production
- Local sourcing = energy security
- Compatible with CHP and seasonal storage
- Utilizes waste streams from forestry/agriculture and civilization

3 -> 4 gen;: network , distributed sourcing   Bild

Biomass District Heating in Practice

- Denmark: >60% of DH from renewables; biomass in urban systems
  ca. 30% Waste to Energy
- Austria: 2,400+ small-scale biomass DH plants
  ca. 5% Waste to Energy
- Switzerland: Wood-based DH plants ca. 1.3 GW installed power
  ca. 30% Waste to Energy

In addition: ca. 450'000 single wood based heating systems in CH

estimated values based on personal experience

Instaled Power

Land	Installed Power	Installed Power Biomass for DH
DK Danemark	ca. 6.000–7.000 MW (estimated)	ca. 1.500–2.000 MW
AT Austria	ca. 28.000 MW (2.400+ Plants)	ca. 28.000 MW (mainly Biomass)
CH Switzerland	ca. 6.000–8.000 MW (estimated incl. Waste heat)	ca. 1.000–1.500 MW (estimated)

Key Considerations & Limitations

- Supply chain sustainability (avoid overharvesting)
- Particulate emissions → need for modern filtration
- Storage and moisture management
- Public perception and environmental NGOs
- Policy and CO_2 pricing uncertainty

Next Steps for Biomass in DH

- Integration with solar thermal and heat pumps
- Thermal storage for peak load and seasonal
- Large battery storage
- Predictive control and demand-side optimization
- Digital monitoring and smart grids
- Biomass as backbone for 4th-gen DH networks

Power Cupelling:
Operational & Technical Benefits

High overall efficiency: 80–90% fuel utilization (heat + electricity)
- Stable baseload operation
- Grid support and local resilience

Fuel & Sustainability Benefits
- Carbon-neutral potential (if sustainably sourced)
- Utilizes residues, supports circular economy
- Aids decarbonization targets

Economic & Strategic Value
- Cost-effective in regions with cheap biomass
- Reduces fossil fuel dependency
- May qualify for renewable incentives

Power Coupling: Limitations & Considerations

Technical & Operational Challenges
- Lower electrical efficiency vs fossil CHP
- Seasonal heat demand variation
- Ash handling, boiler fouling

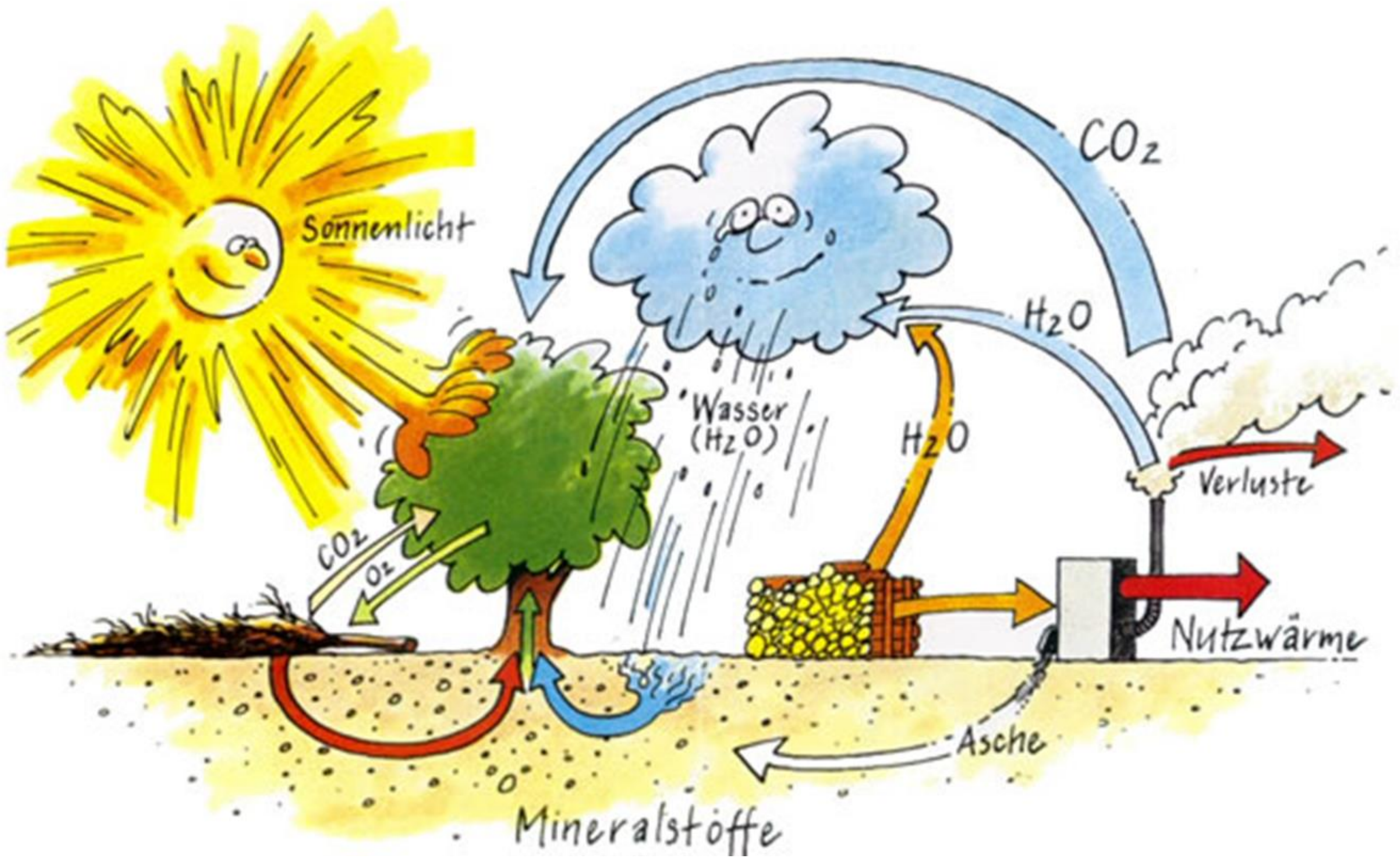
Fuel-Related Challenges
- Complex logistics and preprocessing
- Fuel quality variability
- Sustainability and land-use concerns

Economic Risks
- Higher CAPEX and OPEX
- Price dependency (electricity, biomass)
- Policy and subsidy uncertainty

Key Messages

- Basic physics but consider…- Biomass is a mature, scalable renewable for DH
- Waste and Forests offer strong Biomass feedstock potential
- Address sustainability, logistics, and emissions
- Key role in decarbonizing heat supply

Thank you



Peter Heusser
Dr. sc. techn. ETH
Doldertal 32
8032 Zürich

www.svut.ch
peter.heusser@svut.ch