Small Scale DH in Austria

AEBIOM workshop:

„Biomass for District Heating and Cooling“

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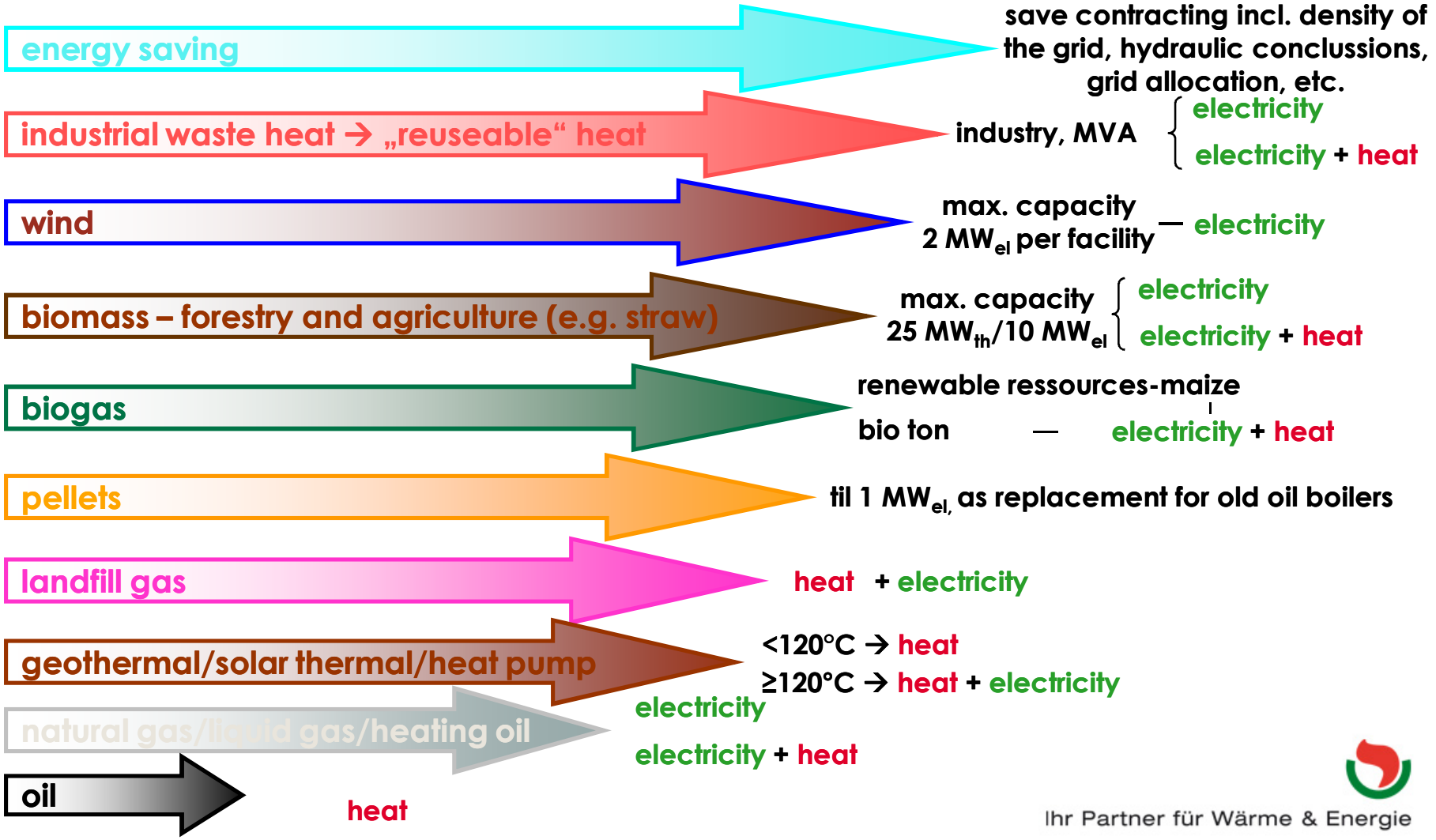
A question of dimensioning

- **Every detail is based on decades of experience and just through coaction of fuel logistics, bioenergy, engineering, IT, district heating-experiences, financing, energy and breakdown management it is possible to provide valuable energy services.**
- **The tailor made suit „bioenergy“ is our trademark, for which we are known for.**
- **We have checked a lot of projects, but in many cases there were made so many mistakes in the past**
  - the dimension of the heating plants and the grids are to high (degree of efficiency to low)
  - pump costs are enourmos
  - heating plants can´t be run fully loaded (in fact of too high installed capacity)
  - to less connection of consumers along the grid together with higher grid losses
- **Therefore a high efficiency can´t be achieved**
- **Heating plants and grids are not dimensioned adequately from the technical, economical and environmental point of view!**

Why Small Scales DH?

- Own bounds are reached (2,5 TWh/a in 90 biomass heating plants; 1000 HZZ; market leader in Austria)
- No/very low promotions
- Very high personnel expenses
- Heat losses in big networks 12-20 %
- Permanent demand for tendering / public character
- standardisation hardly possible
  - Much external / regional influence
  - garantie for product compatibilty
  - Simple posture of replacement parts as well as maintenance / revision required
  - Estival Disconnection of large networks due to contracts is not possible
  - Thehrefore an optimal summer operation ist not possible (integration of solar, heat pumps)
- Specifications of the EU 20 | 20 | 20
- Economic basic conditions
- Higher promotions
- Obligation to oil; gas price must be reconsidered
- More regional binding
- Using of solarthermal / reduction of losses during summer time
- Few transporting losses
- monitoring helps to react faster
- Higher employment rate in the region (operation, raw material procurement)
- Smart Grids | Smart Metering → the way to more energy efficiency and sensitization without losing comfort

Utilisation priorities as basic for smale scale



Technical and economical feasibility?

- Heat based plants, cogeneration-systems with high fuel utilization
- Plant capacity
- Professional fuel management, pooled procuration strategy
- Influence of 40 years operation experience in planning, construction, operation with own program
- High percentage of connection to the heating grid as precondition before construction start
- Concentration on the core business heat delivery with two possibly alternatives → aligned, unconnected
- Best possible integration of heating plants in the existing periphery and utilization of all existing waste heat sources
- Regional connection and closeness to the project, possible inclusion of additional partners (e.g. Public Private Partnership)
- „wood mobilising“ → stronger usage of the yearly increase of domestic wood „win-win-situations“
- Efficiency of the wood harvest must be raised (growth>usage!)

Renewable energy sources and plant capacity

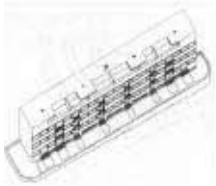
- **biomass →**
  - Plant capacities of appr. 25 MW_{th} and 10 MW_{el} limited
  - Depends on wood logistics and connected district heating grid (heat dimensioned biomasse plants)
- **biogas →**
  - Plant capacity is limitid to 3 – 5 MW_{el}
  - Closeness to raw material suppliers or possibilities for disposal of waste (green can)
  - Storable for peak electricity
- **pellets →**
  - Max. plant capacity of about 1 MW_{th}
  - Substitution of old oil boilers
  - High intermediate raw material price increases were not in the line with the market
- **woodgas →**
  - Currently in developing period
  - The gas cleaing is problematic
- **geothermal →**
  - In Austria because of difficult geology problematic
  - Certainly a good system for the future
  - Borehole deepness are getting bigger and therefore the costs are getting higher (> 5.000m!)

The future of bioenergy

- Biomass heating plants for local and district heating (1 MW_{th} to 25 MW_{th})
- Base load for existing big district heating systems
- Micro grids - mostly with utilization of wood chips (< 1 MW_{th})
- Cogeneration plants
  - steam turbine
  - ORC process
  - steam bolt motor
- Pellets plants as alternative for heating oil plants
- Concentration on the core business (biomass logistics and utilization), creation of WIN-WIN-situations with long-term partnerships and delivery contracts
- Implementation of up-to-date technologies for grid and plant optimization both production and distribution as well as at the customer side
- geothermal
  - HDR – geothermal (Hot Dry Rock Method)
  - If geology is fiding
- Block heat and power plant on basis liquid gaseous biomass
- Upgrading of the economy through admission to the emission trading
- Increased utilization of solar thermal systems as summer base load
- Increased utilization of standardized products (boilers, pumps, heat transfer stations, ...)
- Efficient technologies in the field of combined heat and power plants togehter with cooling
- Upgrading the degree of efficiency through technologic development at thermal plants
- Upgrading of biogas for fuel cells
- Peak electricity of de-centralized plants (e.g. on basis biogas plants)

Typical application of pellets plants

Bio energy service

Floor domestic architecture	Colony – heating grid	combinations pellets- oil/gas heating
		
Heating and warm water	*Heating and warm water for the whole year* *Heating area colony: > 70 kWh/m²a* *Connection frequency: at90/70°.... > 2 MWh/a,trm* *Room heating* *Heating area colony: 50-70 kWh/m²a* *Connection frequency: bei 90/50°.... >1,5 MWh/a,trm*	*Conditions as for floor domestic architecture and heating grids*

- plants > 150 kW up to 700 kW on basis pellets have been realized
- plants > 700 kW → wood chips plants are more economic

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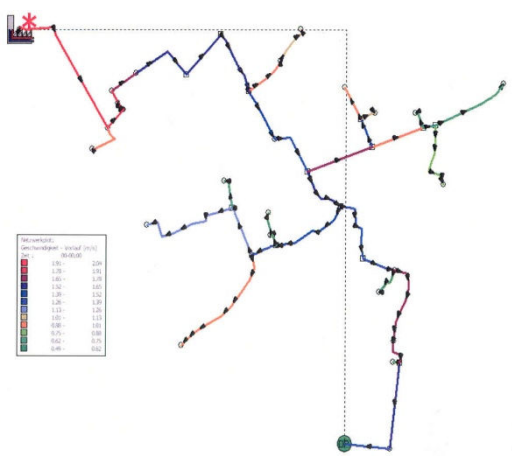
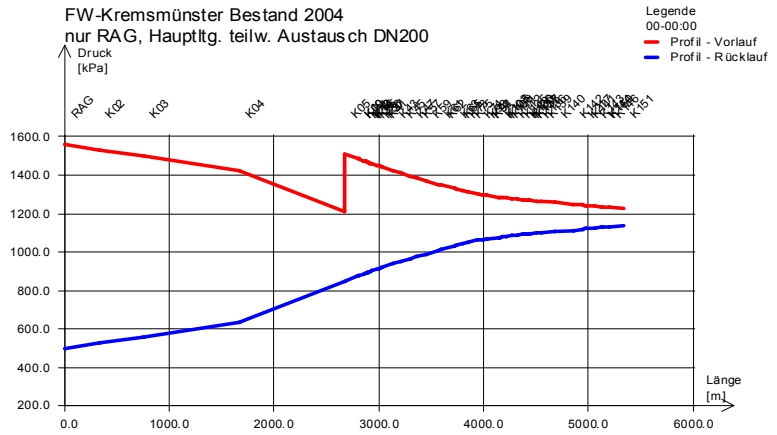
Hydraulic analysis

- For optimized operation and hydraulic analysis we use a tailor made Software, based on our 35 years of experience:
- Due to it the following problems can be solved:
  - minimisation of the heat losses
  - minimisation of the water flow
  - optimization of the pressure conditions
  - correct hydraulic switching at heat producers with different flow temperatures
  - design and dimensioning of the entire heat network
  - control of the pumping system with individual parameters
  - determination of the energy demand at new pipes
  - recognition bottlenecks at temperature and pressure
  - calculation of by-pass controls in order to keep the flow rate low
  - surveillance of the pipe cooling in case of too small flow rates
  - surveillance of the network as heat accumulator
  - preparation of open system data

  → This software can also be used as online system which considers every customer in order to reach an optimized profitability.





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GIS examples

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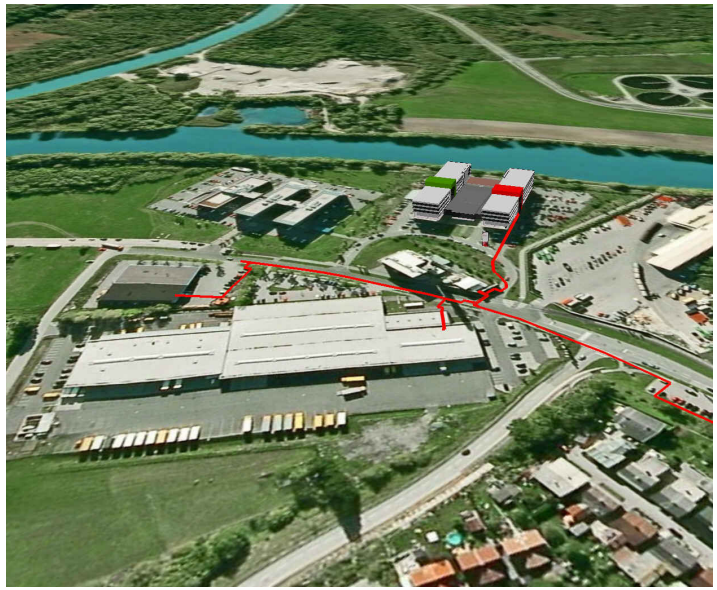

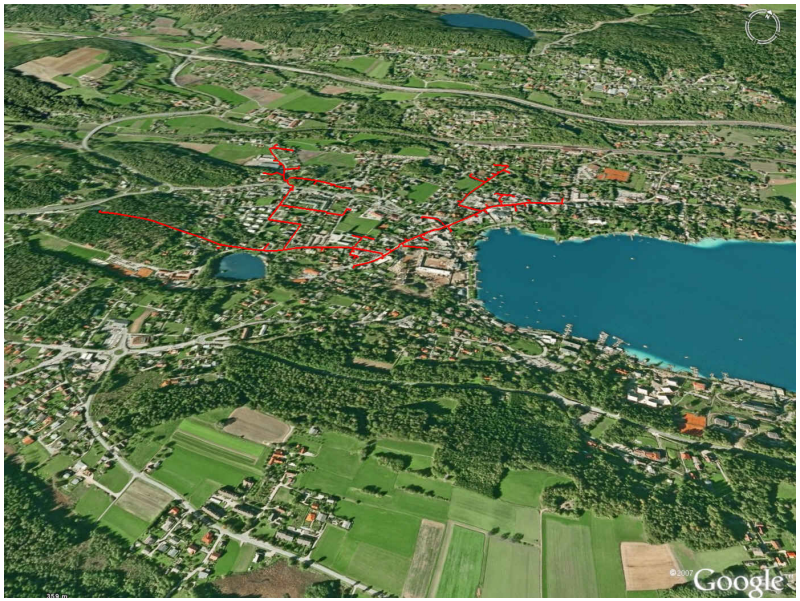

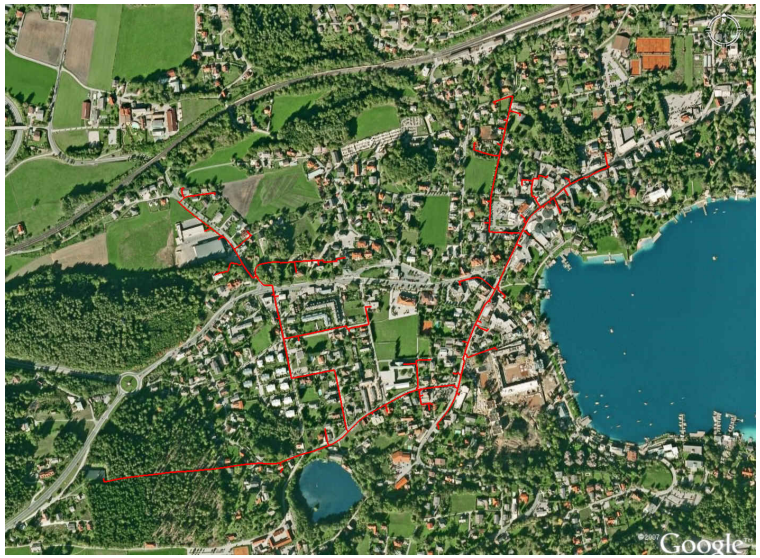

Architecture examples

VARIANTE 1_1

VARIANTE 2_1

VARIANTE 1_2

VARIANTE 2_2

VARIANTE 1_2a

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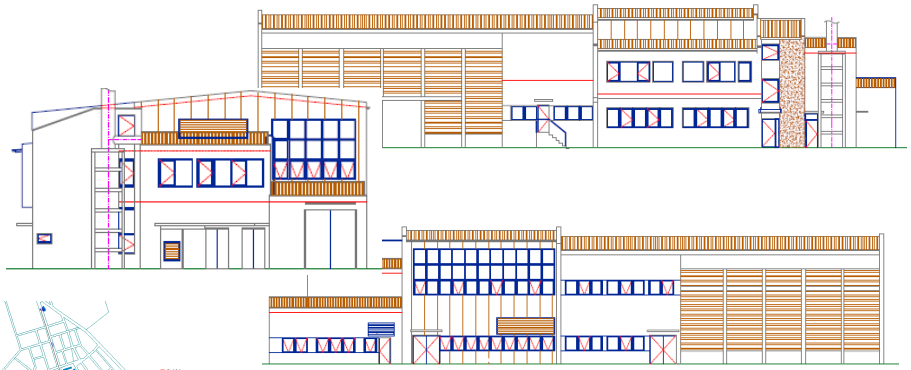
District heating Ihtiman/BG

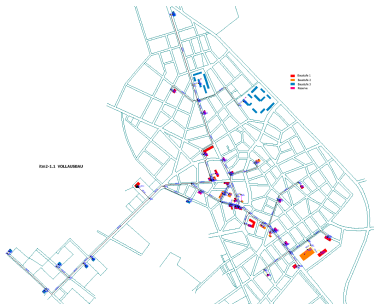
District heating based on biomass – Ihtiman, Bulgaria

- project: district heating based on biomass
- Project status → in operation
  operation start → February 2009
- Installed capacity
  First step:
  - biomass boiler: 3.000 kW_{th}

  Second step:
  - natural gas CHP: 700 kW_{th}/600 kW_{el}
  - biomass boiler: 3.000 kW_{th}
- District heating grid: appr. 7 km
- Connected houses: ca. 40
- Heat sales:
  First step:
  - > 9.300 MWh_{th}/a

  Second step:
  - >12.000 MWh_{th}/a





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Geothermic Fürstenfeld

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in operation since 1999
pumping via immersion pump appr. 25 l/s
temperature cutback: 85° to 55 °
low temperature: further cutback of the temperature on 35°C projected (balneologic use)

projected usable energy:	appr. 10.000 MWh/a
additional low temperature :	appr. 3.000 MWh/a
water horizon:	appr. 1.900 m

advance- and re-injection – bore vertical
distance: 1.000 m

biogas plant based on renewable energy sources (500 kW_{el}) currently in attainment – produces appr. 3,2 GWh_{th}/a;

problems:

- **water quality** → action on material choice
- **re-injection** in 1 km distance

so appr. 98 %
of the primary energy are covered via geothermic and biogas CHP

future:

- **additive biomass plant, because there are problems with the re-injection >2 l/s**
- **appr. 1-1,5 GWh/a rests from geothermic**