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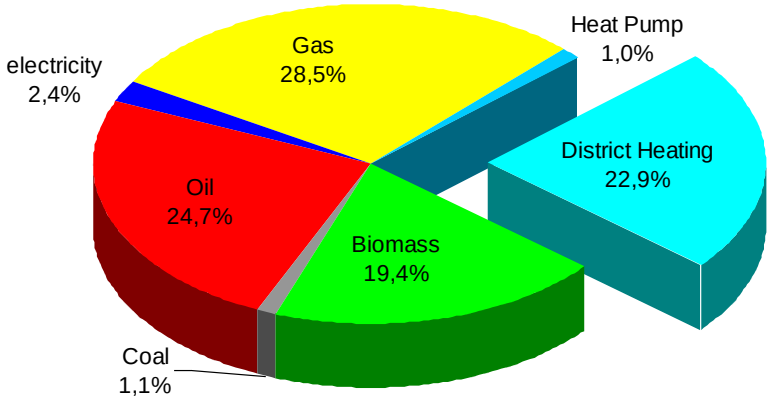
District Heating and Cooling in Austria 2030

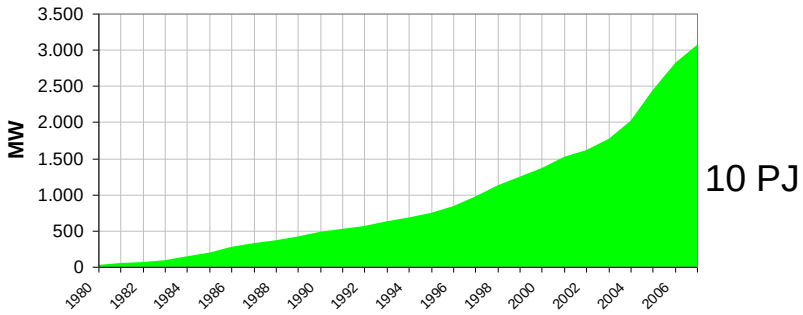
Potential and ecological effects

District heating market in Austria

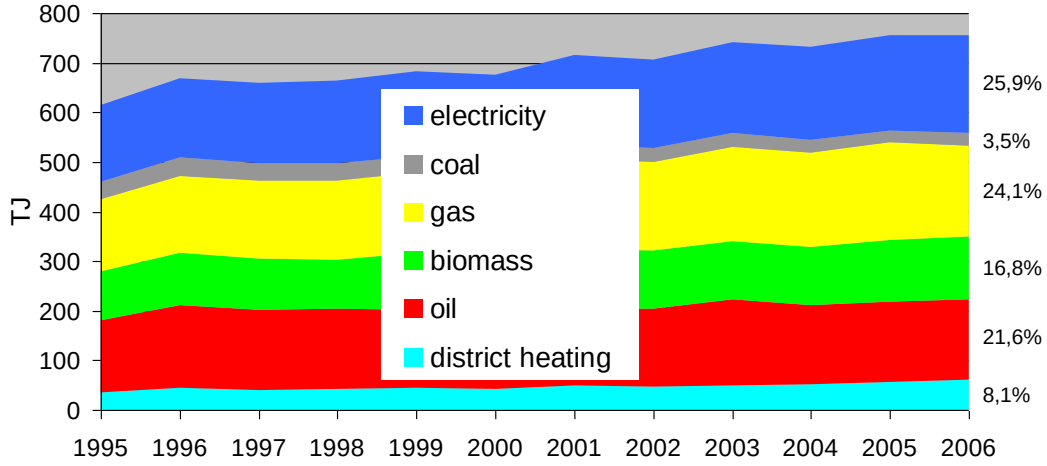
Kind of energy for dwellings (2006)



Development of BIOMASS district heating plants



Final Energy (without traffic)



What is the potential for district heating 2030 in Austria?

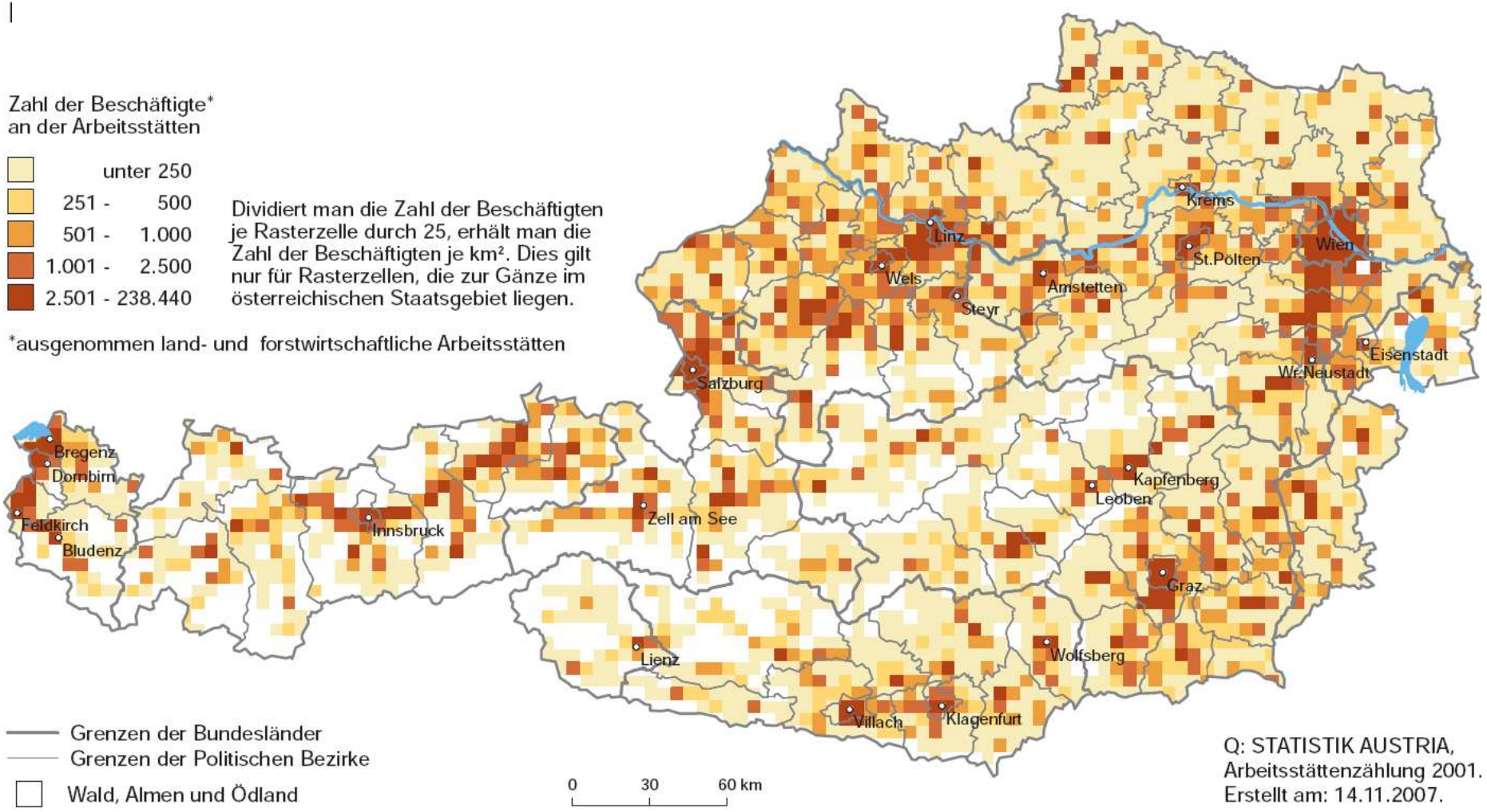
- **Development of the heat demand**
  - Population
  - Size of residential area (m^2)
  - Thermal retrofitting of buildings
  - Employees
  - ……
- **Market situation for using district heating**
  - Willingness to choose district heating
  - Competition with other kind of energy
  - Development of other systems: solar energy
  - Subsidies
  - .....

Methodological access III

Identifying potential

- **Basis unit: Regional heat / cooling demand for heating (incl. hot water) / for cooling**
  - regional resolution: square with 1,000 meter (about 85,000 grid cells)
  - temporal resolution: 1 year
- **Calculation modules (Modelling / Scenarios to 2030)**
  - District heating
    - Heat demand – dwellings
    - Hot water demand – dwelling (numbers of persons)
    - Heat demand non residential buildings (without tourism)
    - Heat and hot water demand tourism
  - Cooling
    - Cooling demand non residential buildings
    - Cooling demand tourism
- **Result: heat energy demand per km²**

National grid
Example: Employees in 2001 by 5 km grid



Basic data for residential buildings

- **Residential Buildings**
  - National building statistics
    - Kind of buildings
    - Number of buildings / dwellings
    - Size of dwellings
    - Kind of energy
    - Heating system
  - Energy demand
    - **Energy consumption (2001, 2004, 2006) for heating of different areas (Bundeslaender) in residential buildings**
      - to calibrate the calculated heat demand
    - National energy statistic of energy consumption 2004, 2006
    - Experience of e7
    - Calculation of the energy certification of buildings
      - Split between the boiler losses and the distribution losses
  - Number of population
    - Hot water demand (net) per person and year

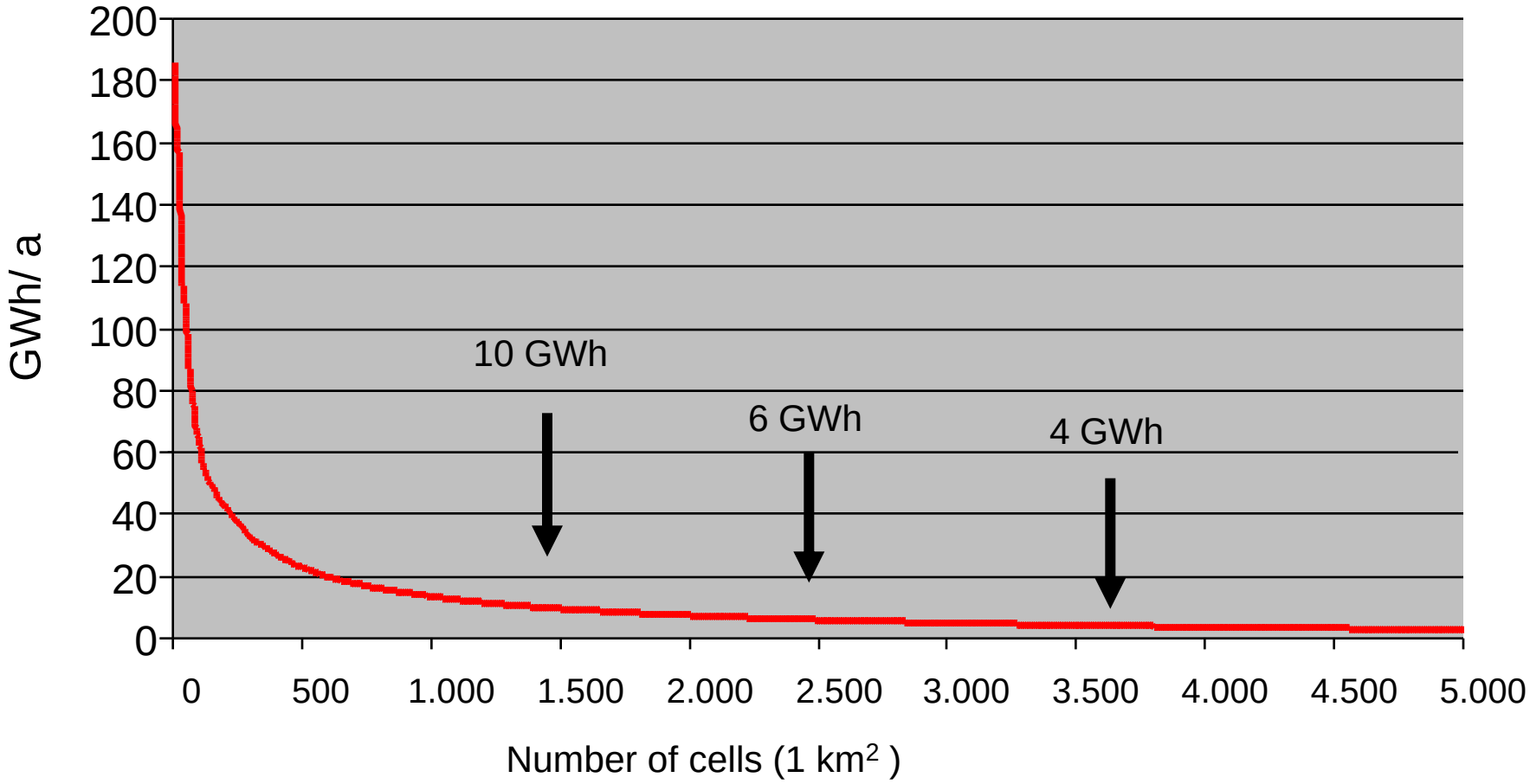
Basic data for non residential sector

- **Non residential buildings** (trade aso)
  - 11 different classes of employees
  - Number of employees (1000 meter square per class
  - Heat energy consumption per employee & class
- **Tourism**
  - Overnight stay (summer / winter) per community
  - Energy consumption for heating (summer / winter)
  - Number of employees in tourism

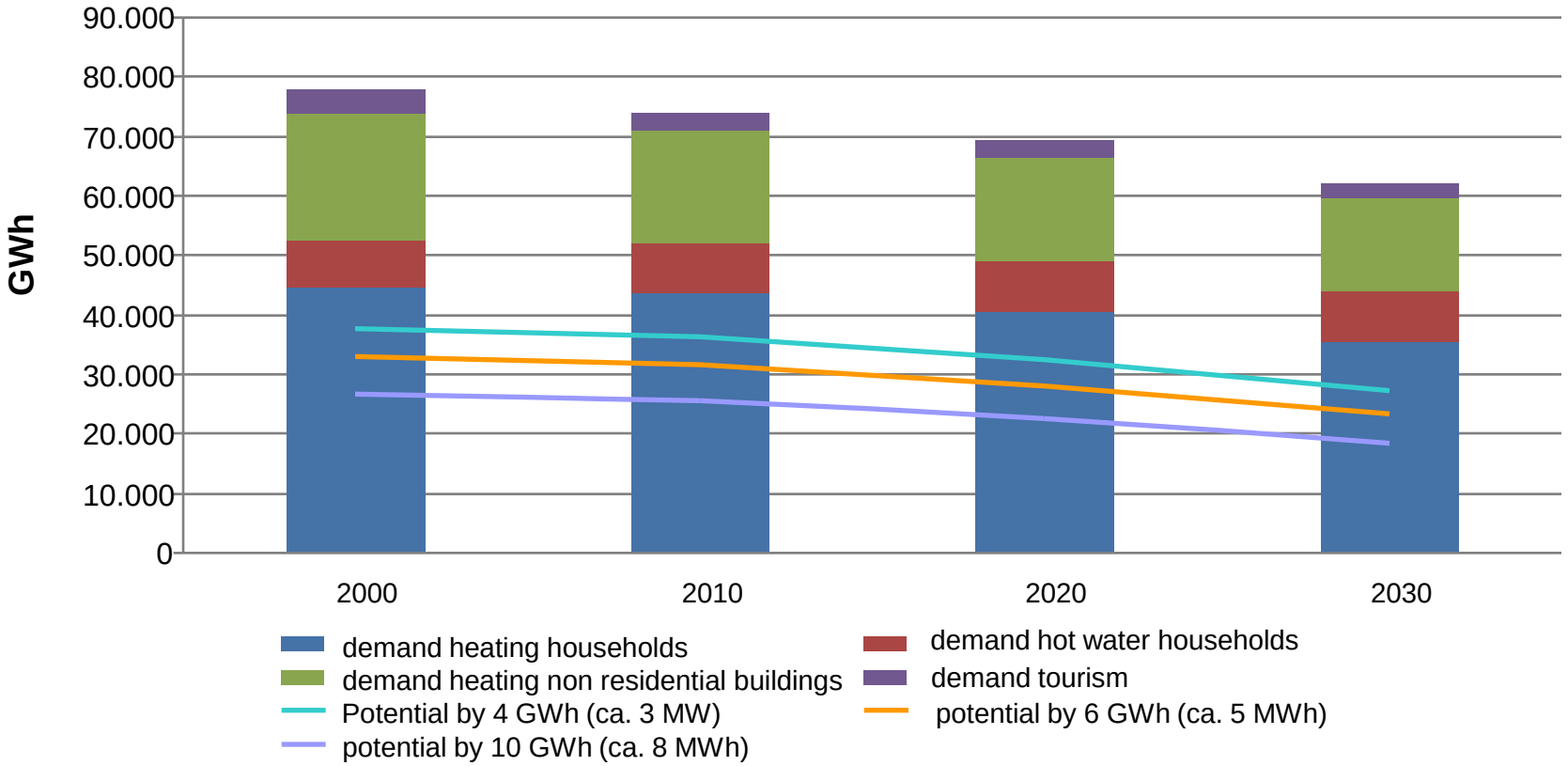
Heat demand, 2030: Factors

- **Future thermal building quality**
  - EPBD
  - National legislation
  - Experience of thermal retrofitting over the last 10 years
- **Technical efficiency gains in household**
- **Development of apartment sizes**
- **New construction and renovation rates for residential buildings**
- **Forecasts (countries) on demographics, households and workplace development (ÖROK forecasts)**

District Heating Potential:
What is the size of the minimum energy demand for the use of district heating?



Heat demand and realistic potential - scenarios to 2031



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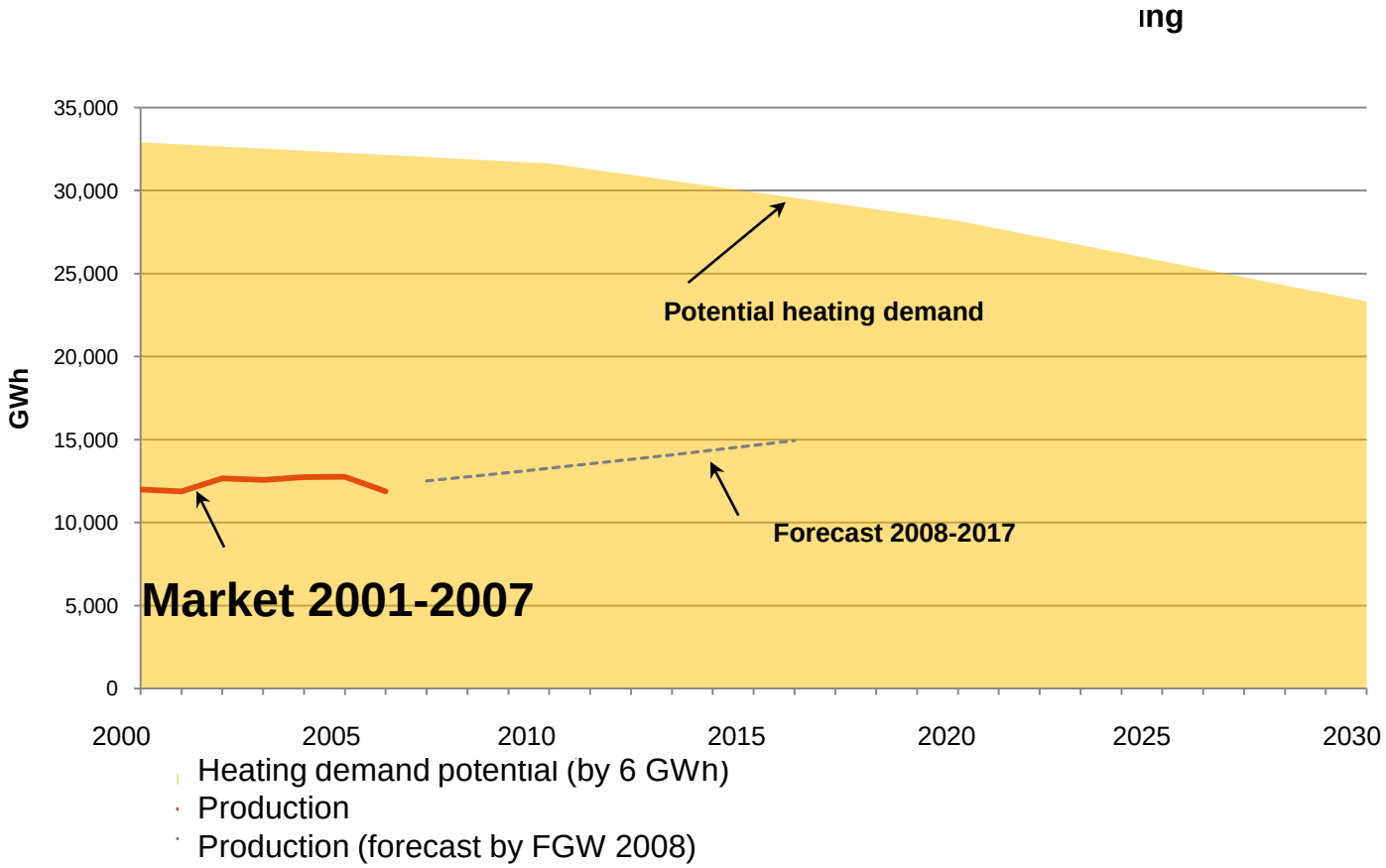
Potential demand for district heating versus market



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Ecological Effects

Methods of impact analysis

- **Primary energy factor (PEF) according** ÖNORM EN 15316-4-5
  - Norm: *Heizungsanlagen in Gebäuden – Verfahren zur Berechnung der Energieanforderungen und Nutzungsgraden der Anlagen* (Teil 4-5: Wärmeerzeugungssysteme, Leistungsfähigkeit und Effizienz von fernwärme- und großvolumigen Systemen); (Anmerkung: Es werden Primärenergiefaktoren für nicht-erneuerbare Energie verwendet (Def. siehe EN Kap. 3.1))

- **Balance method**
  - Comparison CHP (and heating plant) with separate production of heat and electricity
  - Accounting for the use of primary energy
  - Accounting for CO_2 and other air pollutants

Primary energy factor (PEF)

Scenarios

- **District heating system 2006: 0,59**
- **Scenario 1: energy mix CHP, energy MIX power plant and technology 2006, without heating 0,48**
- **Scenario 2: energy mix 2006, technology 2030 0,05**
- **Scenario 3: energy mix and technology 2030 0 (-0,12)**

Comment:

- According to EN 15316-4-5 negative PEF are zero
- Main reason: high efficiency production of electricity

Balance method

Primary energy use and emissions

- **Comparison of different models**
  - Production of electricity and heat cogeneration
  - Separate production of electricity and heat (decentralized production of space heating)
  - Transport losses in pipelines and in the grid of heat and electricity are taken into account
  - Energy mix and efficiency in decentralized heating systems will also be adapted

Energy use and emissions

Scenario 1

	Energy use	CO_2	NO_x	CO	SO_2	dust
	GWh	t	t	t	t	t
Separate production of heat and electricity	2.315	521.602	533	3.909	188	132
Production of heat and electricity with cogeneration	1.958	361.425	396	156	57	38
Savings absolutely	357	160.177	137	3.753	131	94
Savings in %	**15,4%**	**30,7%**	**25,8%**	**96,0%**	**69,5%**	**71,6%**

- Results normalized to (additional) 1,000 GWh of heat demand
- CHP technology 2006
- Energy mix CHP 2006
- Electricity production with power plant energy mix 2006
- Power plant technology 2006

Energy use and emissions

Scenario 2

	Energy use	CO_2	NO_x	CO	SO_2	dust
	GWh	t	t	t	t	t
Separate production of heat and electricity	2.763	648.233	633	3.534	223	132
Production of heat and electricity with cogeneration	2.236	412.720	452	178	65	43
Savings absolutely	527	235.513	181	3.356	158	89
Savings in %	**19,1%**	**36,3%**	**28,7%**	**95,0%**	**70,7%**	**67,4%**

- Results normalized to (additional) 1,000 GWh of heat demand
- Only CHP (without heating plants)
- Technology 2030
- Energy mix of the cogeneration 2006 and distributed generation 2006
- Electricity production with energy mix power plant 2006

Energy use and emissions

Scenario 3

	Energy use	CO_2	NO_x	CO	SO_2	dust
	GWh	t	t	t	t	t
Separate production of heat and electricity	2.413	492.371	605	4.374	179	118
Production of heat and electricity with CHP	2.024	312.771	521	241	61	38
Savings absolutely	388	179.600	85	4.132	118	80
Savings in %	**16,1%**	**36,5%**	**14,0%**	**94,5%**	**65,9%**	**67,6%**

- Results normalized to (additional) 1,000 GWh of heat demand
- Only CHP (without heating plants)
- Technology 2030
- Energy mix co-generation and peripheral heat 2030
- Electricity production with energy mix 2030

Potential for district cooling

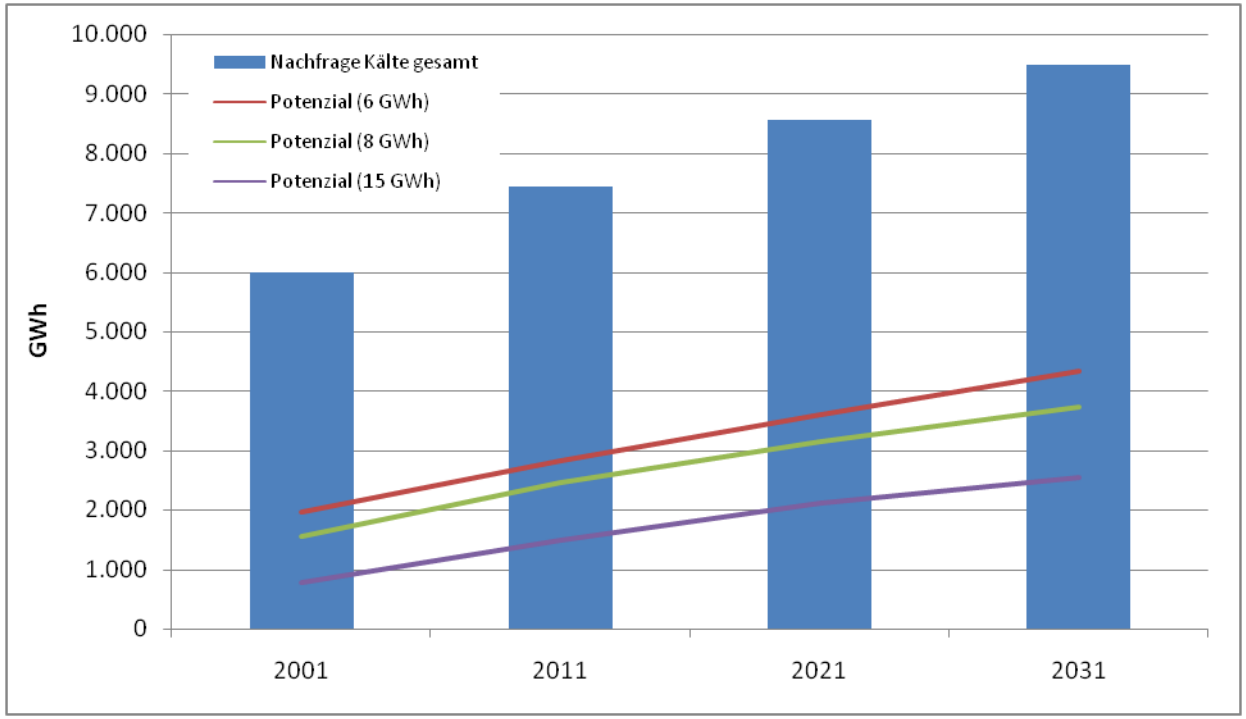
Assumptions for calculating

- **The following sectors were included in the calculation**
  - trade: 6 MWh/employee
  - health service: 4 MWh/employee
  - services: 2 MWh/employee
  - tourism/restaurant: 12 kWh/overnight stay

- **Factors taken into consideration for the forecast until 2030**
  - Increasing comfort demands (per sector)
  - Increase of space per employee (per sector)
  - Higher efficiency of buildings (per sector)
  - Change in employment numbers (ÖROK forecast, districts)

Theoretical potential for district cooling

(services, trade, tourism, health sector)



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Conclusion

- There is still a considerable potential for expansion of district heating in Austria, despite a decreasing overall demand for heat
- Economic development potentials of the district heating as far as possible by rapid development (anticipated capital investment)
- District expansion is an important measure for climate change and energy security (savings of energy and greenhouse gases)
- Potential for district cooling rises rapidly at (a doubling by 2030), but is concentrated in urban areas
- Ecological effects of cooling in the use of existing district heating (waste heat) are high

Contact

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