Integrating Renewable Energy Generation through Demandside Management

NSB 2011 - Session C11 – Energy efficiency in single-family houses

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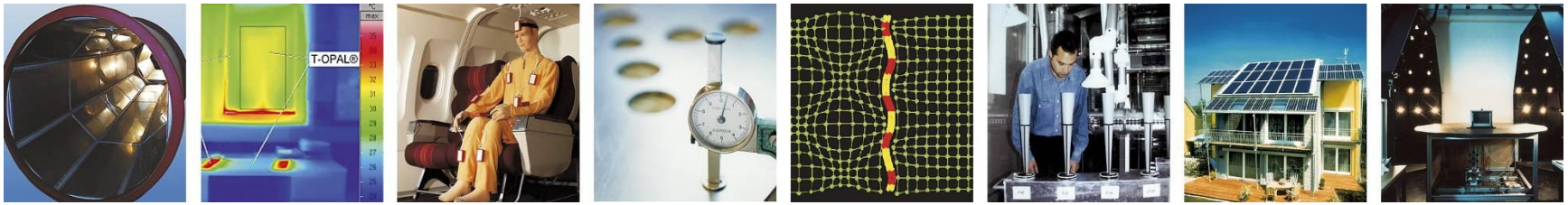
Building on knowledge



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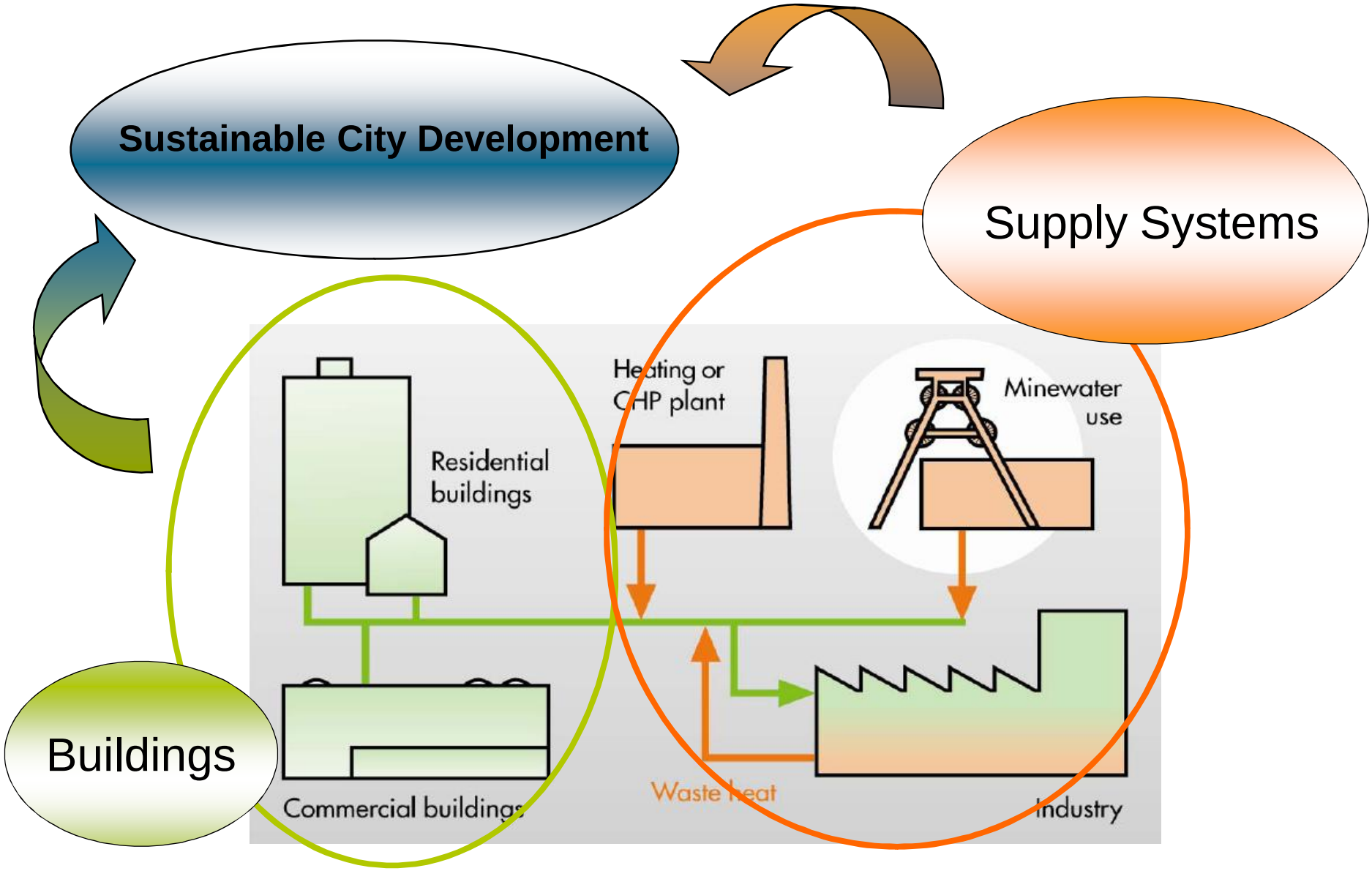

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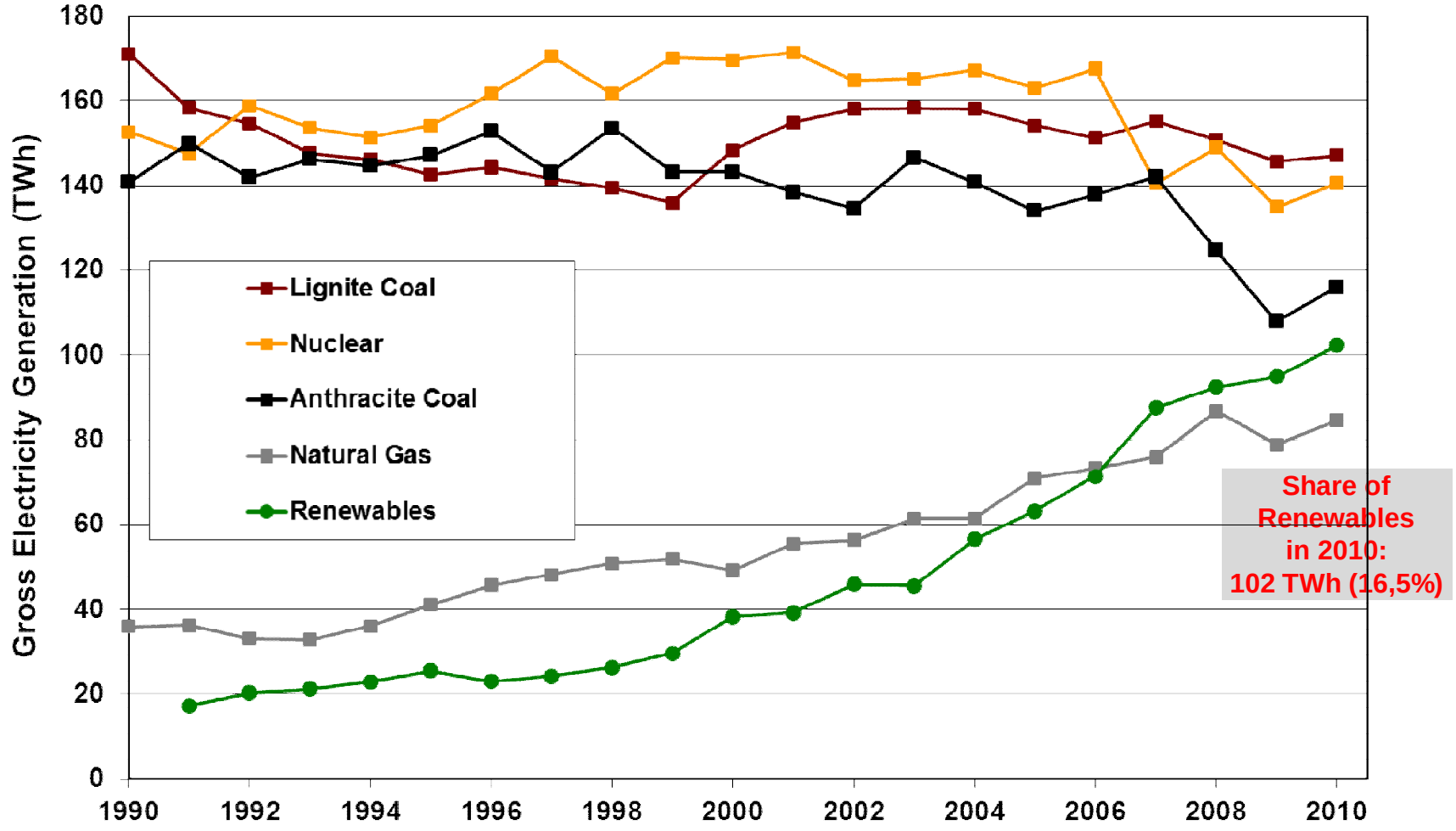
Gross Electricity Generation in Germany

Gross Generation 1990: 550 TWh

Gross Generation 2010: 621 TWh



Share of Renewables in 2010: 102 TWh (16,5%)

Source: Arbeitsgemeinschaft Energiebilanzen - Bruttostromerzeugung in Deutschland von 1990 bis 2008 nach Energieträgern

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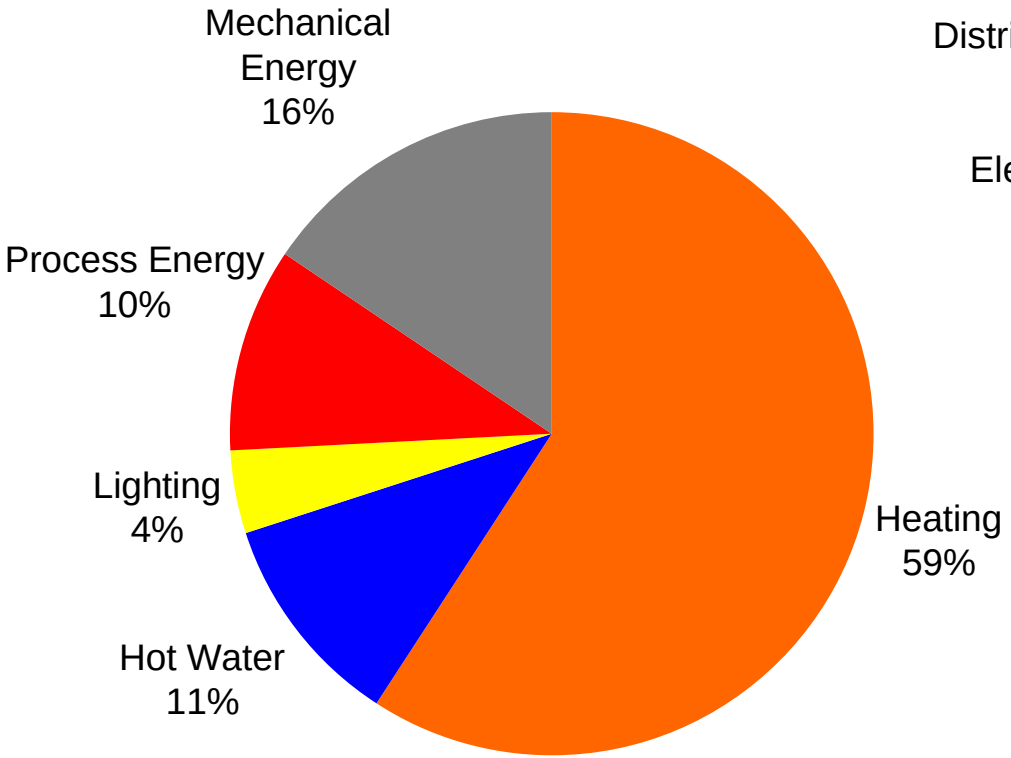
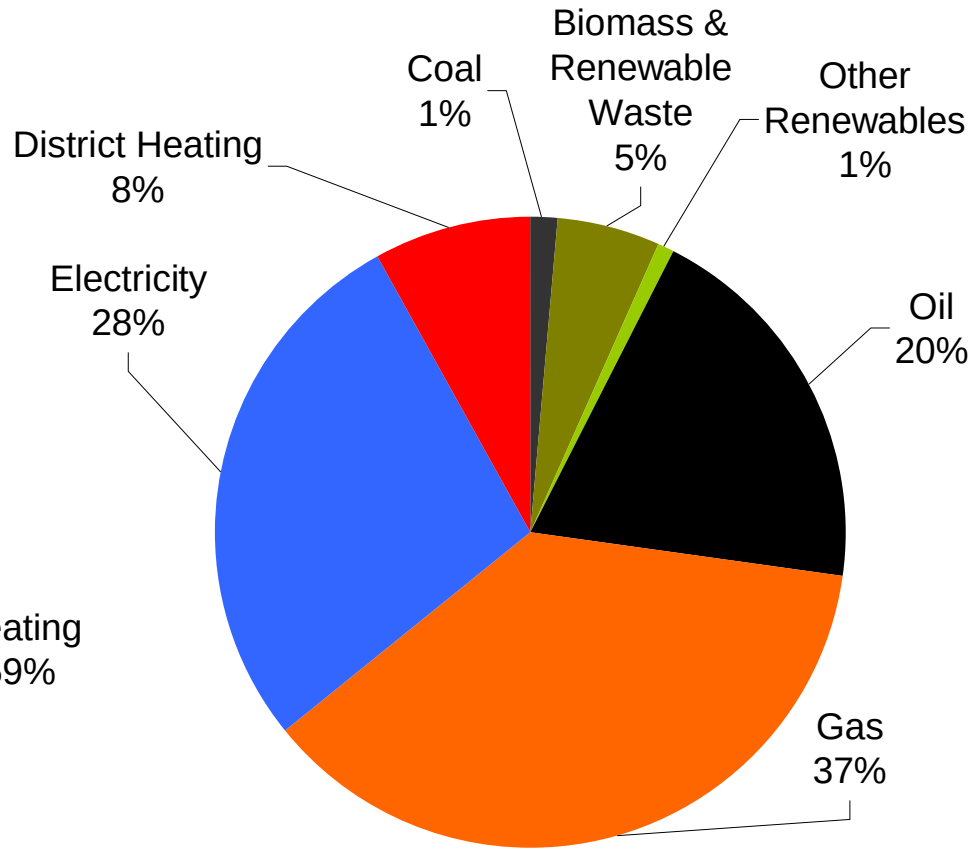
End-Energy Consumption und Supply
Residential & Trade, Commerce and Services





Source: Bundesverband der Energie und Wasserwirtschaft – Endenergieverbrauch in Deutschland 2007

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Wolfhagen 100% Renewable

Wolfhagen 100% Renewable

Distinctive Characteristics:

- >1400 half timbered houses in the municipality.
- In 2008 city council decided to swithc to a 100% renewable electricity supply for the municipality by 2015.
- The Electricity grid is managed by the Stadtwerke Wolfhagen, the city-owned municipal utility company.
- The municipal utitlity currently plans a wind park with a name plate capacity of 10.2 MW
- Locally installed PV generates about 20% of the local electricity consumption.

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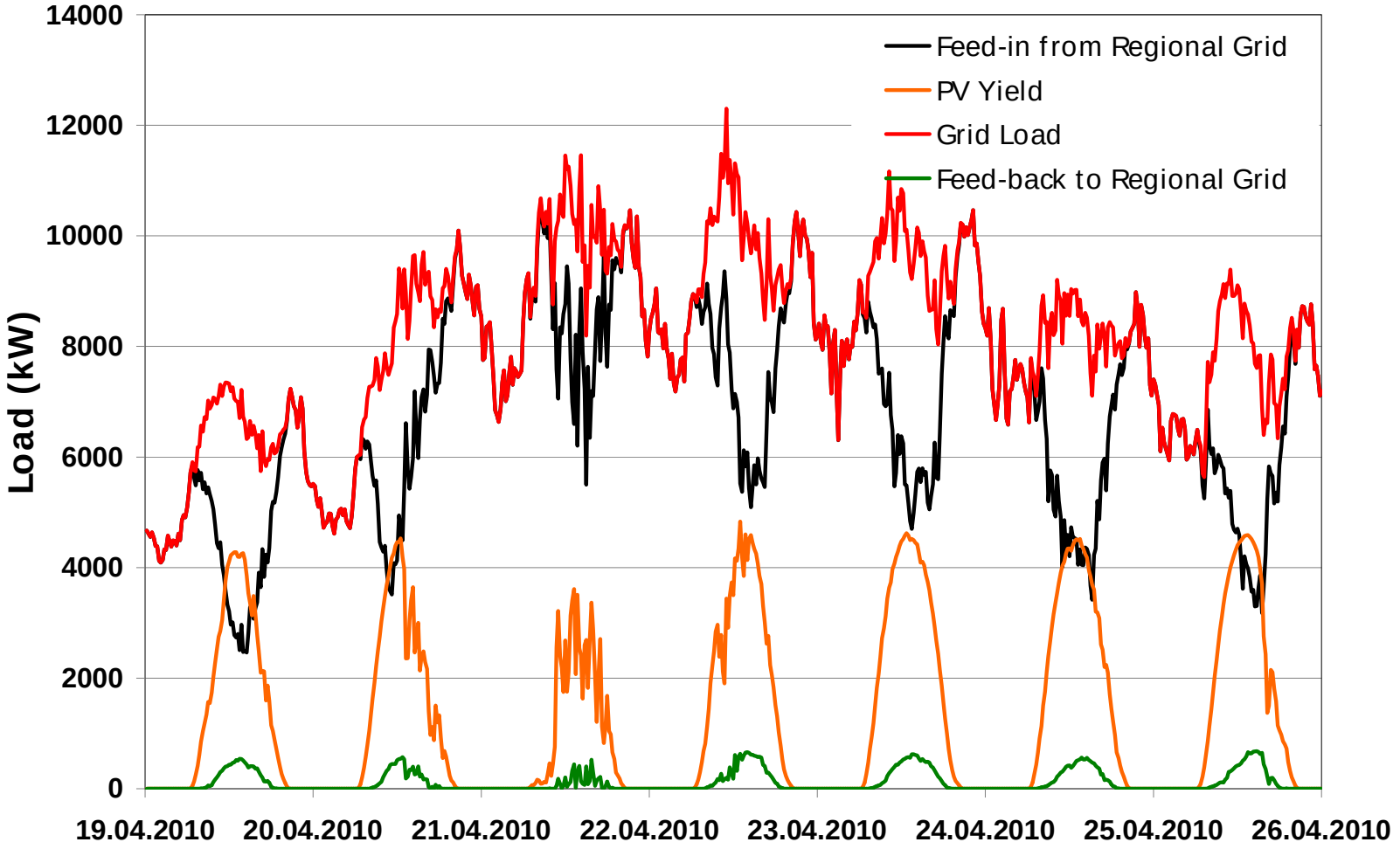
Current Local Electricity Generation and Consumption



Source: Stadtwerke Wolfhagen

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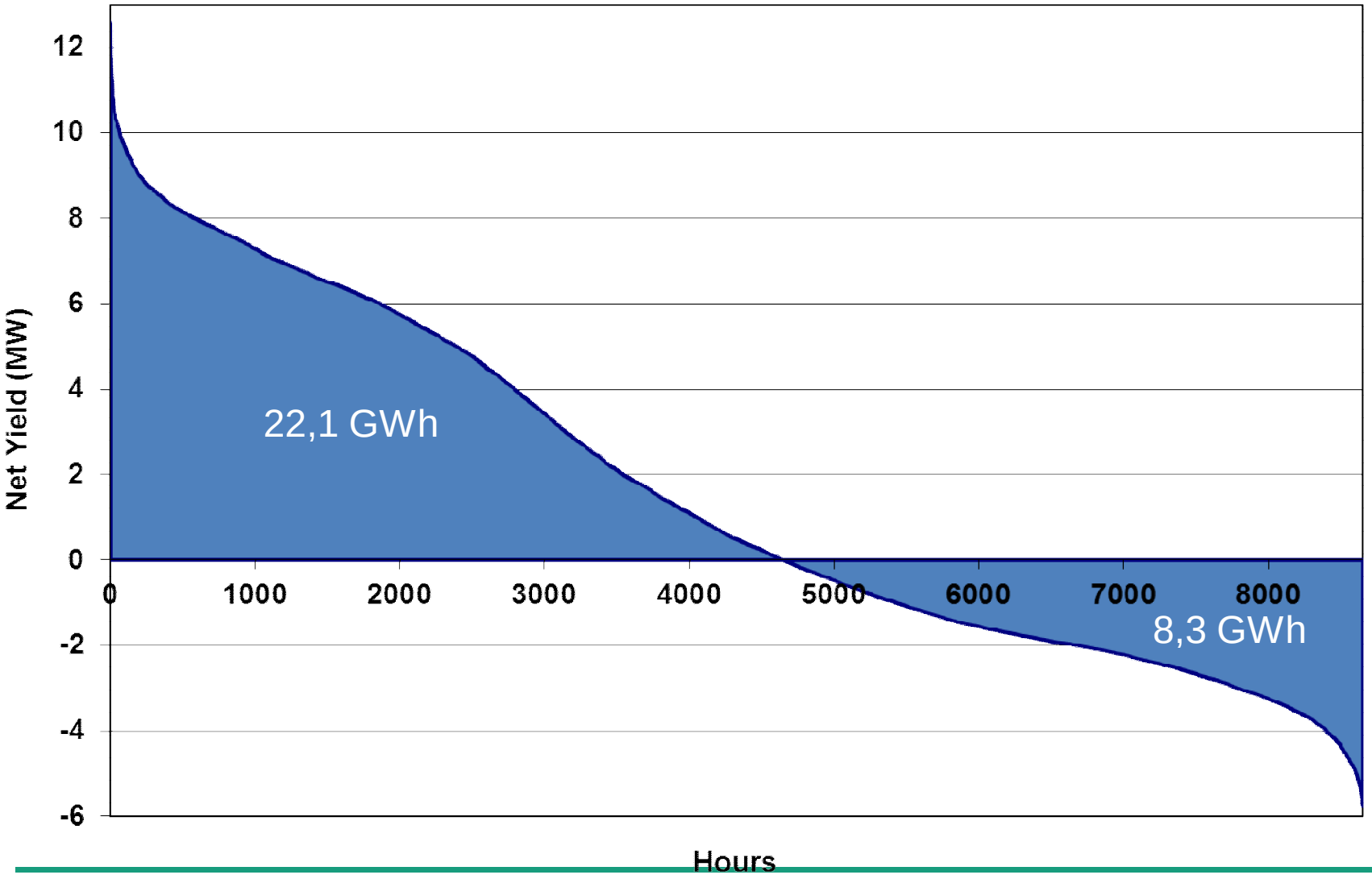
Future Daily Net Electricity Generation



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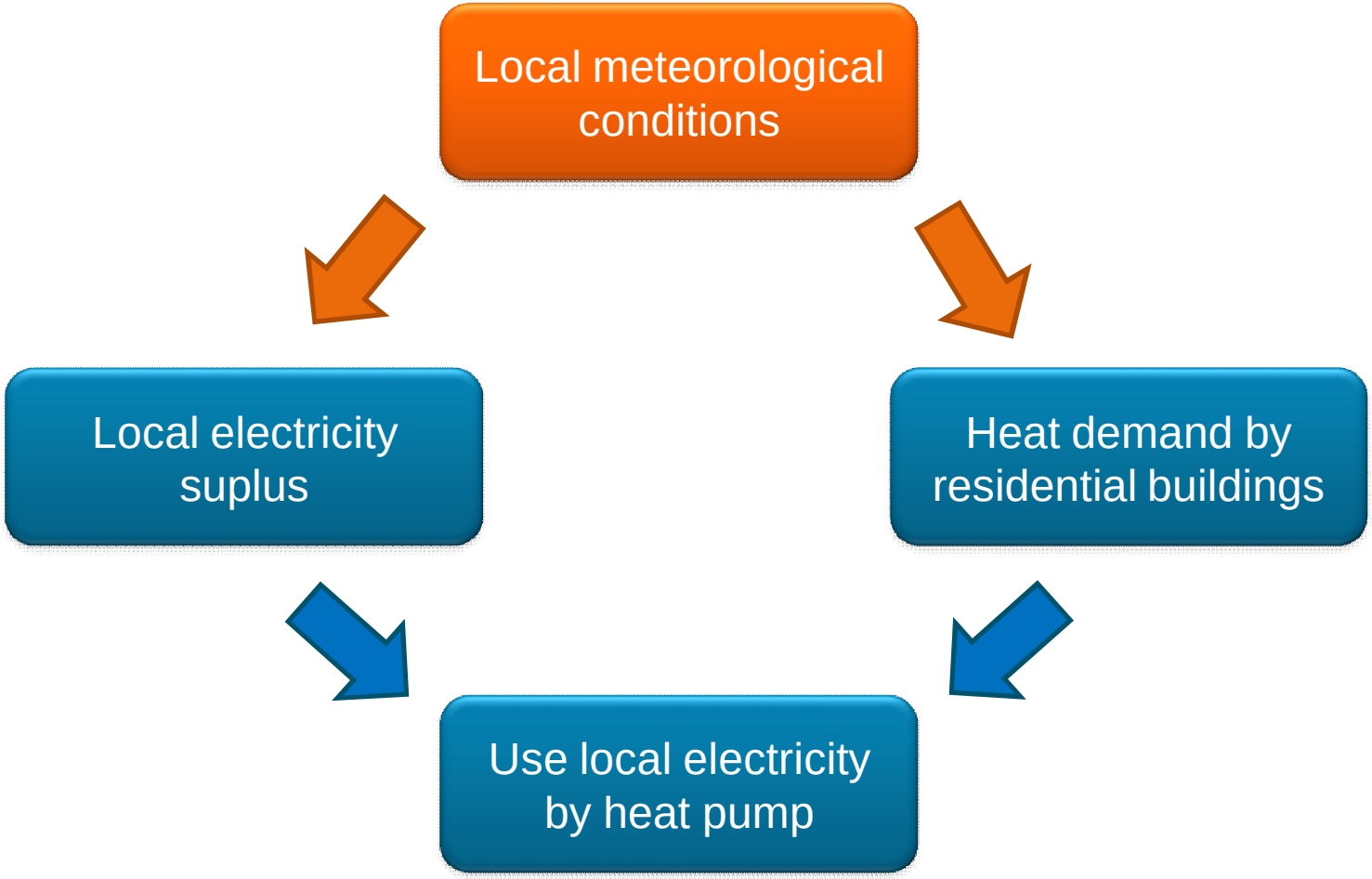
Objective: Supply Heat from Locally Generated Electricity



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Simulation of Heat Demand for a Single Family Home in TRNSYS

EnEV 2009 Building (current German Building Code)

Floor area: 182 m^2

U-Values ($W/(m^2 K)$)

Walls:	0,199
Roof:	0,195
Windows:	1,4

A/V = 0,56

Annual Heat Demand: 70 $kWh/(m^2 yr)$

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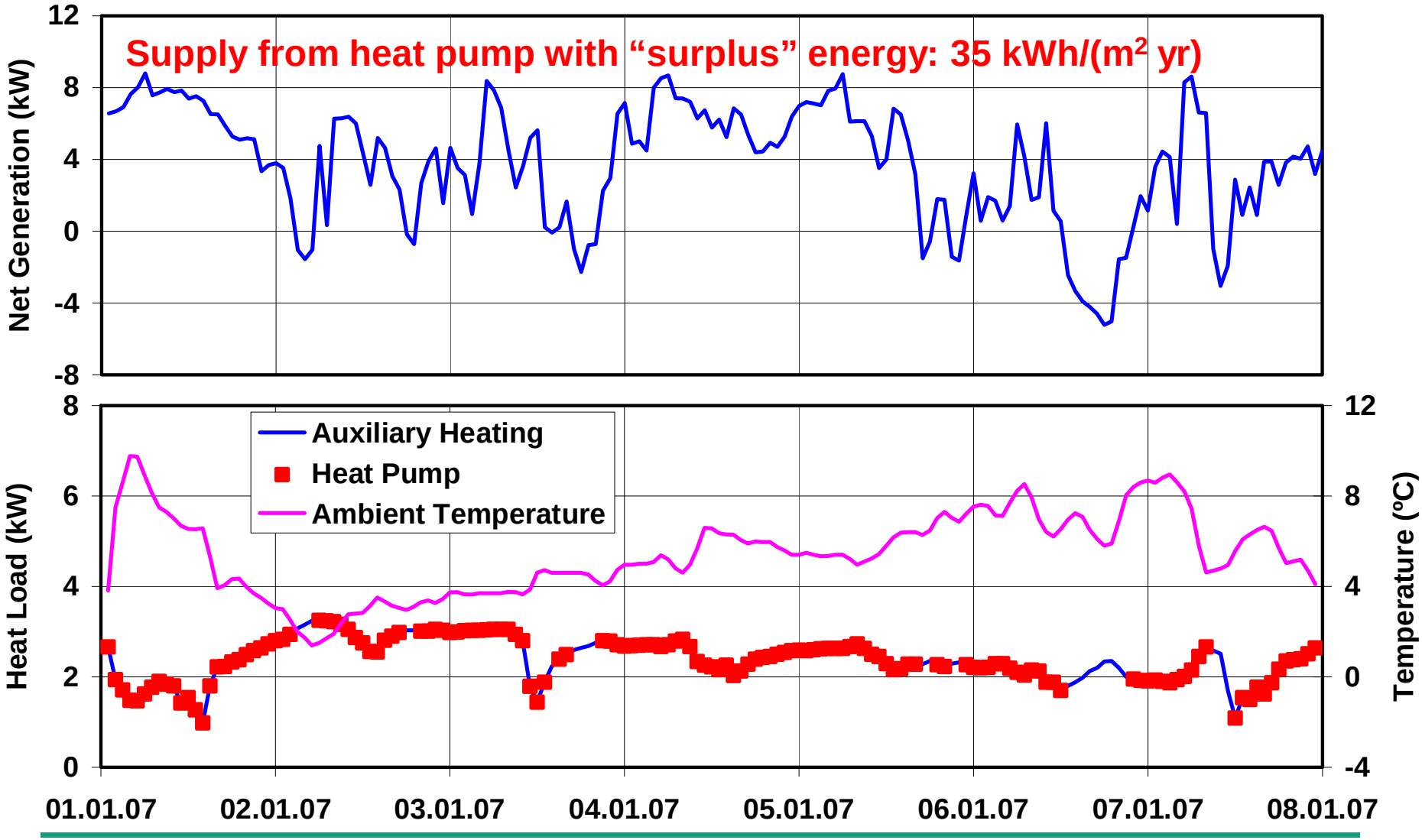
Heating the Model Building (Annual Consumption 70 kWh/(m² yr))



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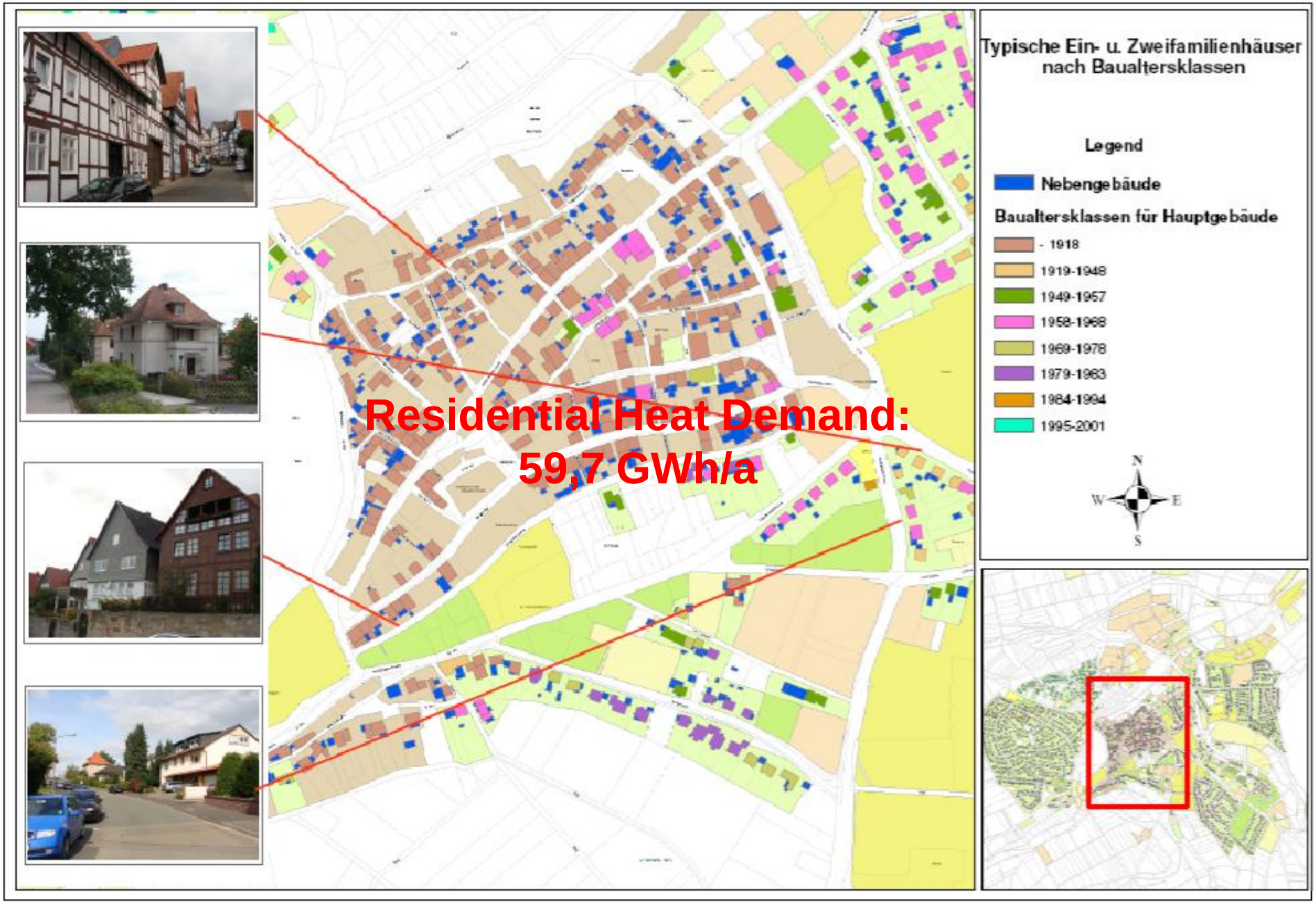

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Scaling up

A **Single Home** can use about 50% renewable electricity

Net Generation during the cold period (October-March): 7 GWh

Heat pumps with a COP of 3 could generate 21 GWh of residential heat.

That corresponds to 35% of the current residential heat consumption of Wolfhagen.

Coupling electricity generation and residential heat supply has the potential to play an important role in future energy systems.

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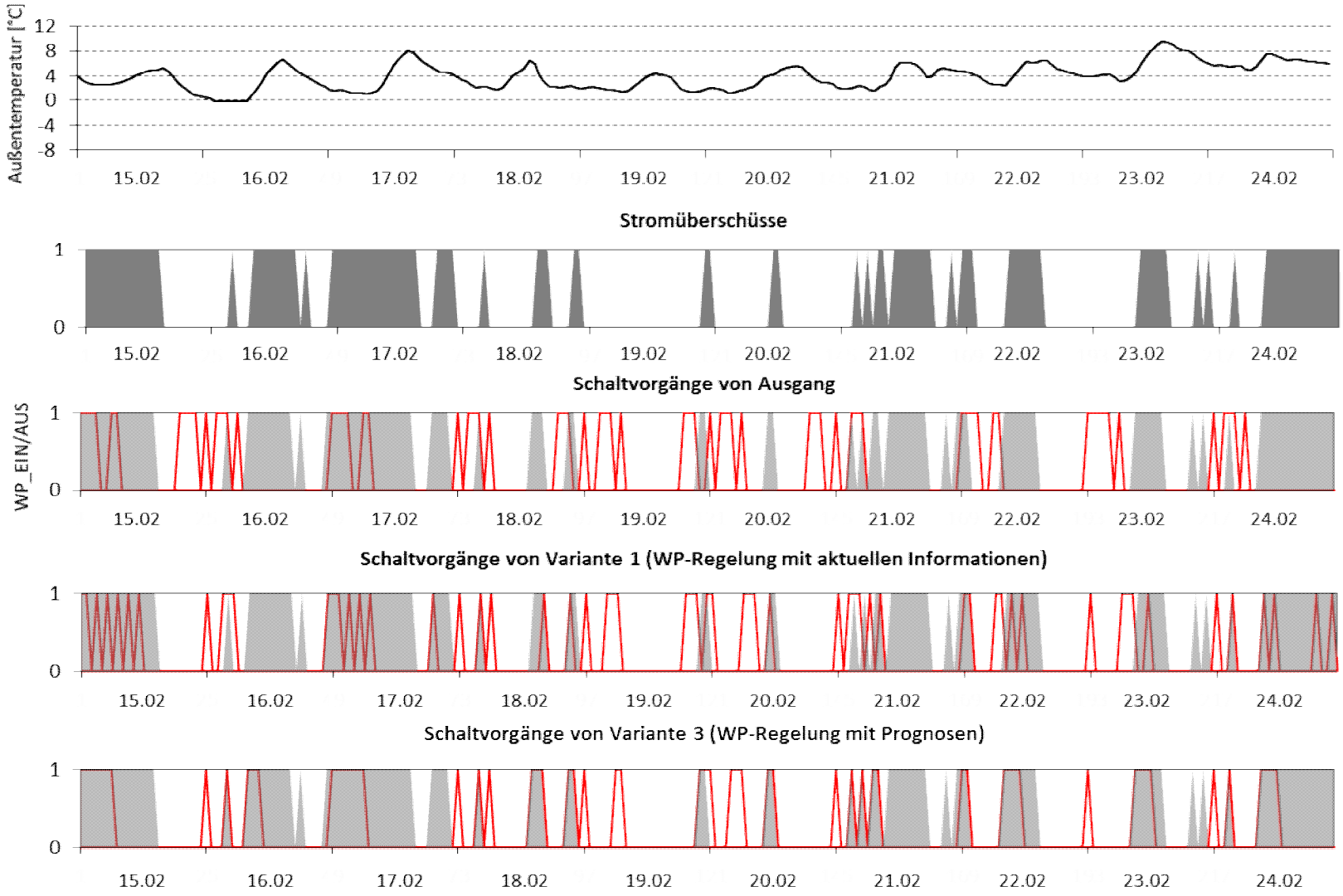
Current Work: Shifting Heat Supply



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Thank you for your attention

Questions?

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