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SYSTEMATIC INVESTIGATION OF THE BUILDING ENVELOPE'S AND HOT WATER PRODUCTION SYSTEMS' INFLUENCE ON THE HEAT LOAD PROFILE OF DISTRICTS

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Planning of New Residential Developments

How can I quickly assess:

Annual heat load profile?

Total heat demand?

Linear heat density?

 \rightarrow Answers within 10 minutes!!



Influencing Factors on the Heat Load of Developments





Result: Heat Density of Various Districts over Plot Ratio



Location: Potsdam Germany (nearby Berlin); each marker = one district



Result: Linear Heat Density of Various Districts



Location: Potsdam Germany (nearby Berlin); each marker = one district



Categorization of Districts with Plot Ratio acc. to (Persson & Werner, 2011)

The plot ratio represents the ratio of the sum of heated building area to the land area of the district:



Compilation of buildings – Generation of Districts





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Simplified Building Typology – 13 Building Types





Four categories

	13 buildings in the range of	
Number of housing units	136	
Living area / living area per resident *1	831860 m²	34 52 m²/Pers
DHW demand *2	7.012.5 <i>kWh/m²_{heated}/a</i>	≈ 22.0 40.0 <i>I/Pers/d</i>
Residents	254	

*1 Data report 2018 of the Federal Statistical Office Germany. The data reflects the building landscape of Germany and is based on the 2011 Census ("Statutory Collection of Statistical Population Data") and the 2014 Microcensus ("Survey of one percent of all households in Germany").

 *² useful energy demand for hot water in residential buildings according to the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) Germany, 2017; referred to the heated area, which 1.2 times the living space

Simplified Building Typology – 13 Building Types





 \rightarrow Pool of heat load profiles per house type and hot water preparation system





Multi Family Houses



Simplified Building Typology – 13 Building Types





Comparison Heat Demand to Final Heat Load



Useful Energy Demand

Final Energy Demand:

hot water preparation with storage + circulation



Comparison Heat Demand to Final Heat Load



Useful Energy Demand

Final Energy Demand:

instantanious hot water preparation + circulation



Change with increasing Energy Efficiency



EnEV Standard Transmission Losses: 0.27 .. 0.40 W/(m²K)



Location: Potsdam Germany, nearby Berlin

Change with increasing Energy Efficiency



KfW 55 – higher insulation thickness, better windows Transmission Losses: 0.21 .. 0.31 W/(m²K)



- 12 % compared to EnEV Standard

Location: Potsdam Germany, nearby Berlin

Change with increasing Energy Efficiency



KfW 40 – even better insulation & air ventilation system with heat recovery Transmission Losses: 0.17 .. 0.27 W/(m²K)



- 56 % compared to EnEV Standard

Location: Potsdam Germany, nearby Berlin

Heat Density of Various Districts



Location: Potsdam Germany (nearby Berlin); each marker = one district



Linear Heat Density of Various Districts





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Thank you for your kind attention!

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Summary

- · Method to quickly asses final heat demand and linear heat density
- You only need the location, plot ratio, and energy efficiency standard of building
- Plot ratio suitable to describe new residential developments
- Analysis valid for location Potsdam in Germany
- Outlook:
 - considering various locations & development of adjustment factors



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