

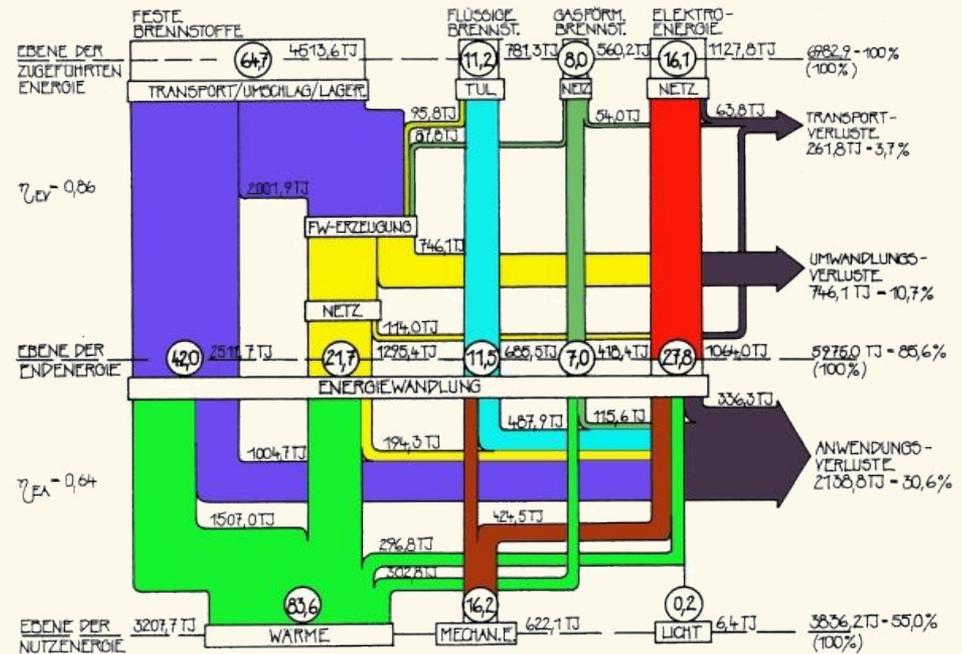
# Interactive Sankey Diagrams

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Faculty of Media  
Bauhaus University Weimar  
Germany

# Sankey Diagrams

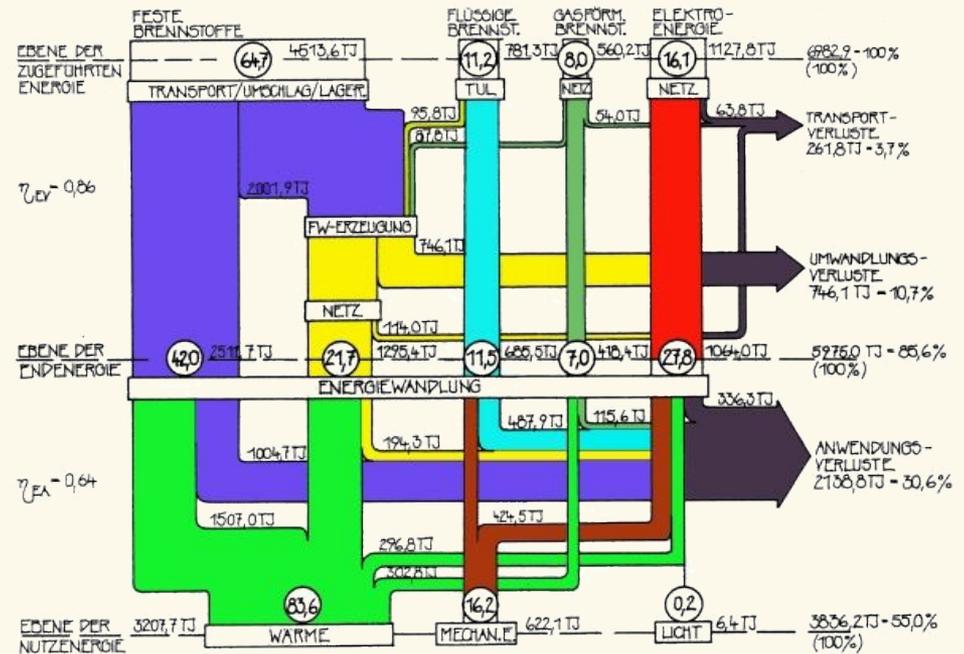
- Static visualizations of dynamic processes
  - Transport flows
  - Trade relations
  - Traffic
  - Processes of production and conversion
  - Energy distribution



Quelle: Göldner, S.: "Stadtökologische Grundbelastung durch Energieanwendungsprozesse".-Diplomarbeit 1991  
Hochsch. f. Archit. u. Bauwes. Weimar

# Sankey Diagrams

- Representation of a graph
  - Weighted
  - Directed
  - Width encodes weight
  - Mostly acyclic
- Quantitative information about flows
  - Amount
  - Relationships
  - Transformation

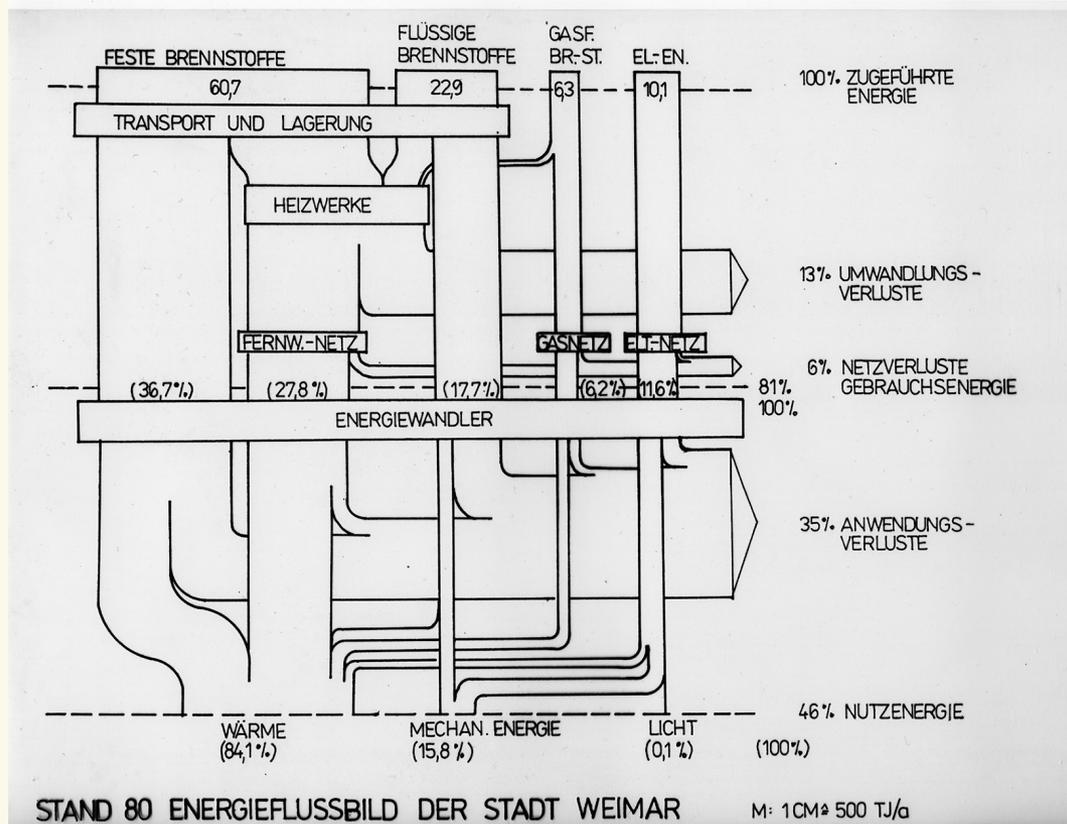


Quelle: Göldner, S.: "Stadtökologische Grundbelastung durch Energieanwendungsprozesse".-Diplomarbeit 1991  
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# History

- Irish engineer M. H. P. R. Sankey (\*1853, +1921)
- Sankey diagrams used since the 19th century



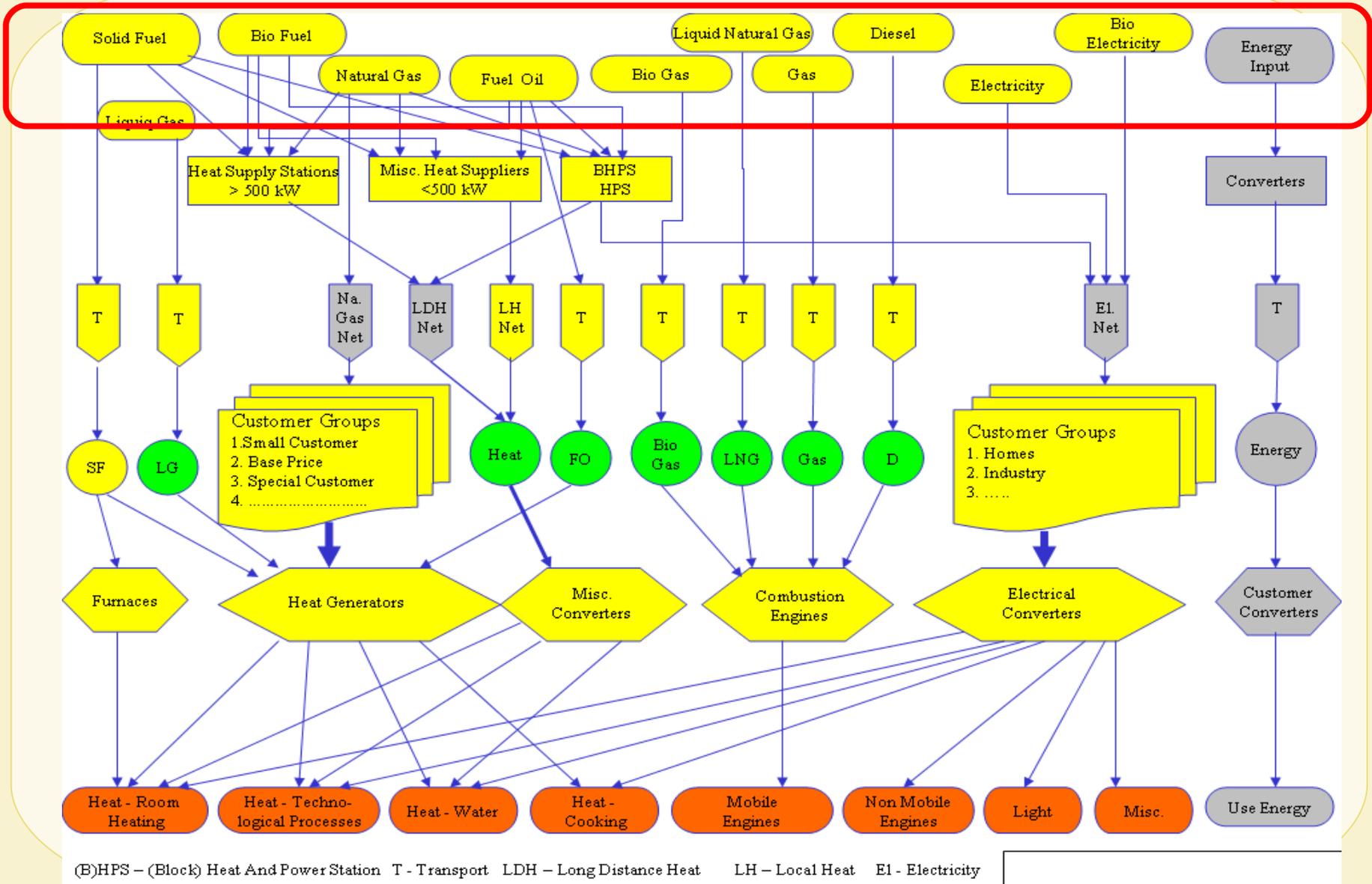
© Bauhaus University Weimar 1980

# Energy Flow Structures In A City

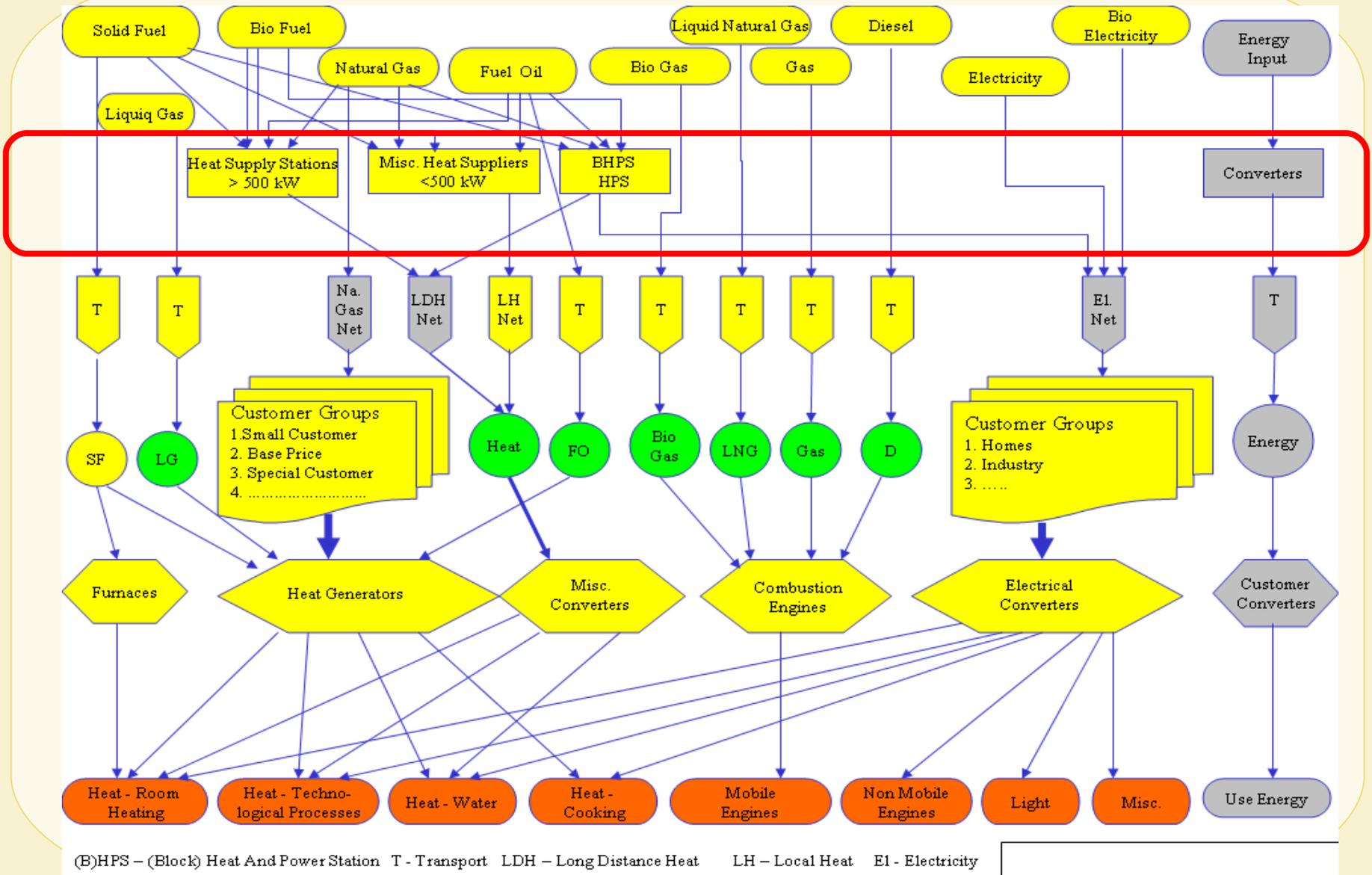
- Every city needs energy
  - Electricity
  - Fuel
  - Natural gas
  - Oil
- Energy distribution requires a complex network of
  - Cables
  - Tubes
  - Tanks
  - Regional heating and power stations.
- Energy used for
  - Heating
  - TV
  - ....



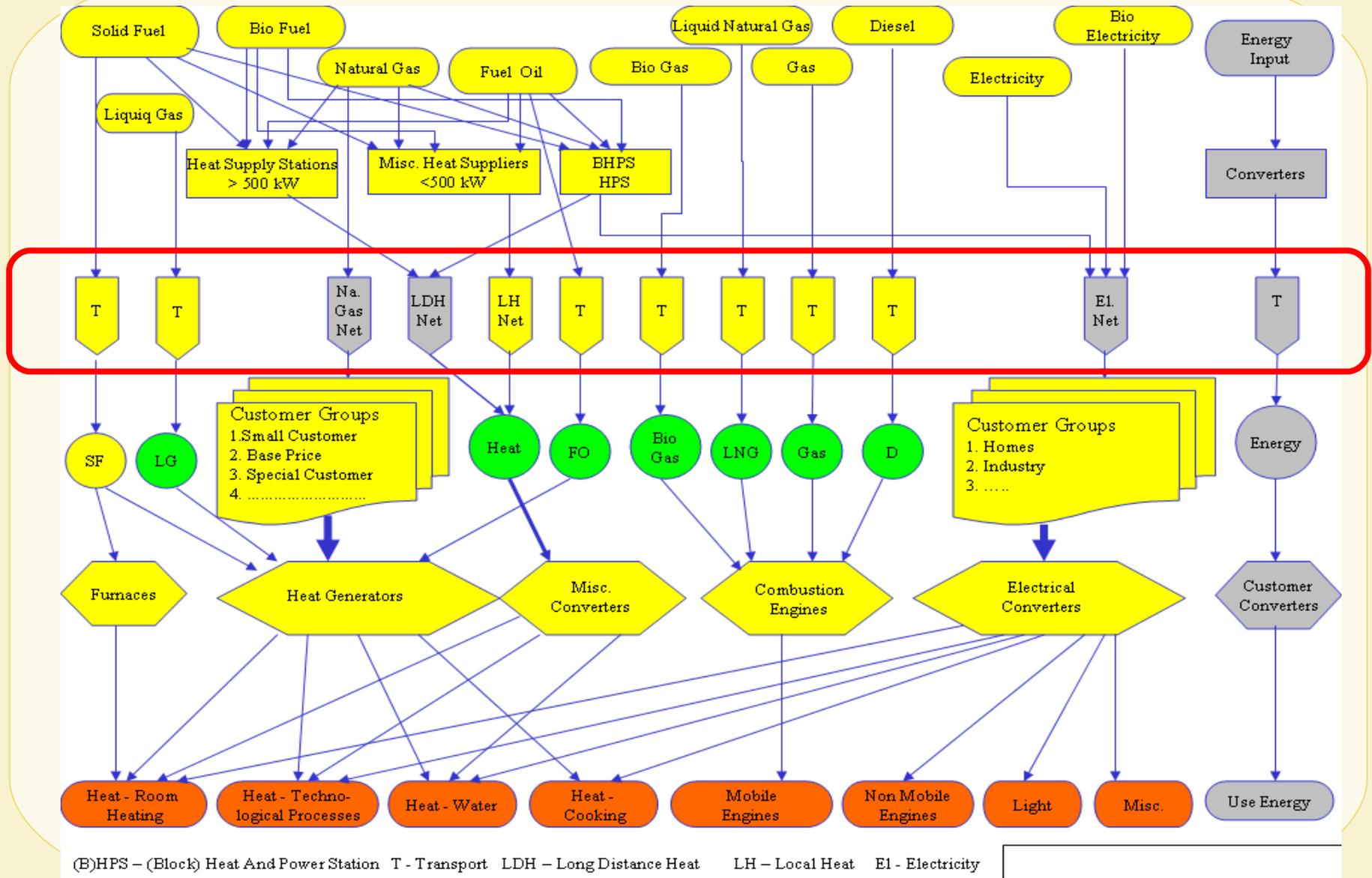
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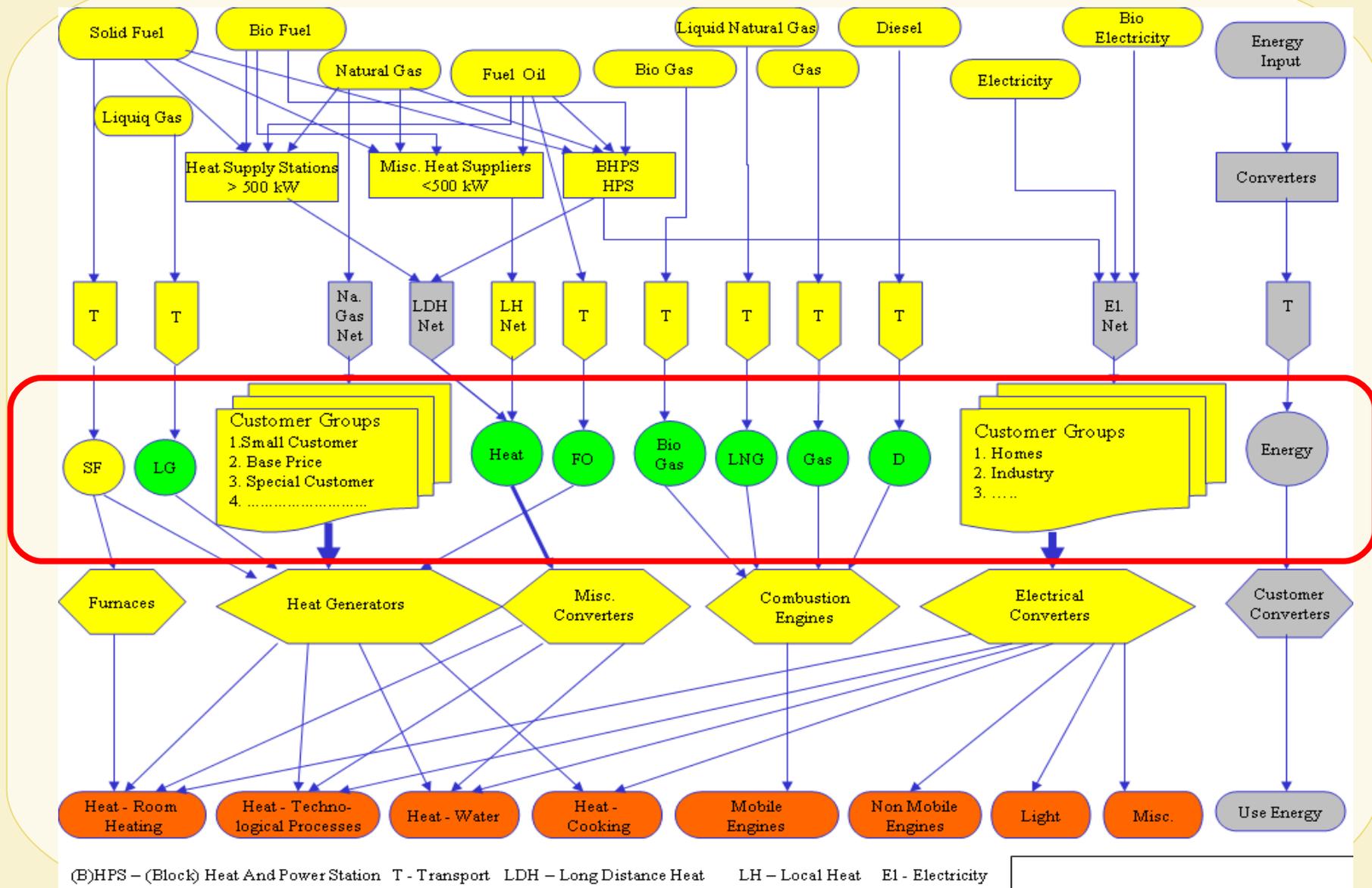
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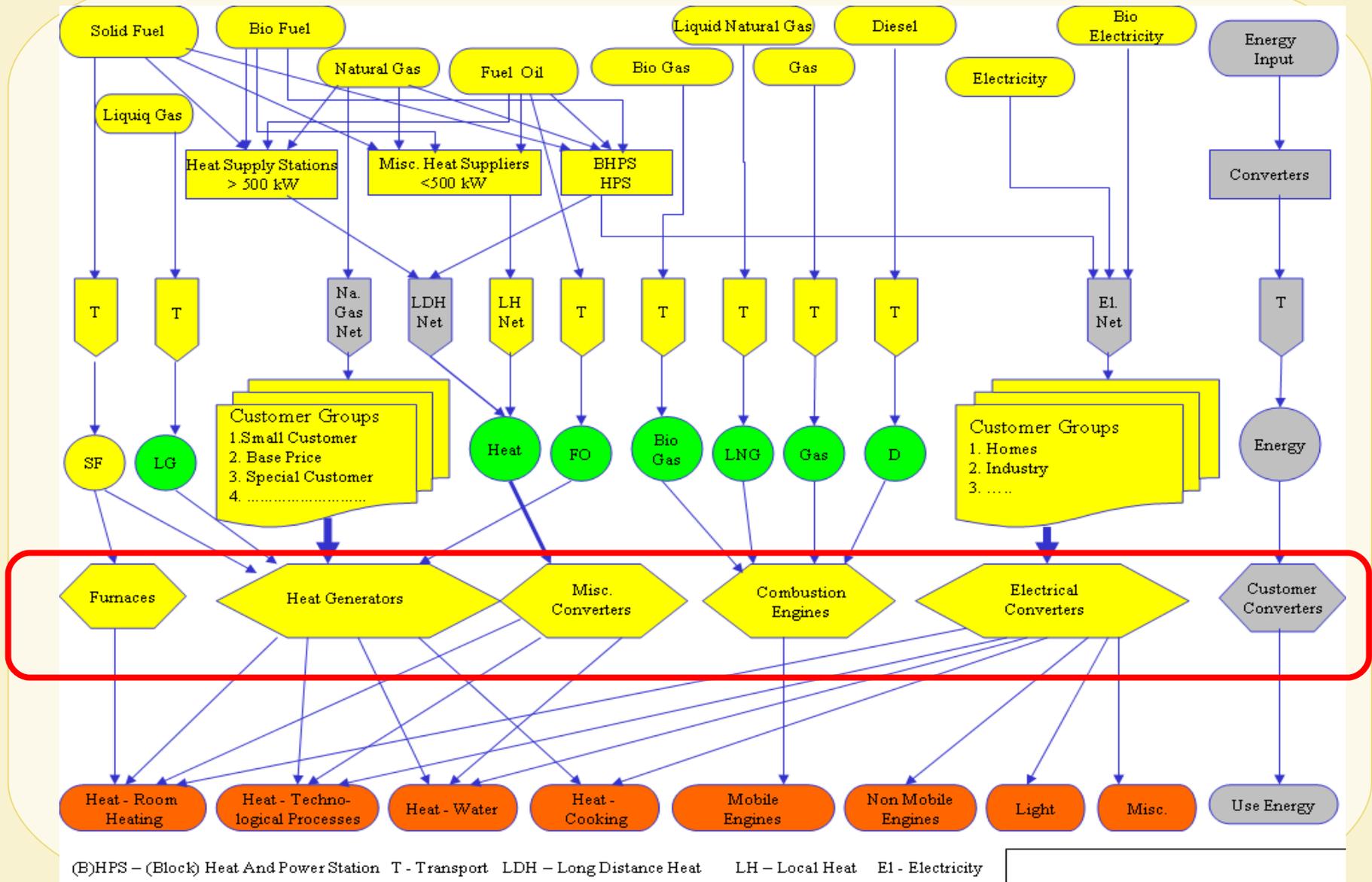
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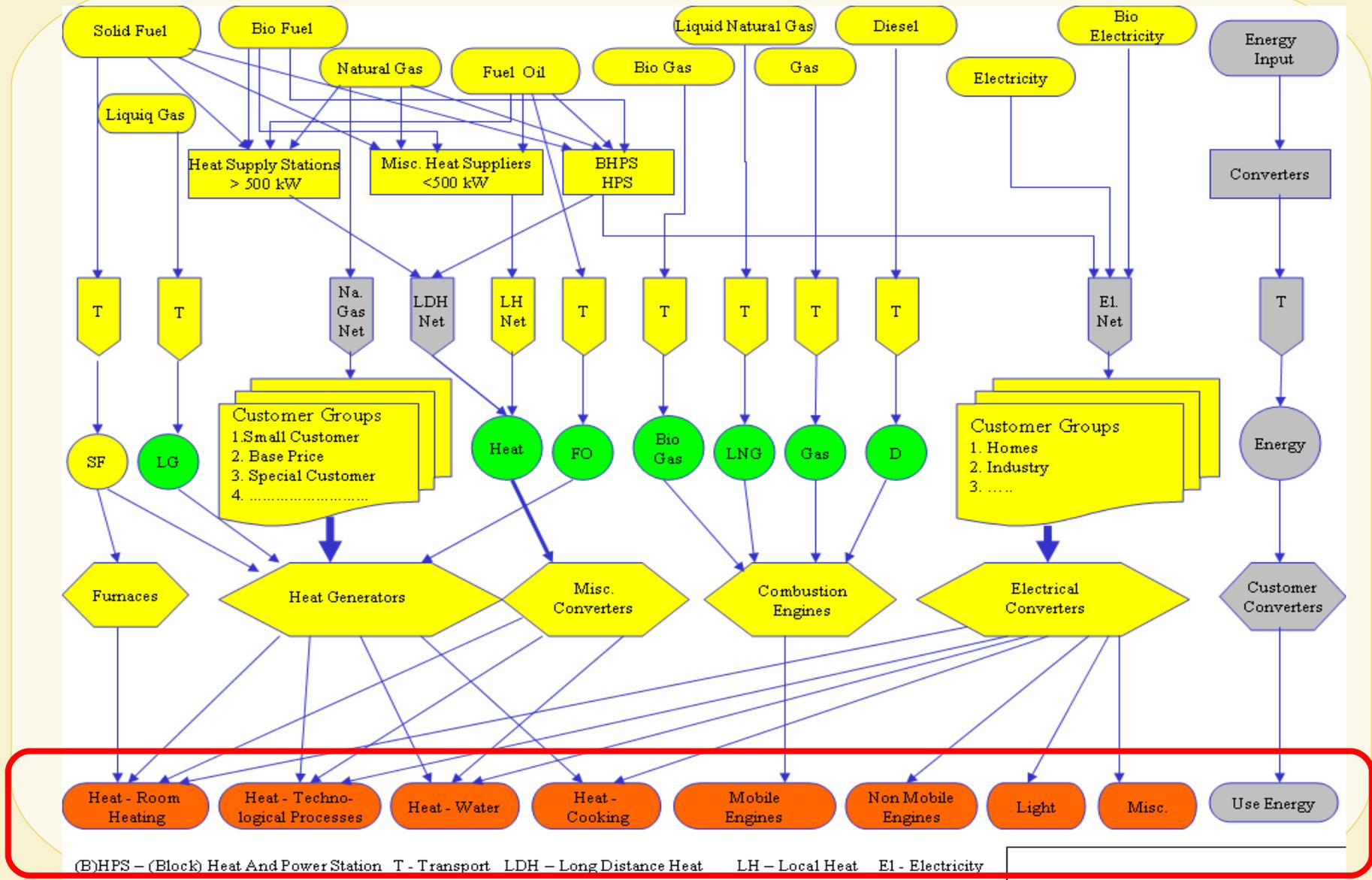
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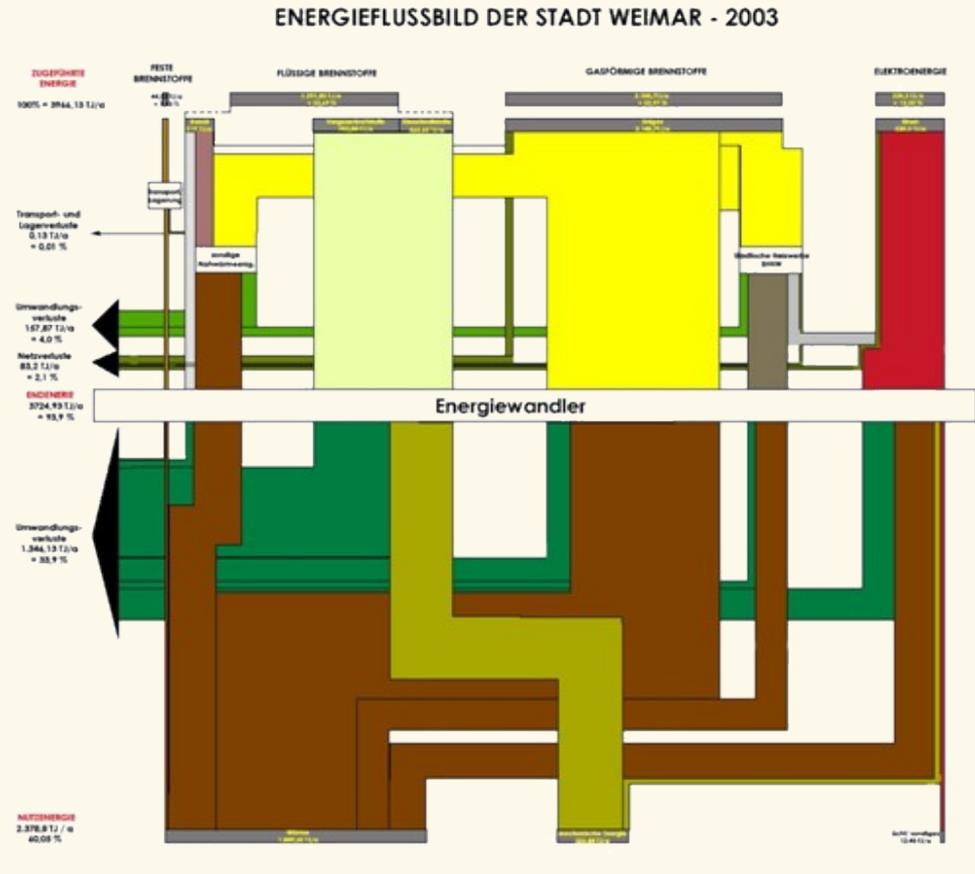
# Energy Flow Structures In A City



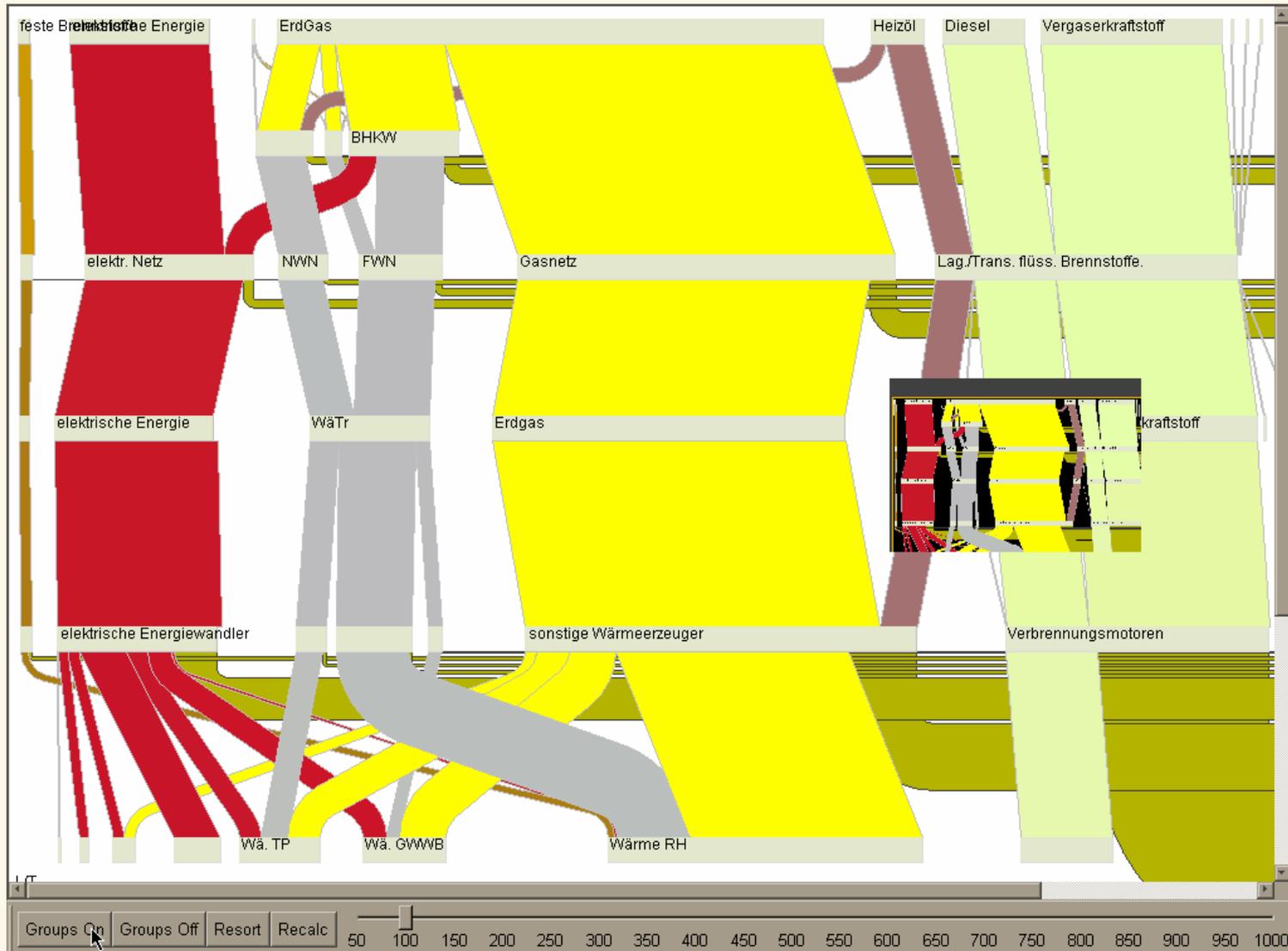
(B)HPS – (Block) Heat And Power Station T - Transport LDH – Long Distance Heat LH – Local Heat E1 - Electricity

# Energy Flow Structures In A City

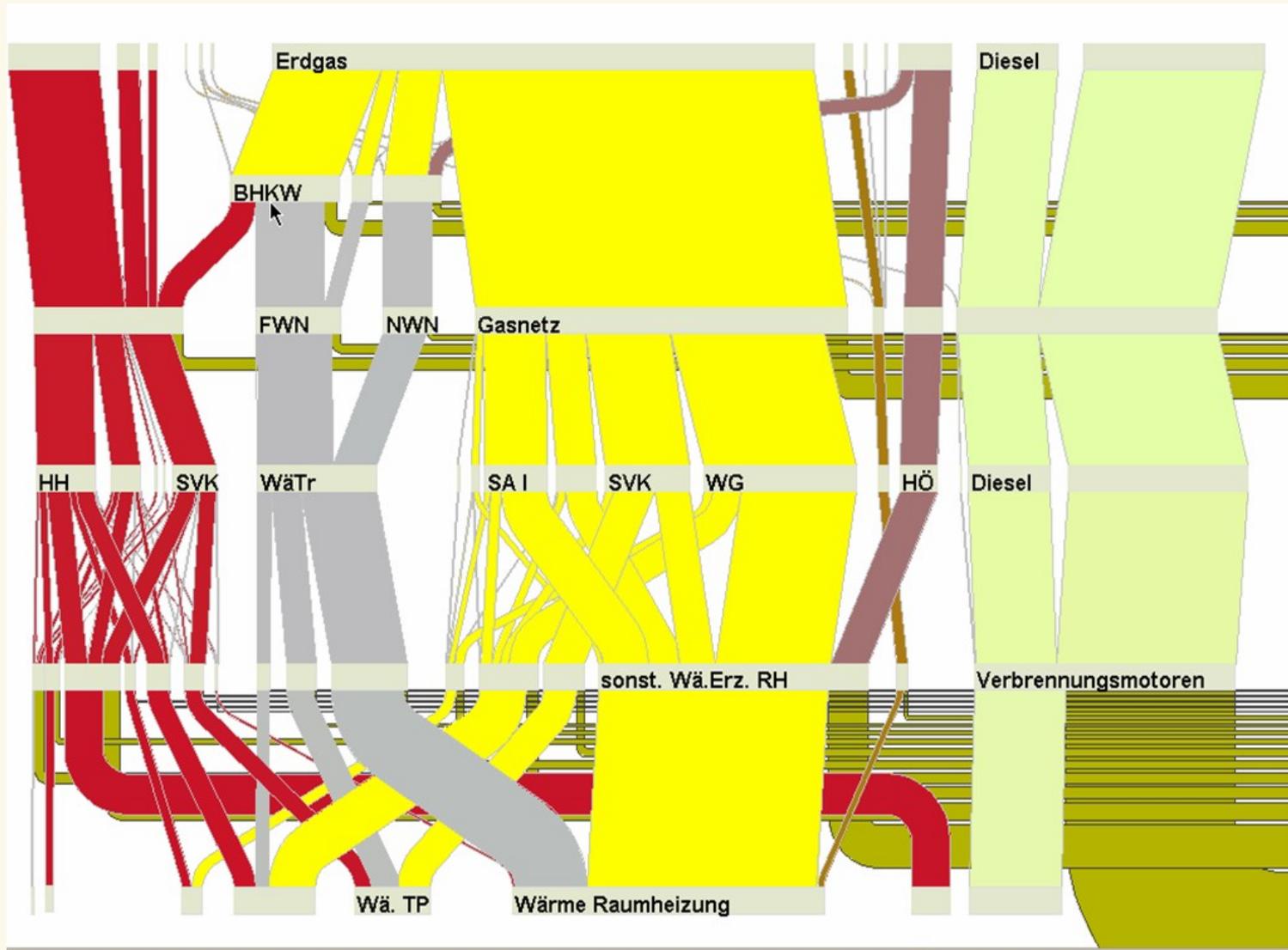
- How is the energy distributed?
- What kind of energy is used for which purpose?
- How large are the amounts of used energy
- Where are the largest losses?
- How did data change over the years?
- How does the distribution network need to change?



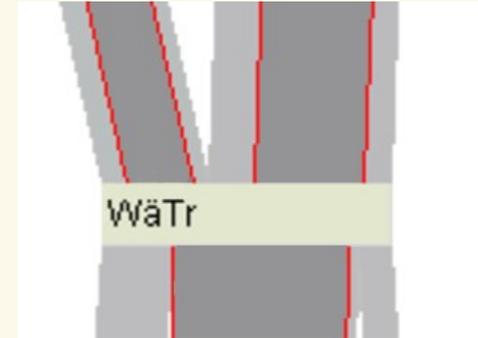
# Level Of Detail



# Flow Tracing

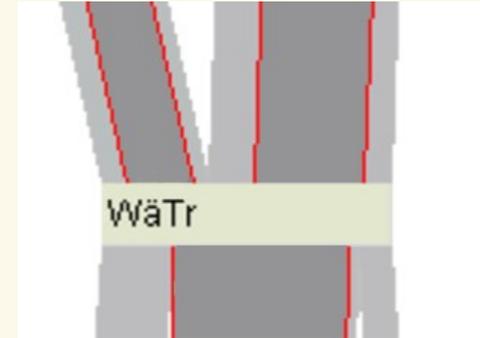


# Flow Tracing Visual Cont

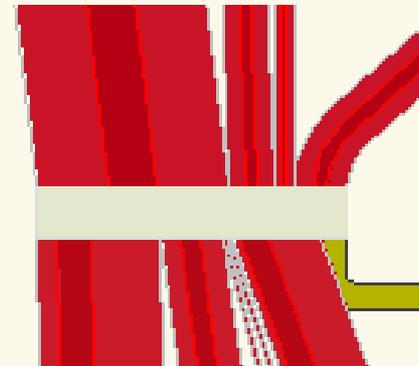


Visual continuity for single incoming flow

# Flow Tracing

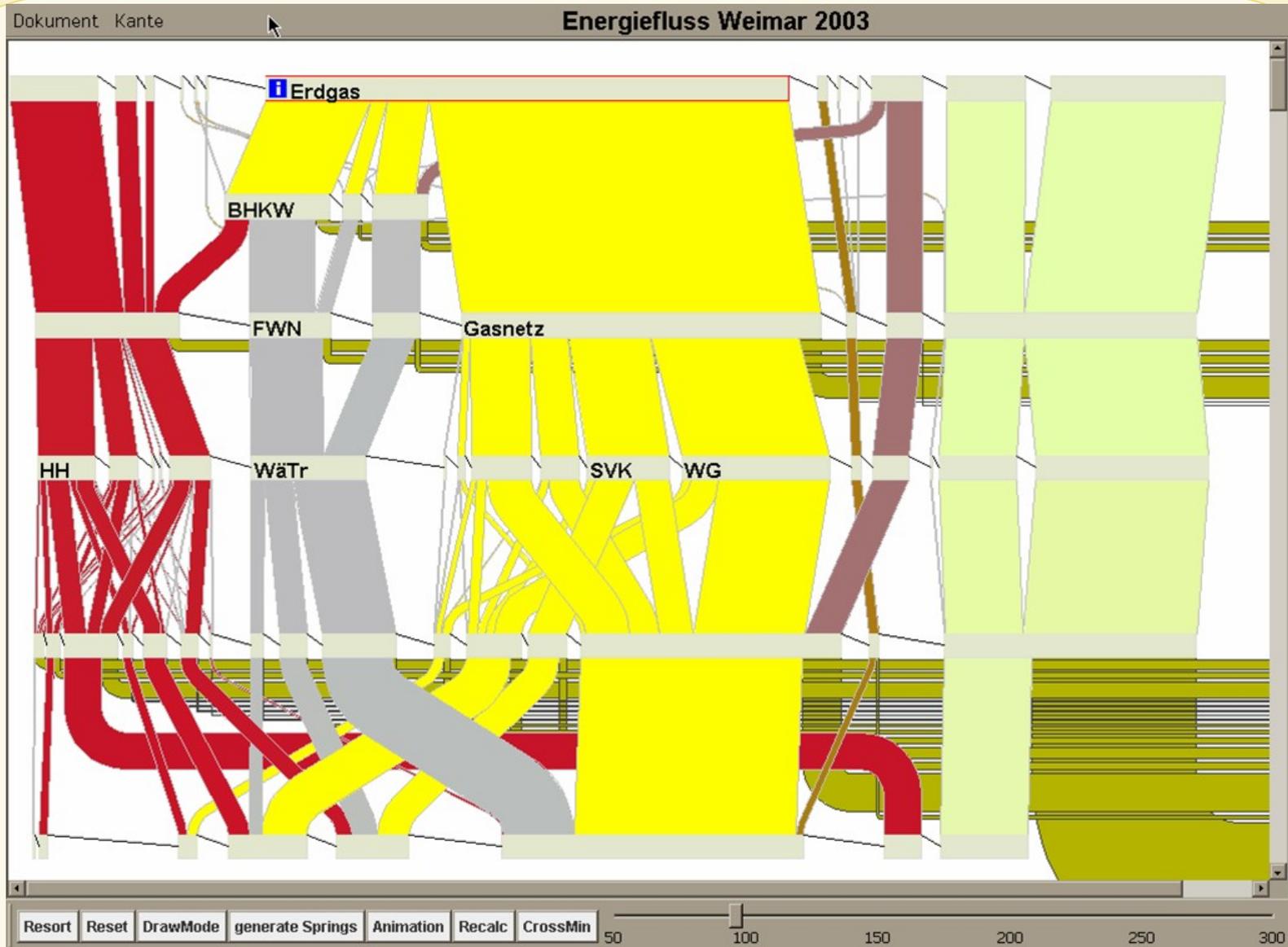


Visual continuity for single incoming flow

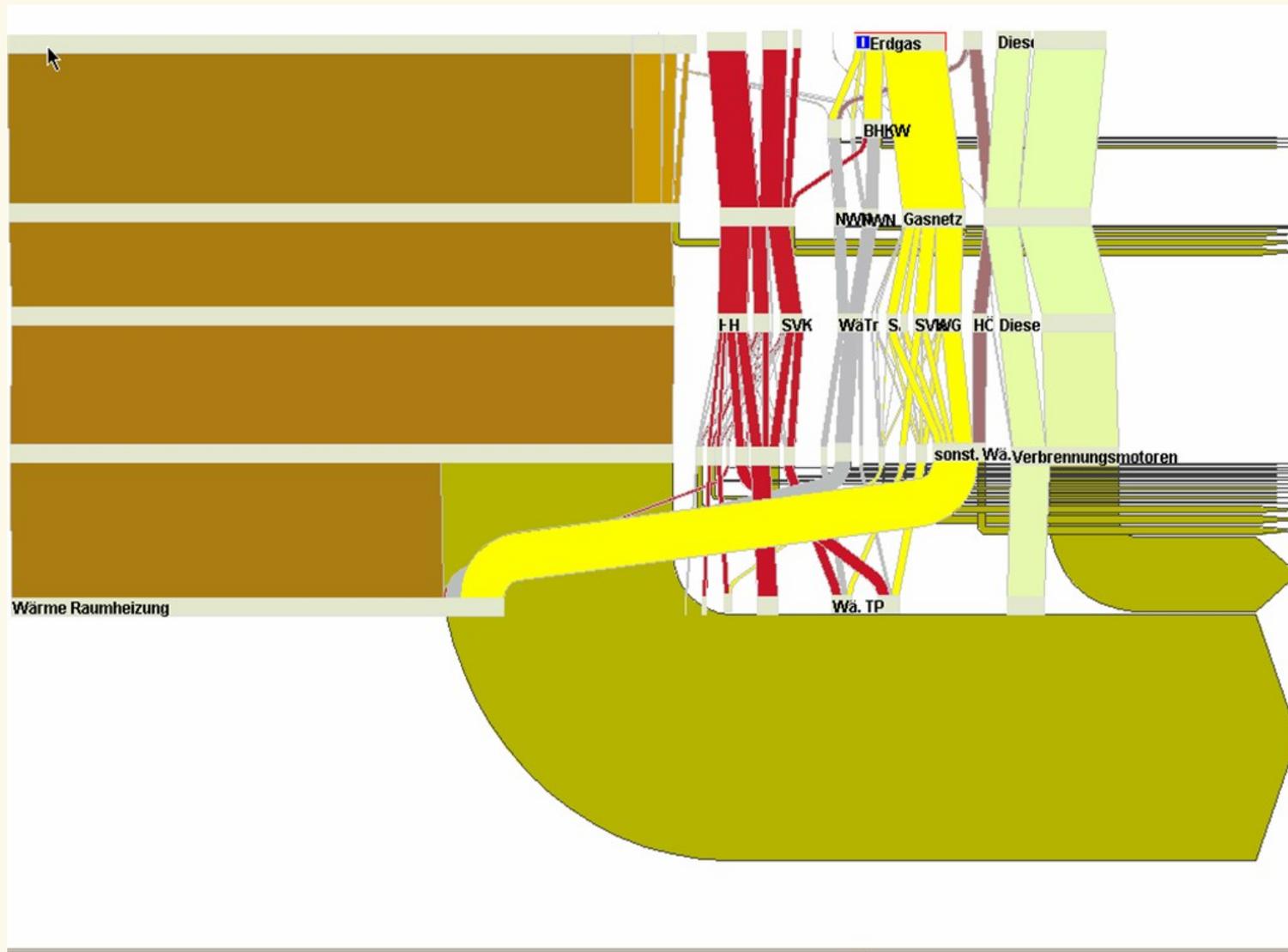


Multiple fractions accumulated in the middle

# Interactive Changes to the Data

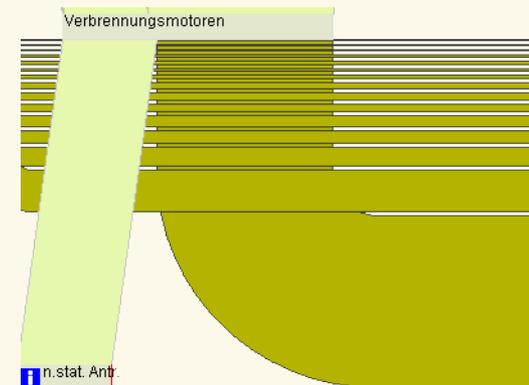
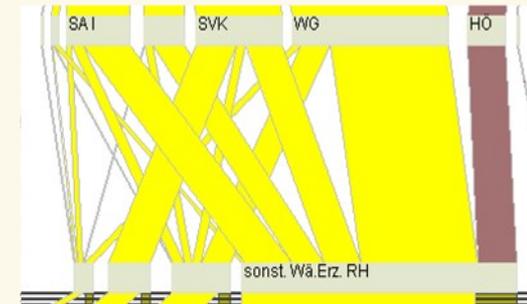
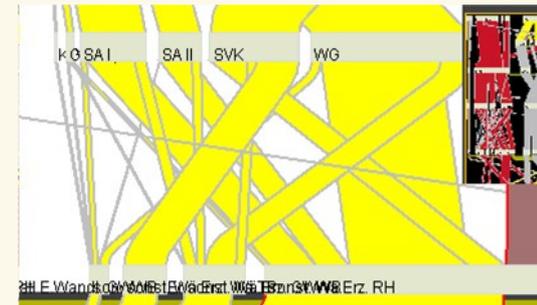


# Time-Varying Sankey Diagrams



# Experience: Edge Drawing Order

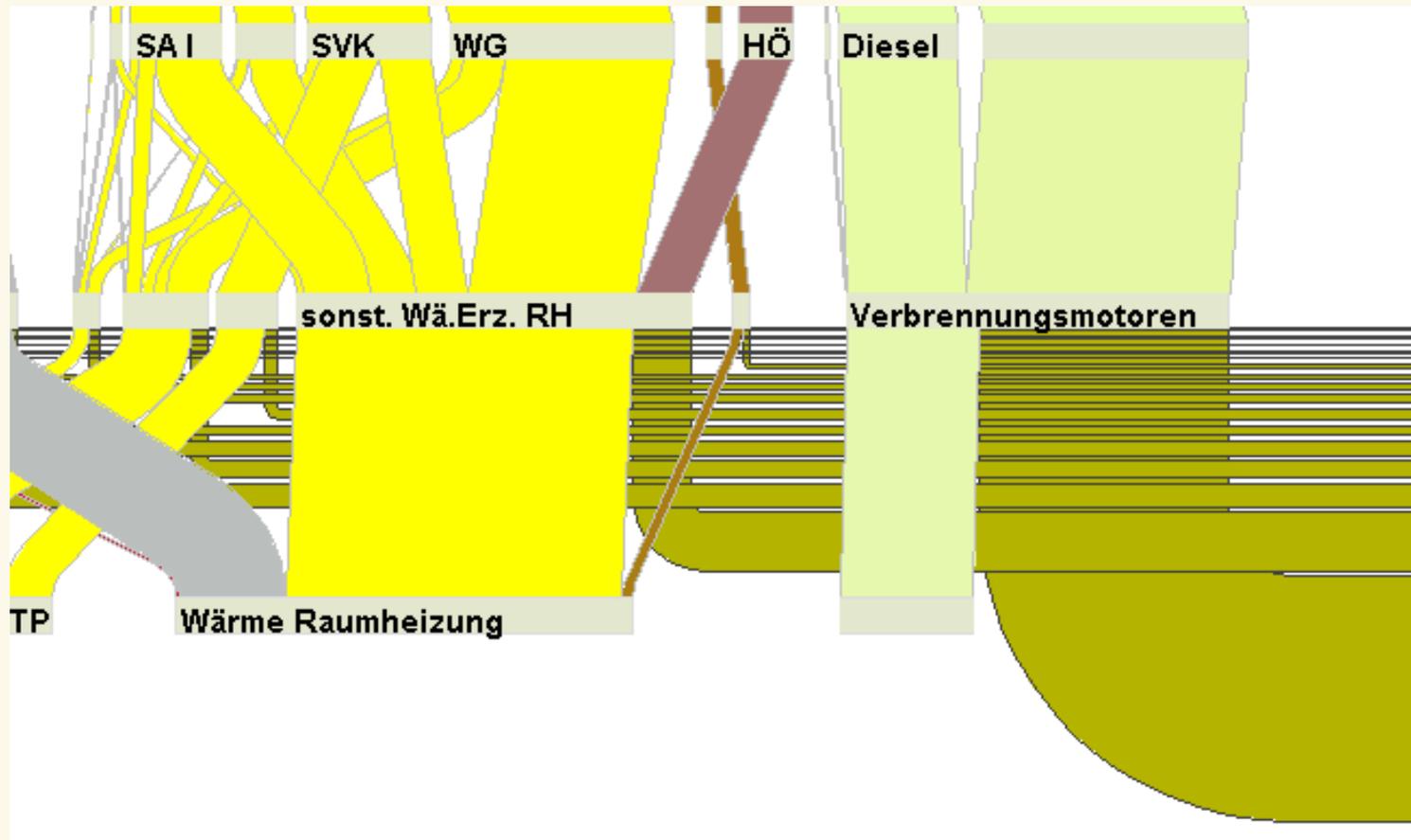
- No edge sorting
- Thick edges are drawn on top of thin edges
- Thin loss edges are drawn on top of thick loss edges



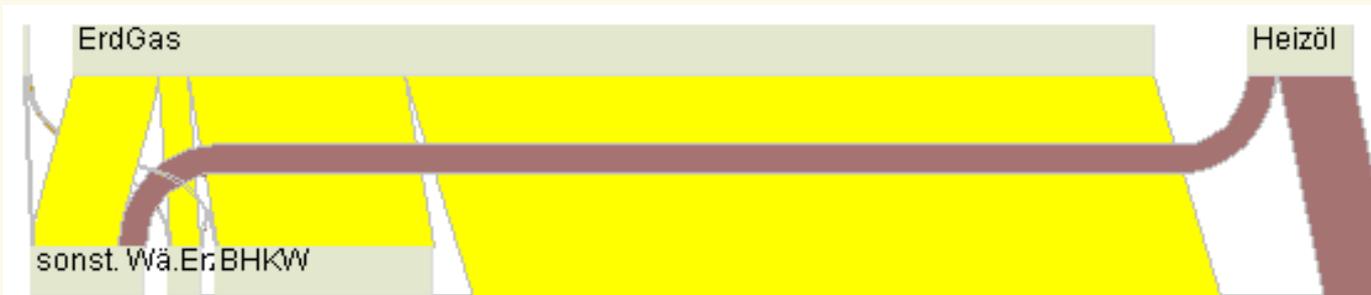
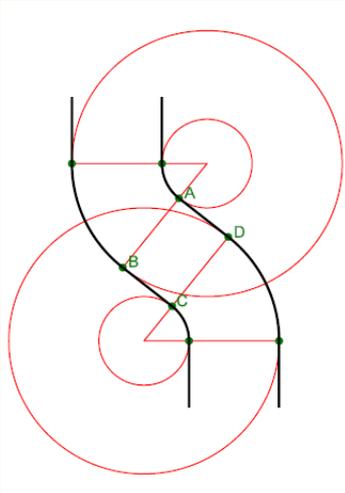
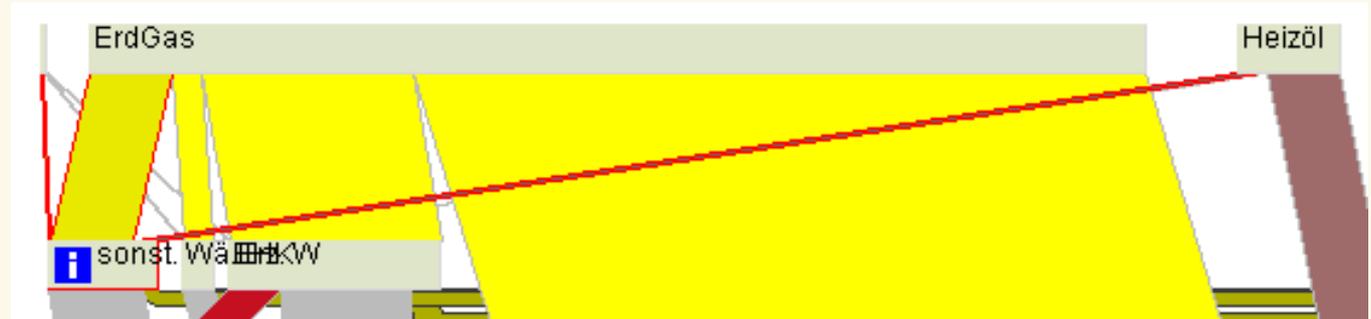
# Experience: Overall Edge Drawing Order

1. Thick loss edges
2. Thin loss edges

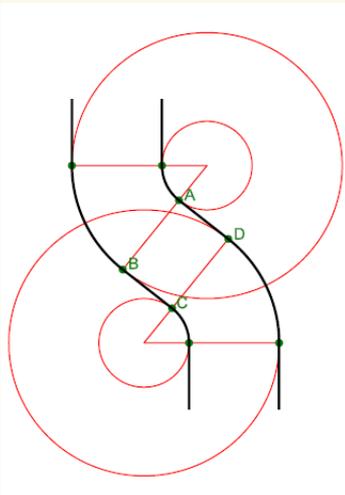
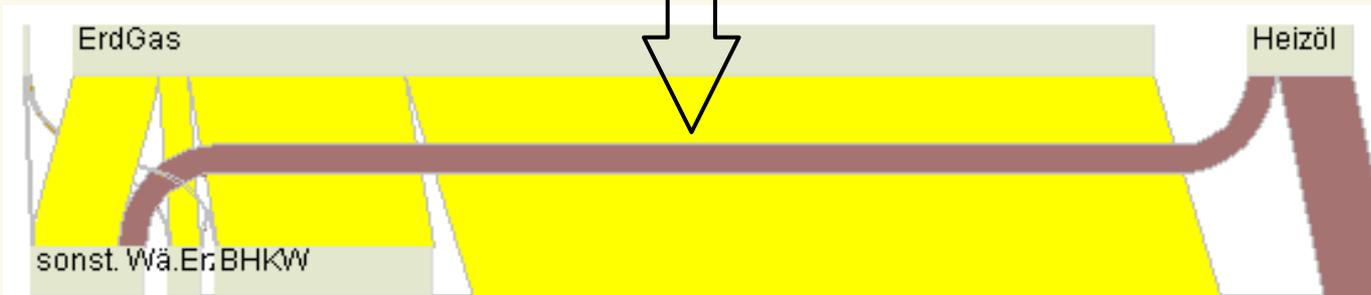
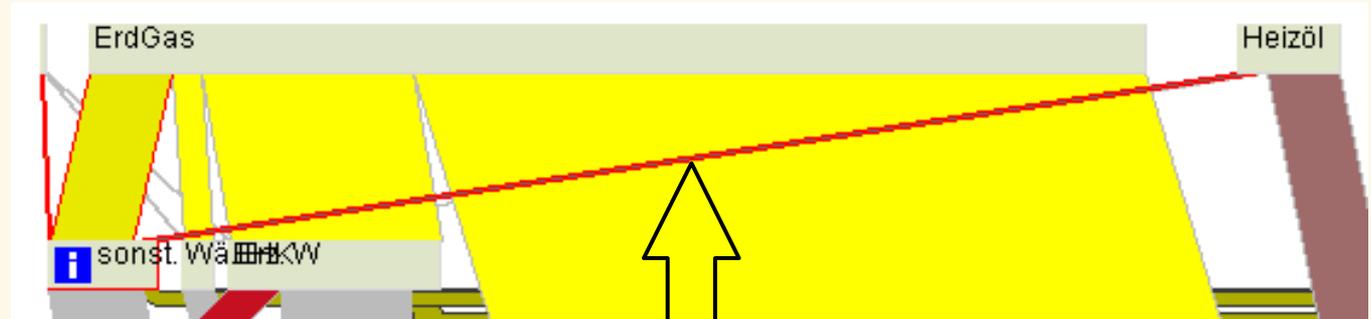
1. Thin edges
2. Thick edges



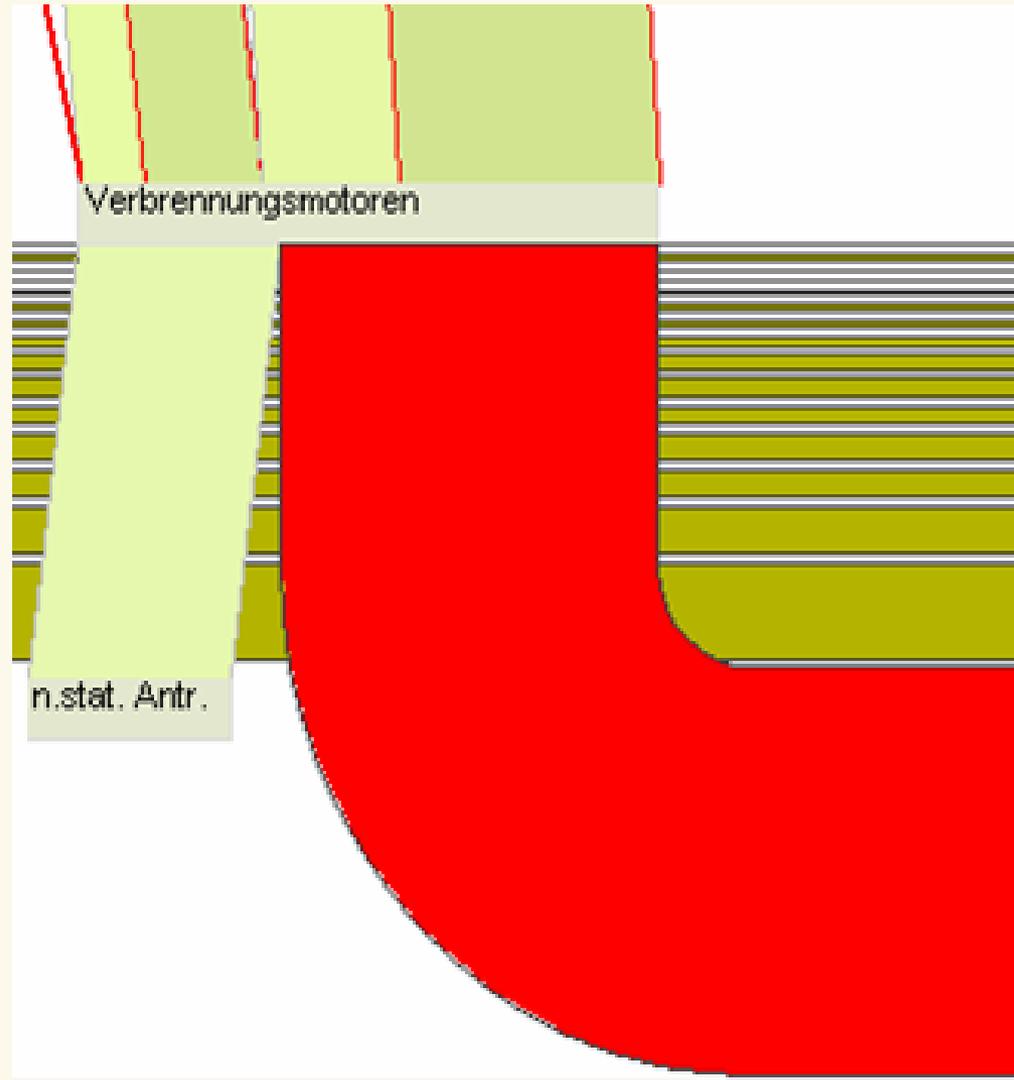
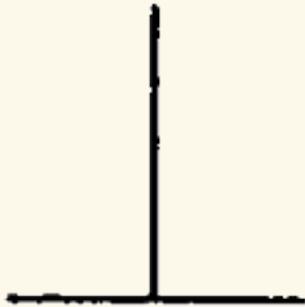
# Experience: Edge Drawing



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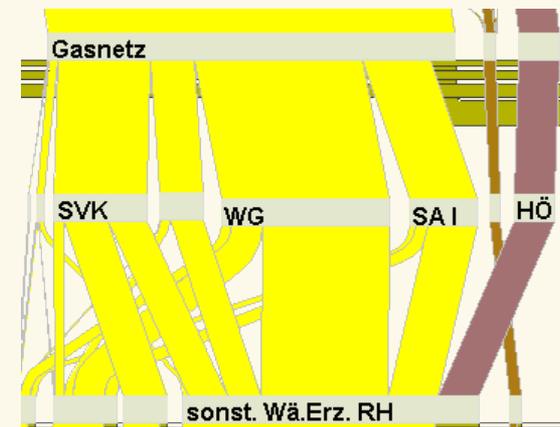
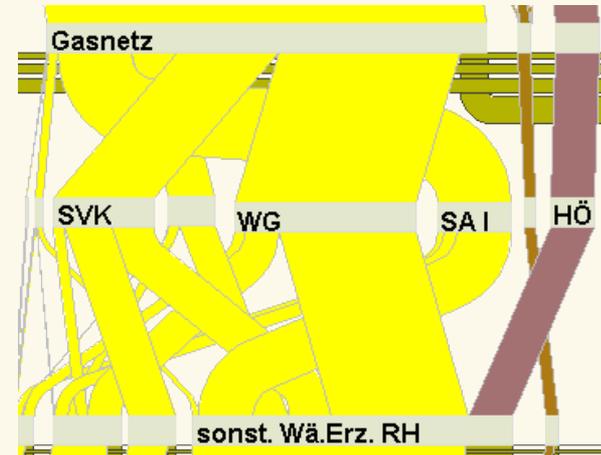


# Experience: Vertical horizontal illusion



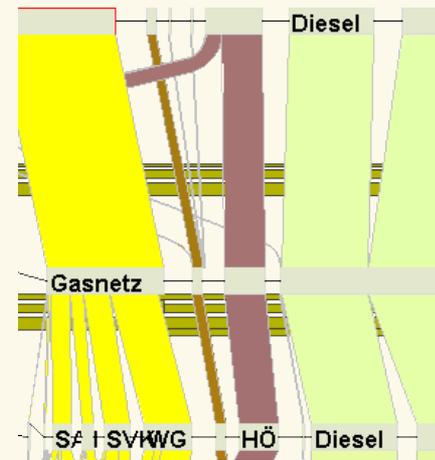
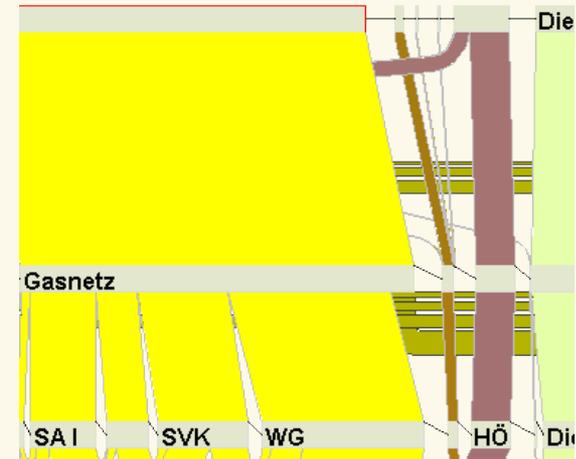
# Discussion: Manual Layout vs. Automatic Layout

- Sorting incoming/outgoing edges per node
- Spring-based layout
- Barycentric method
- Manual Touchup



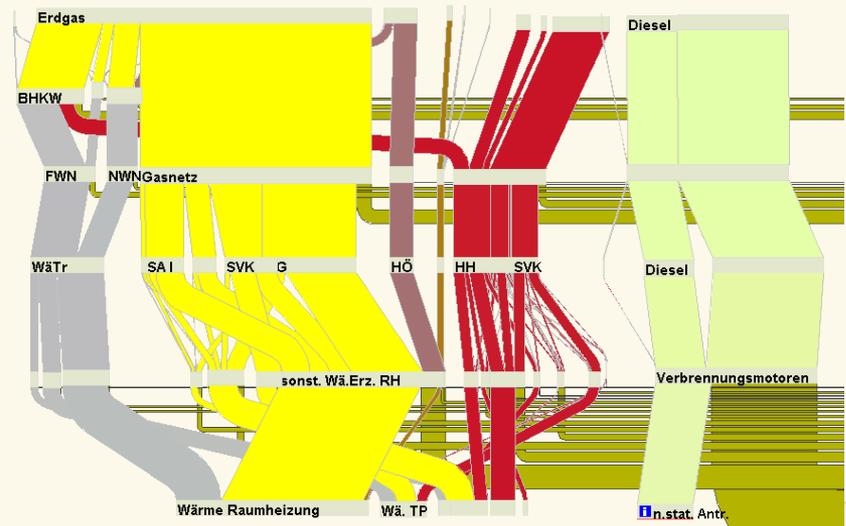
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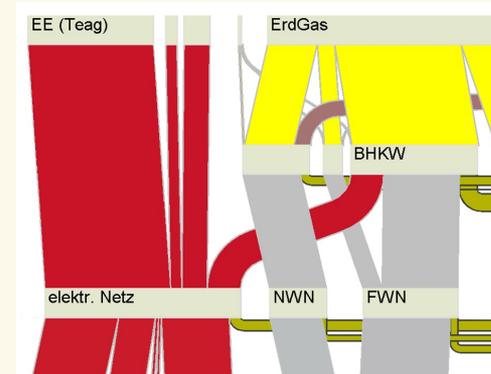
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# Conclusion

- Interactive Exploration
  - Level of Detail
  - Detail on Demand
  - Flow Tracing
  - Animation
  - Detail and Overview
- Used for educational purposes
  - Available at [www.stadtwerke-weimar.de](http://www.stadtwerke-weimar.de)
- Planning



# Future Work

- Further development of the planning capabilities
- Animation and animated transitions for parameter changes
- Authoring component and semi-automatic layout
- Application to other domains

# Future Work

- Further development of the planning capabilities
- Animation and animated transitions for parameter changes
- Authoring component and semi-automatic layout
- Application to other domains
  - Material Flow
  - Packet flow
  - Water flow
  - Flow of money

# THANK YOU!

