Umwelt Bundes Amt
Für Mensch und Umwelt

# Opportunities for a greenhouse gas neutral energy supply

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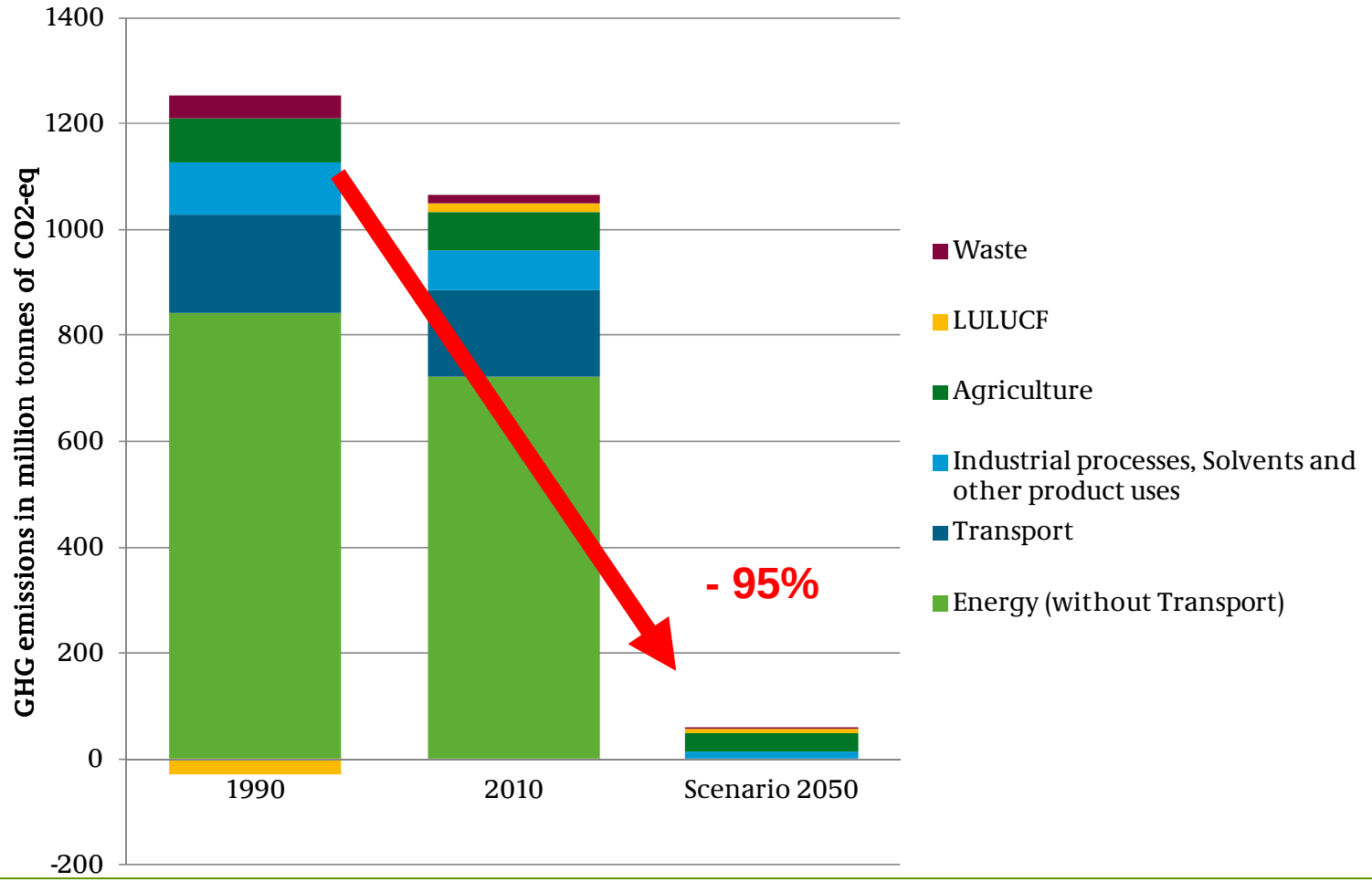
# Greenhouse gas neutral Germany in 2050 – a UBA scenario

- Consideration of possibilities for reducing greenhouse gases across all source categories



# Basic assumptions – Energy supply

- Resolute exploitation of efficiency potentials across all sectors using energy

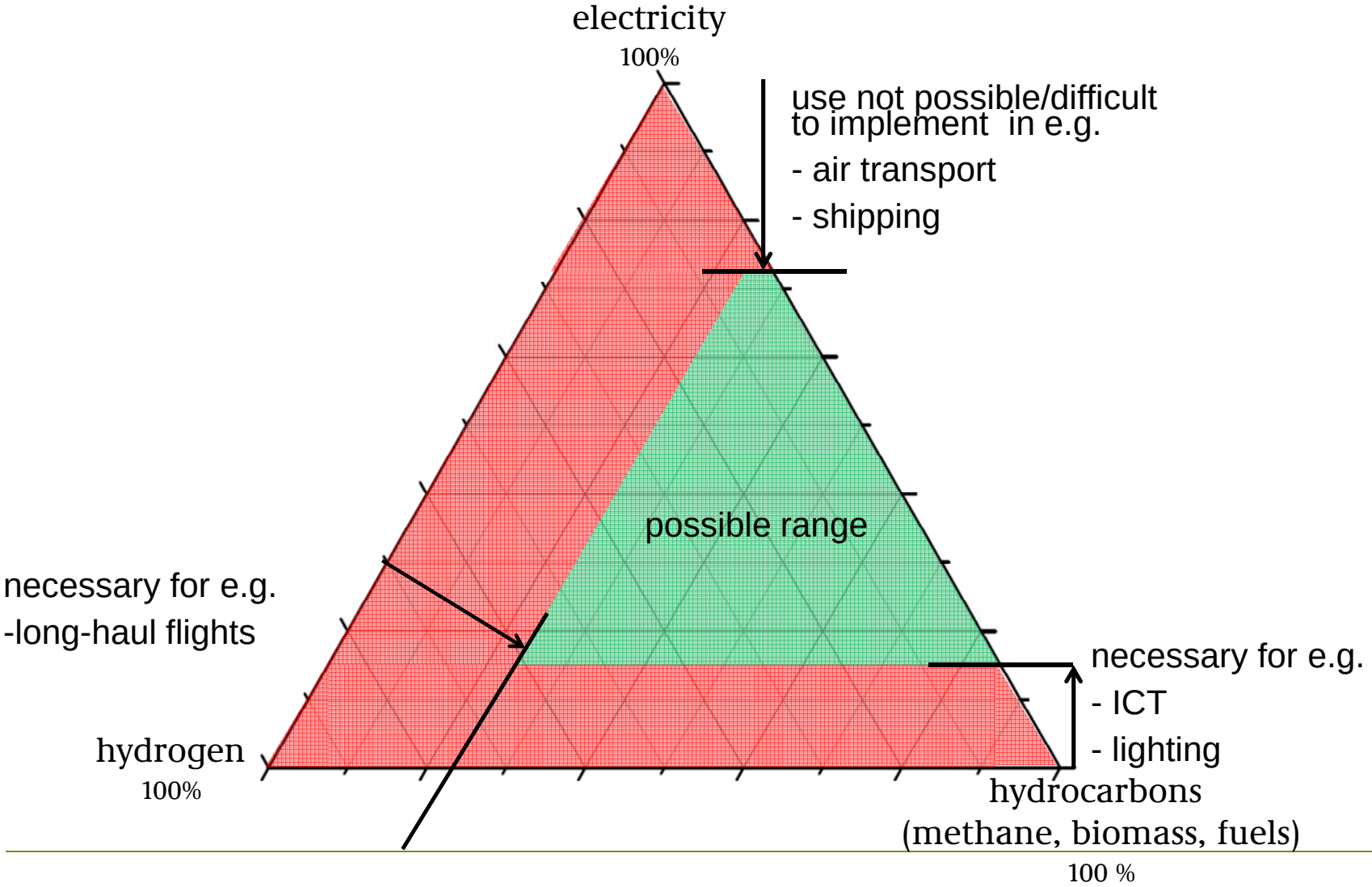
- Energy efficiency was assumed to double on average in the various industrial sectors

- CCS is an unsustainable technology and is not, therefore, an element of the future energy supply, due inter alia to diverse environmental impacts
- Use of nuclear energy for energy supply was excluded

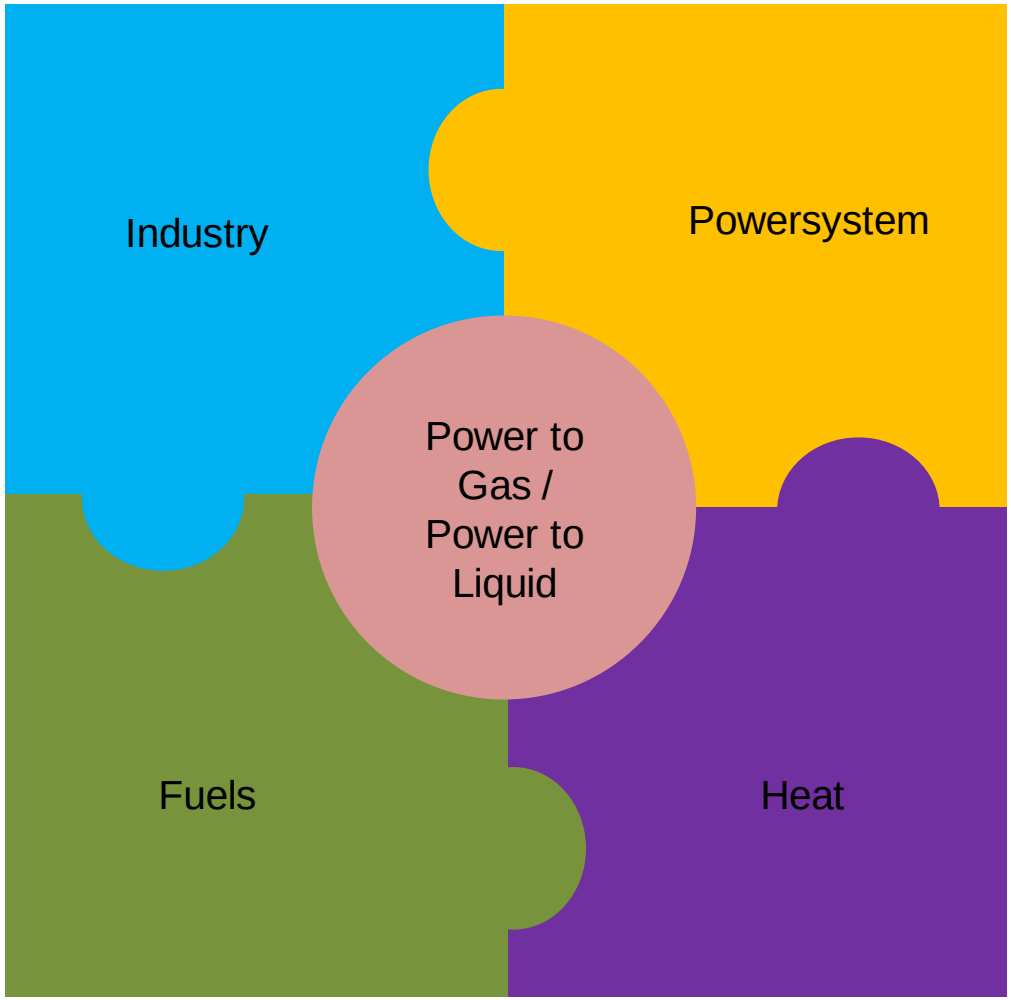
- No use of biomass crops for energy production
- Waste biomass and residual biomass are used for energy production mainly in cases where this benefits the climate (slurry digestion)

- Analogous to today‘s global market for fossil energy sources, there will be an international market for renewable energy sources

# Possible range of GHG-neutral final energy sources



# Role in a Future Energy System

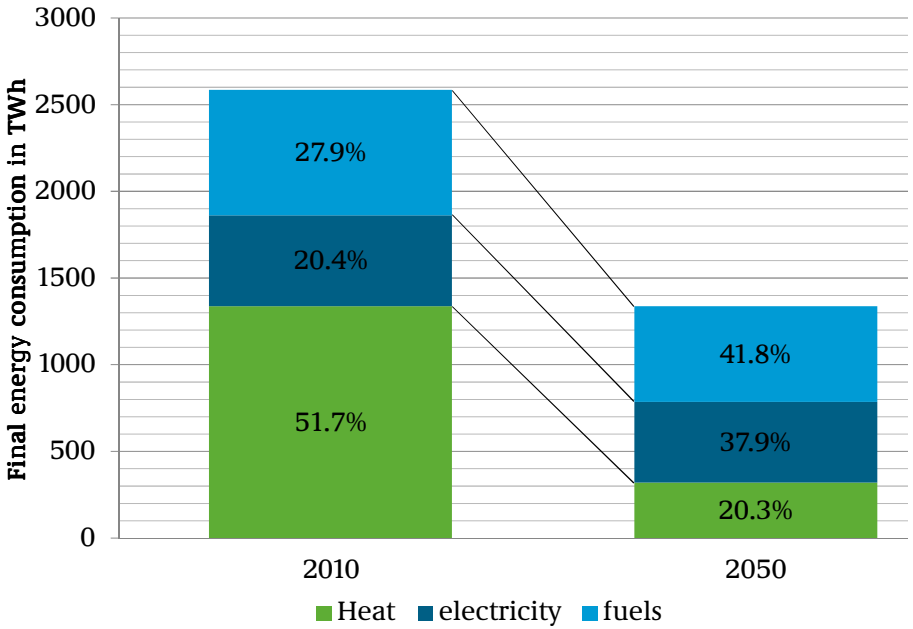


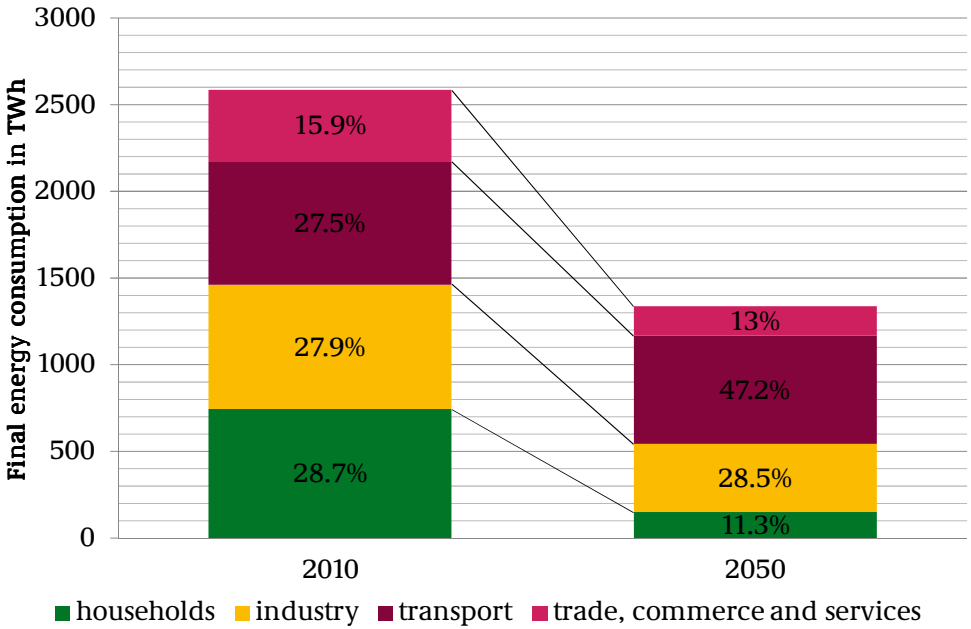
# Final energy demand – UBA-Scenario

| | Electricity [TWh] | Renewable methane [TWh] | Renewable liquid fuels [TWh] |
|---|---|---|---|
| Private households | 104.7 | 44.5 | 0 |
| trade, commerce and services | 90.3 | 62.4 | 18.6 |
| Industry | 179.7 | 199 | 0 |
| Transport | 91.1 | 0 | 533.3 |
| **Total** | **465.8** | **305.9** | **551.9** |
| | **1323.6** | | |

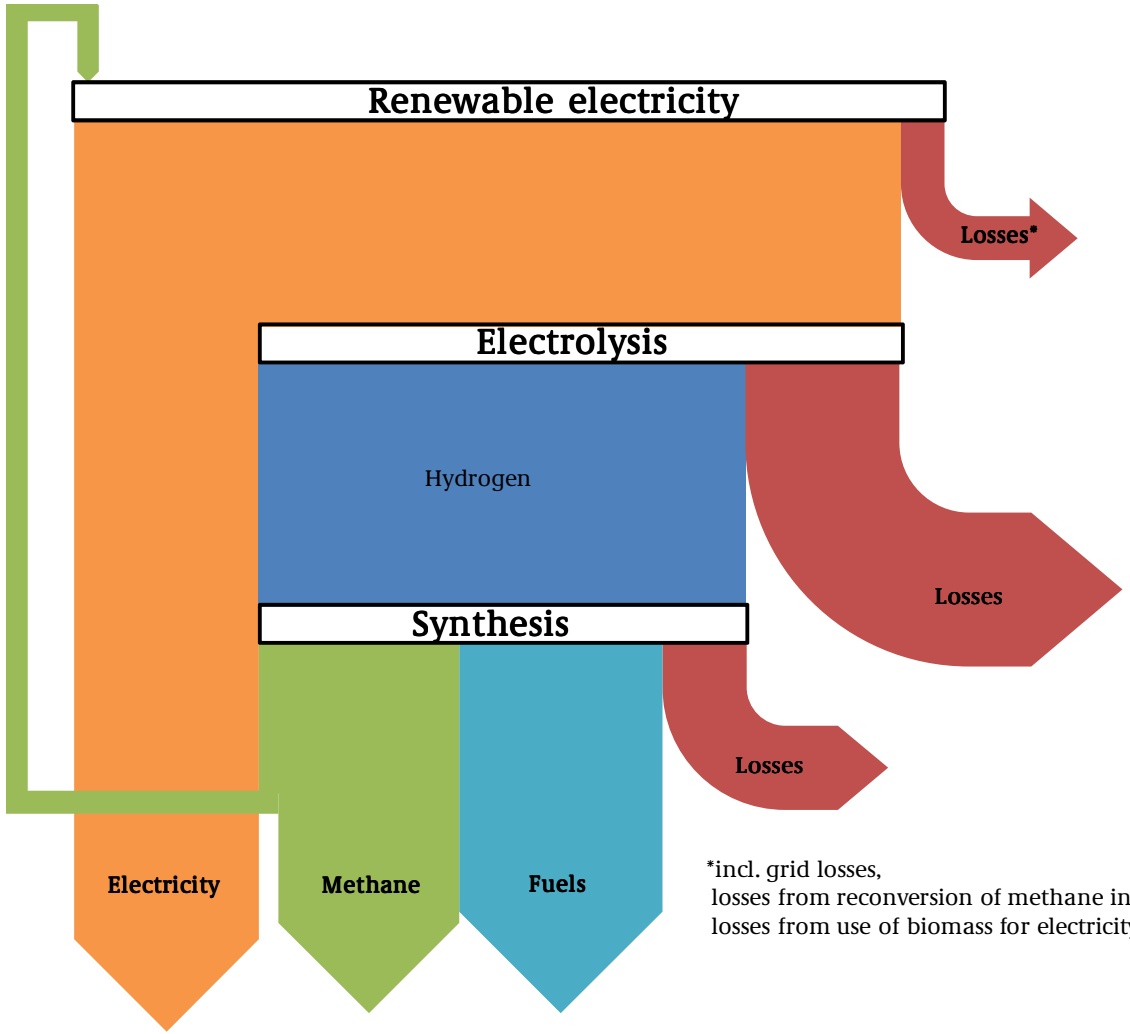
- additional 282 TWh for material use in industry

# Comparison of final energy sources 2010 and 2050



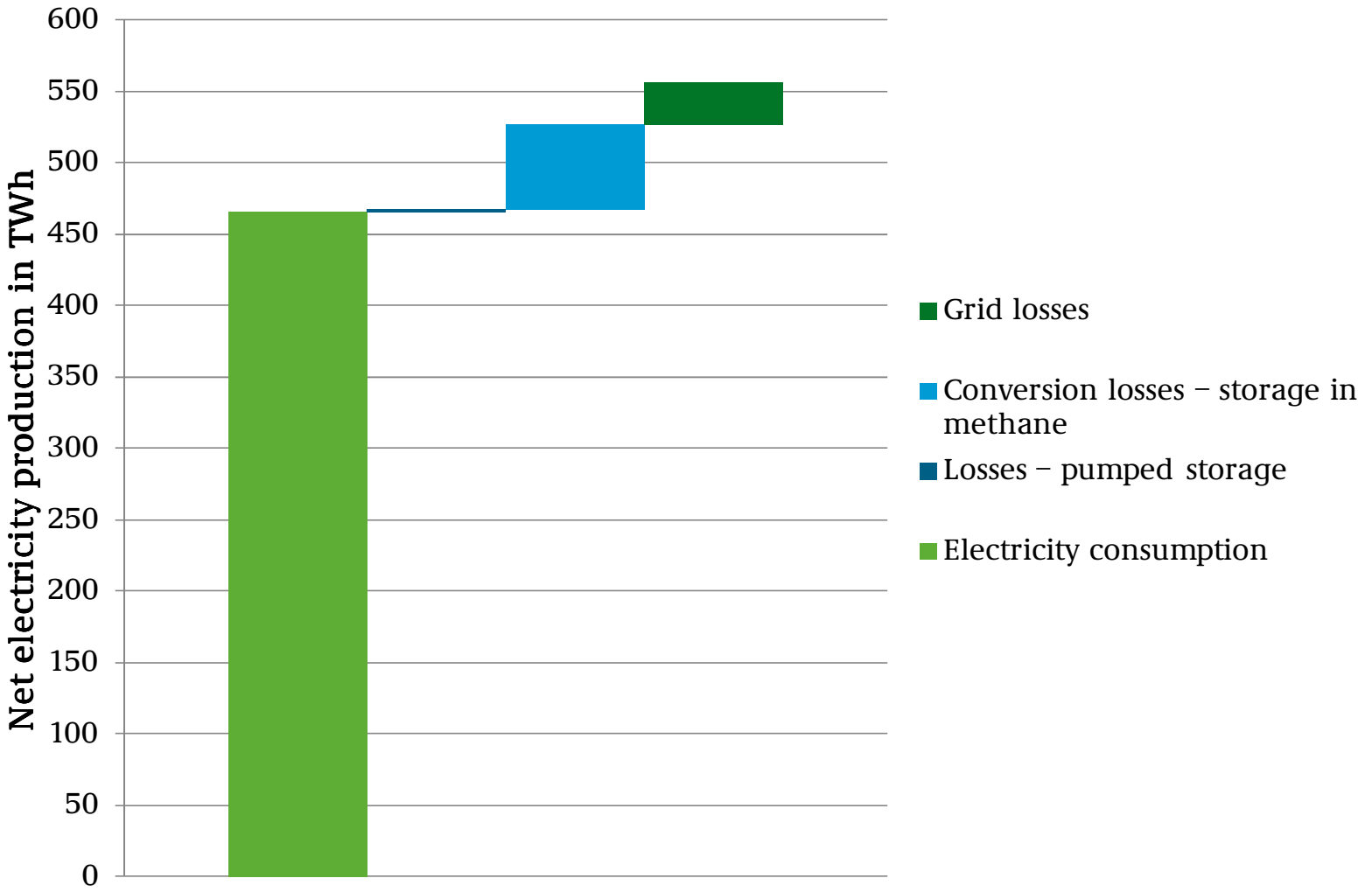



# Energy flow

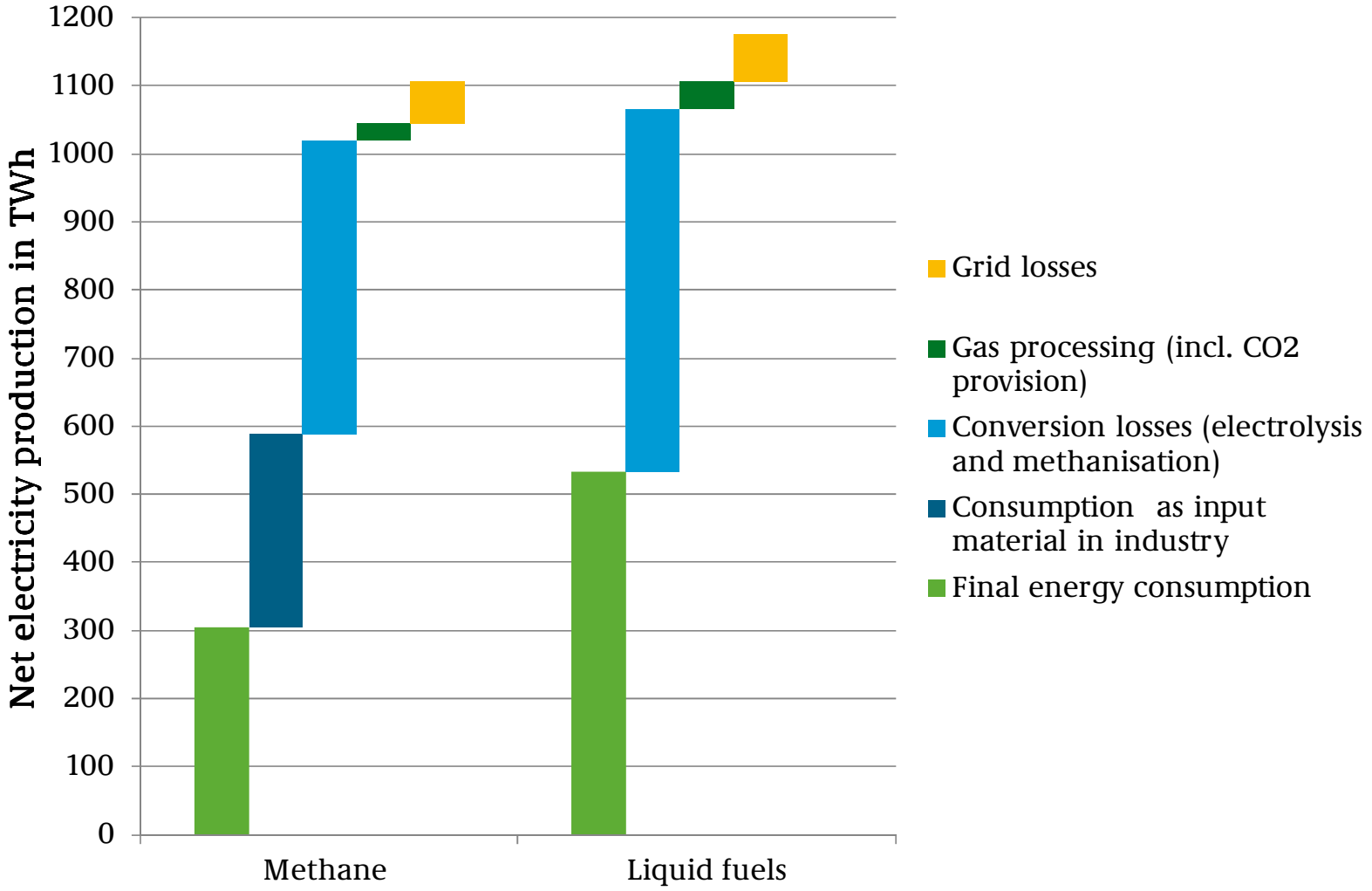



*incl. grid losses,
losses from reconversion of methane into electricity and
losses from use of biomass for electricity provision

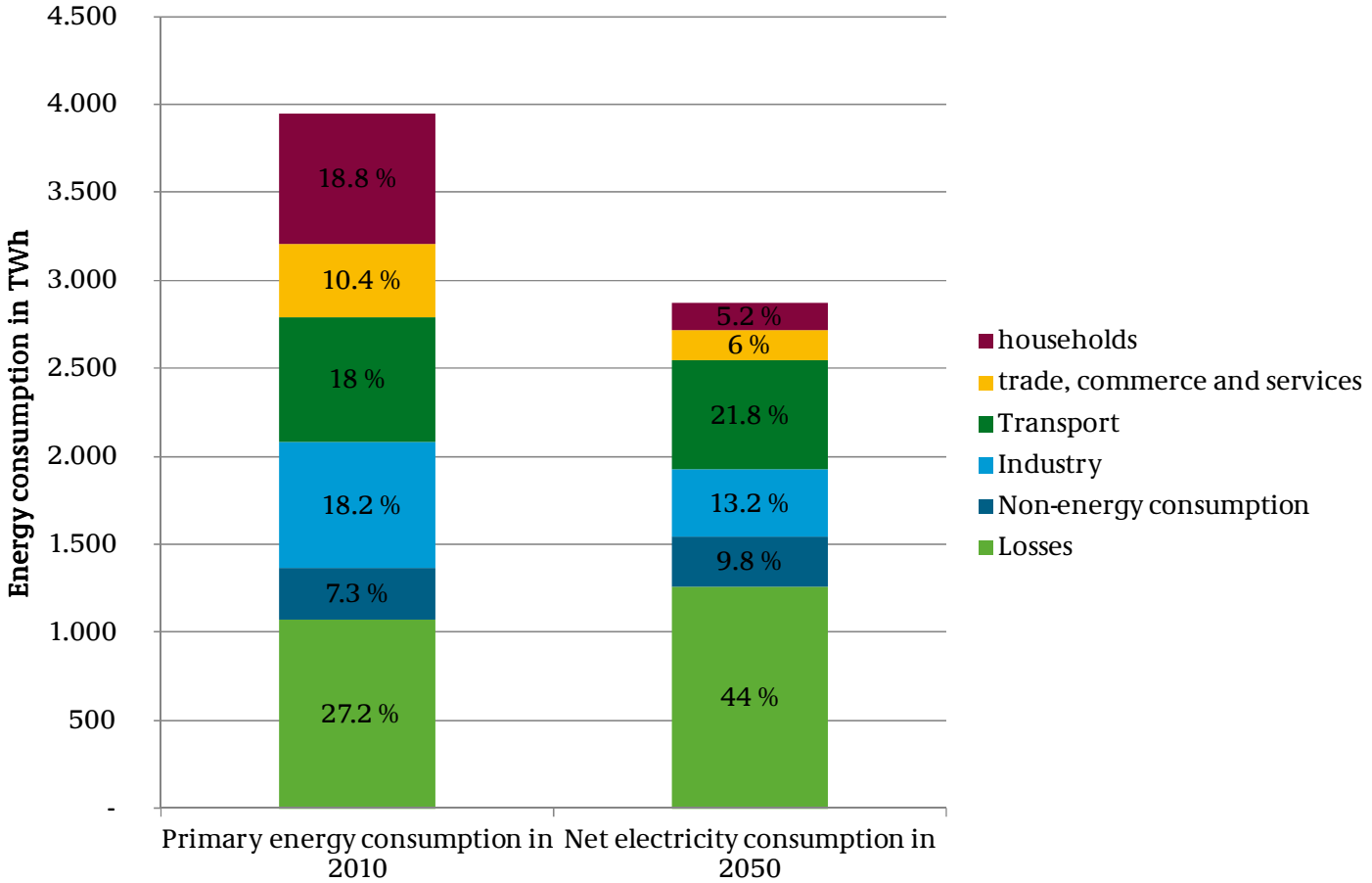
# Net electricity production for direct electricity uses



# Net electricity production for fuel supply



# Comparison of energy consumption in 2010 and 2050




- This does not include losses from the transportation of fuel imports.

→ **The net amount of renewable electricity that has to be produced for full supply by energy from renewable resources is 3000 TWh.**

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# Summary

- A GHG-neutral energy supply is technically feasible.
- In the long term the final energy demand for electricity cannot be lowered substantially but will stabilise at today‘s level.
- If saving potentials are consistently exploited and efficiency is increased across sectors, final energy consumption can be halved.
- Conversion of renewable electricity into chemical energy sources (power to gas/liquid) is an important element of a greenhouse gas neutral energy supply.
- PtG (also as PtL) is very important not just to ensure a stable supply of electricity, but mainly to supply industry with fuels and chemicals and the transport sector with fuel.
- In an electricity-based GHG-neutral energy supply system, energy losses will be higher compared to energy supply based on fossil sources.
- Due to the fact that its production is more energy-efficient and the advantage that no carbon source is needed, hydrogen should be used as a final energy source.