



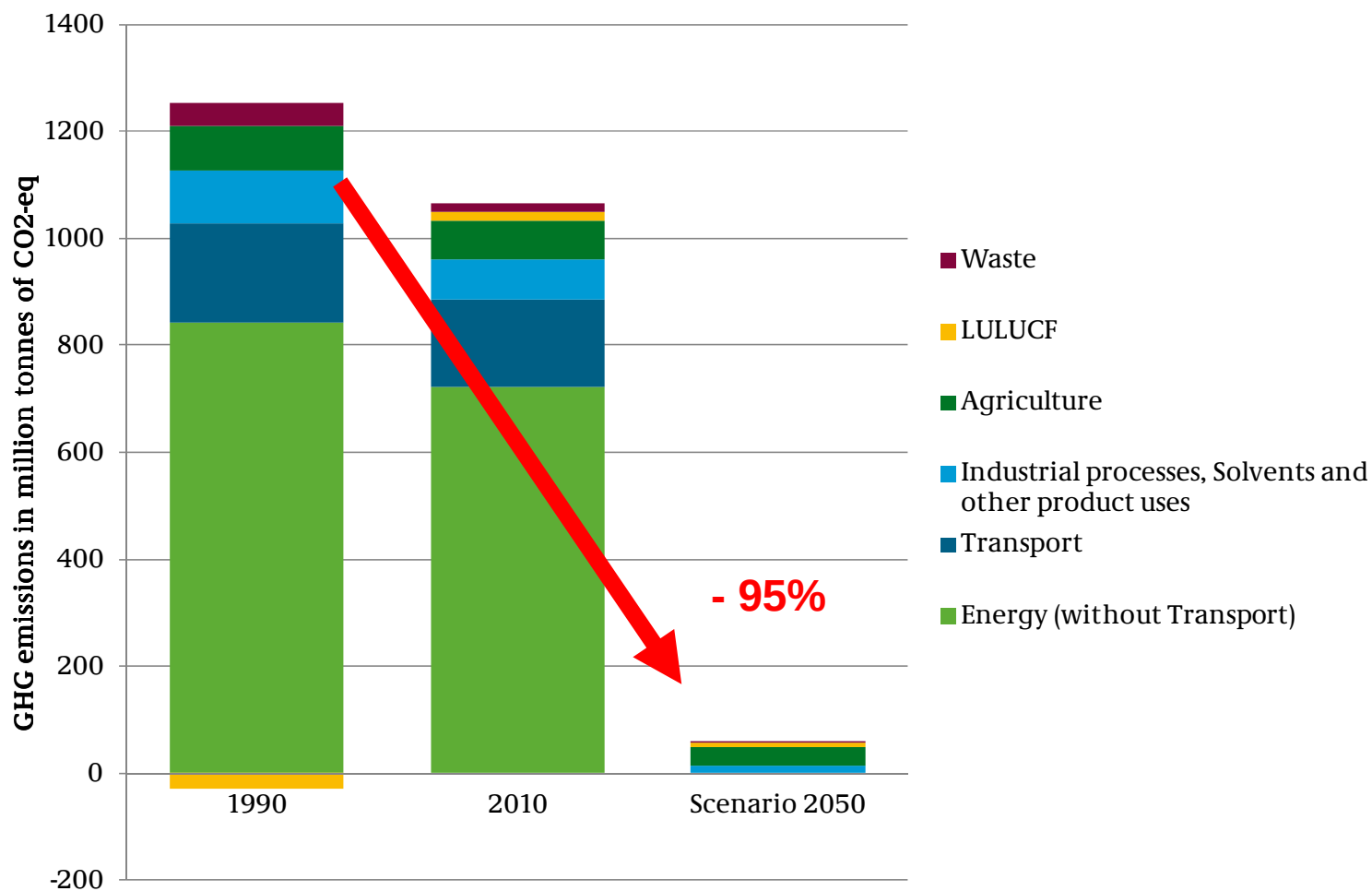
Opportunities for a greenhouse gas neutral energy supply

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Greenhouse gas neutral Germany in 2050 – a UBA scenario

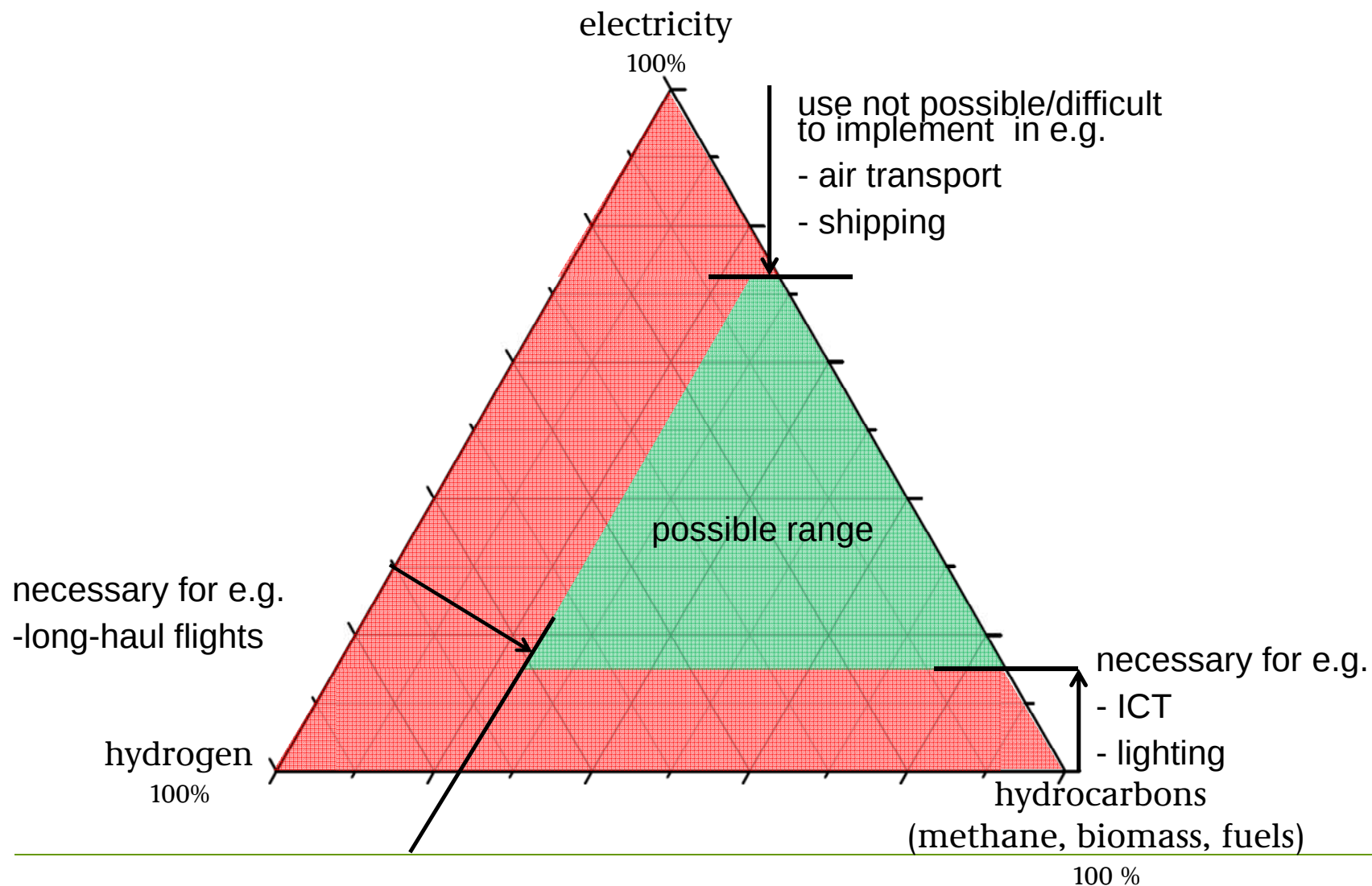
- Consideration of possibilities for reducing greenhouse gases across all source categories



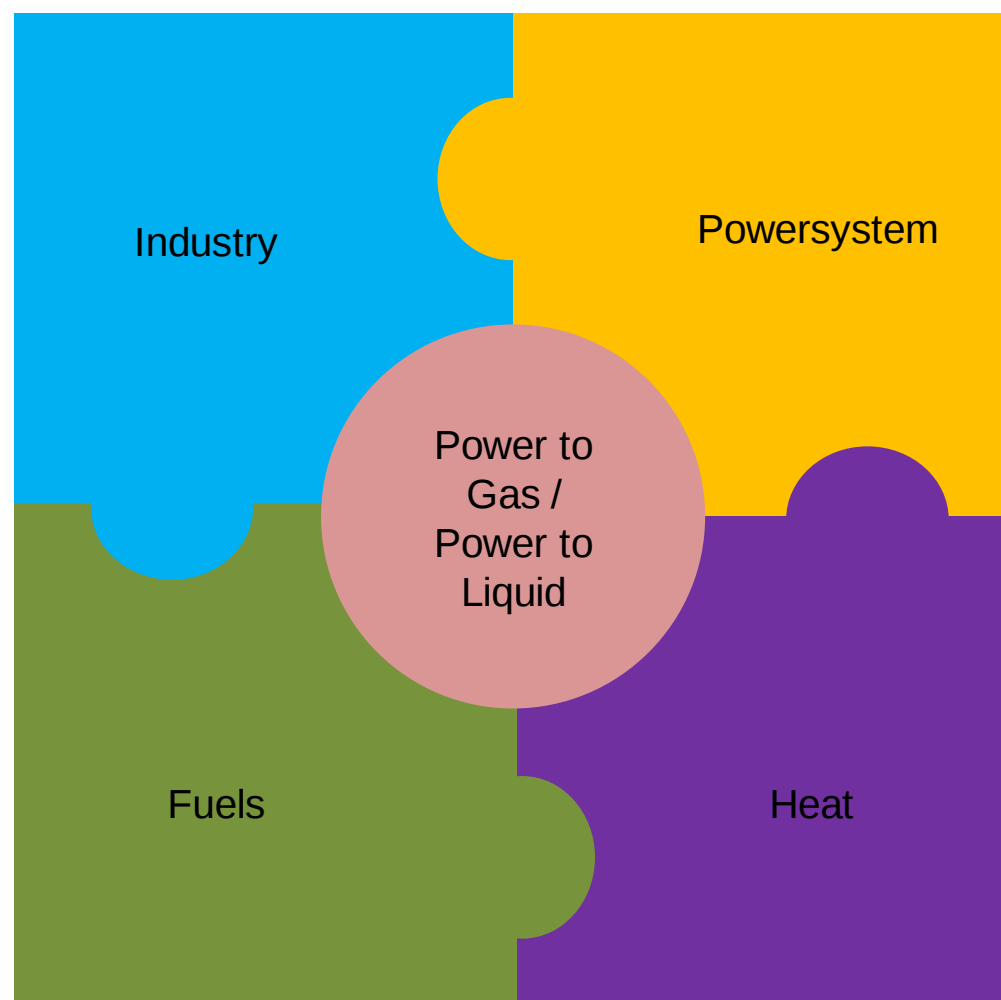
Basic assumptions – Energy supply

- 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

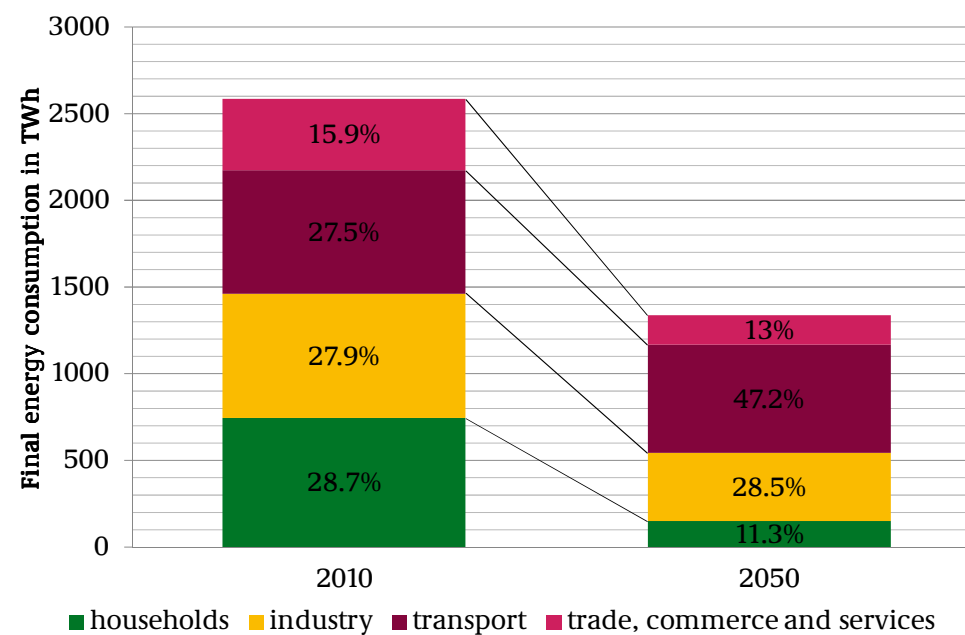
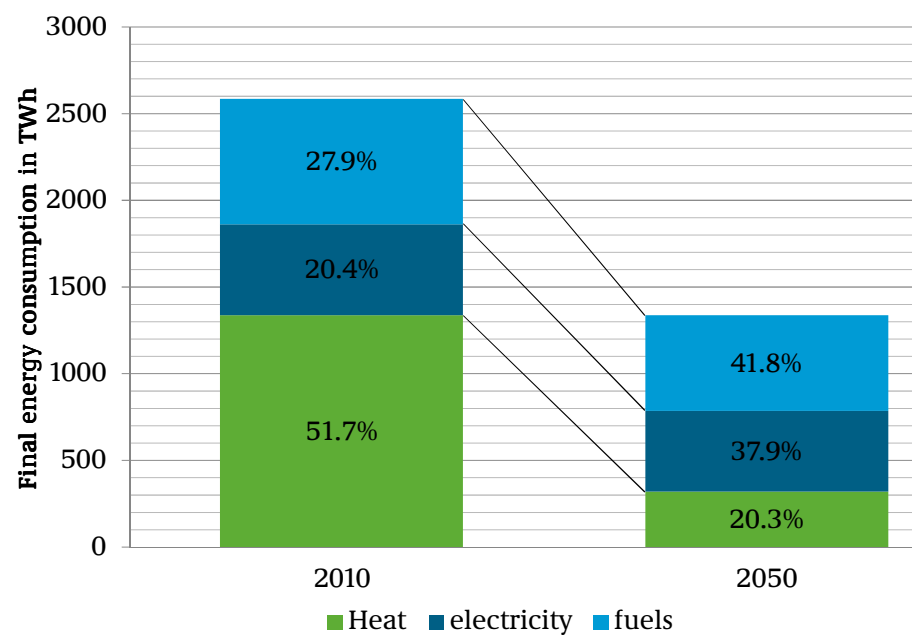


Final energy demand – UBA-Scenario

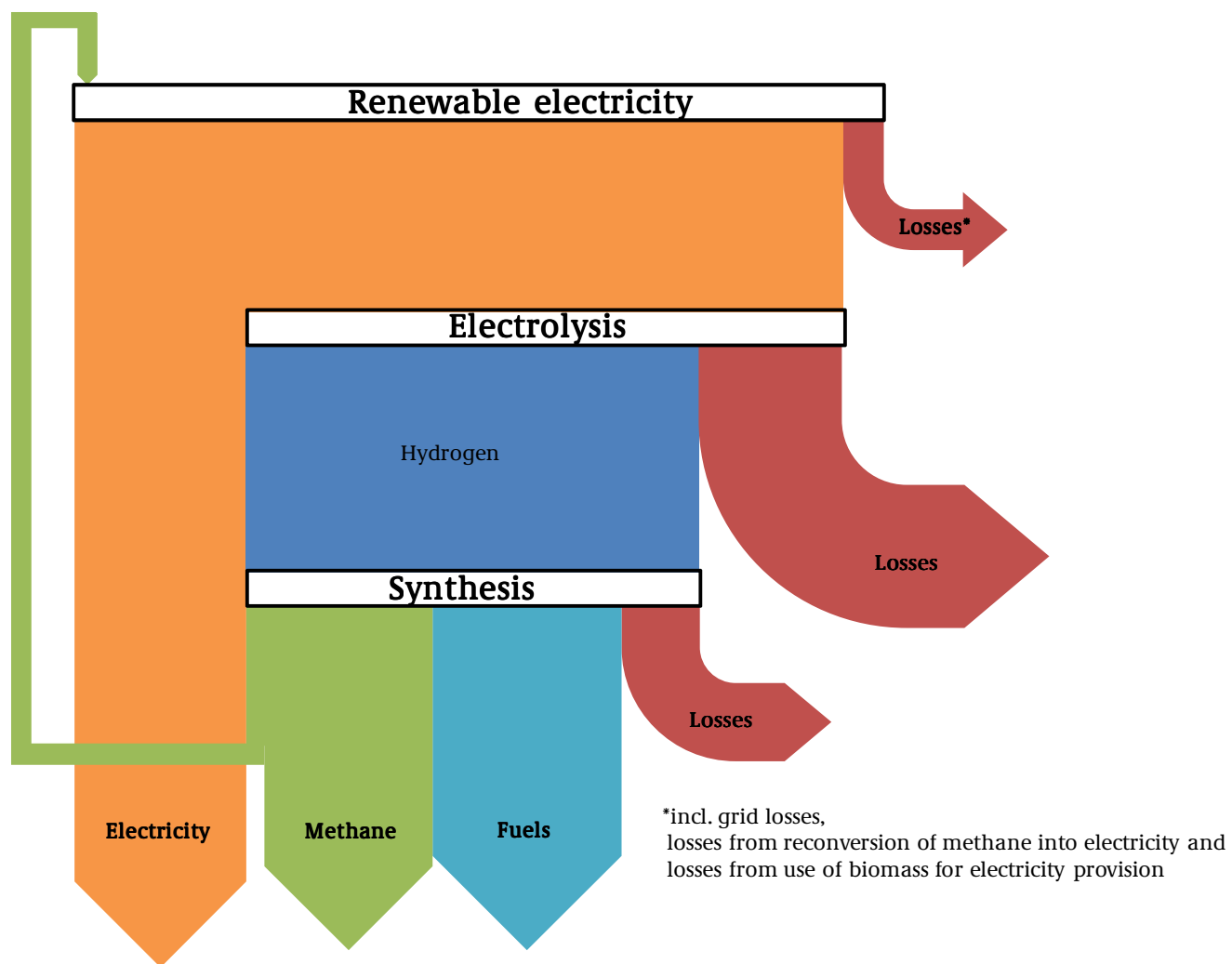
	Electricity [TWh]	Renewable methane [TWh]	Renewable liquid fuels [TWh]
Private households	104.7	44.5	0
trade, commerce and services	90.3	62.4	18.6
Industry	179.7	199	0
Transport	91.1	0	533.3
Total	465.8	305.9	551.9
	1323.6		

- additional 282 TWh for material use in industry

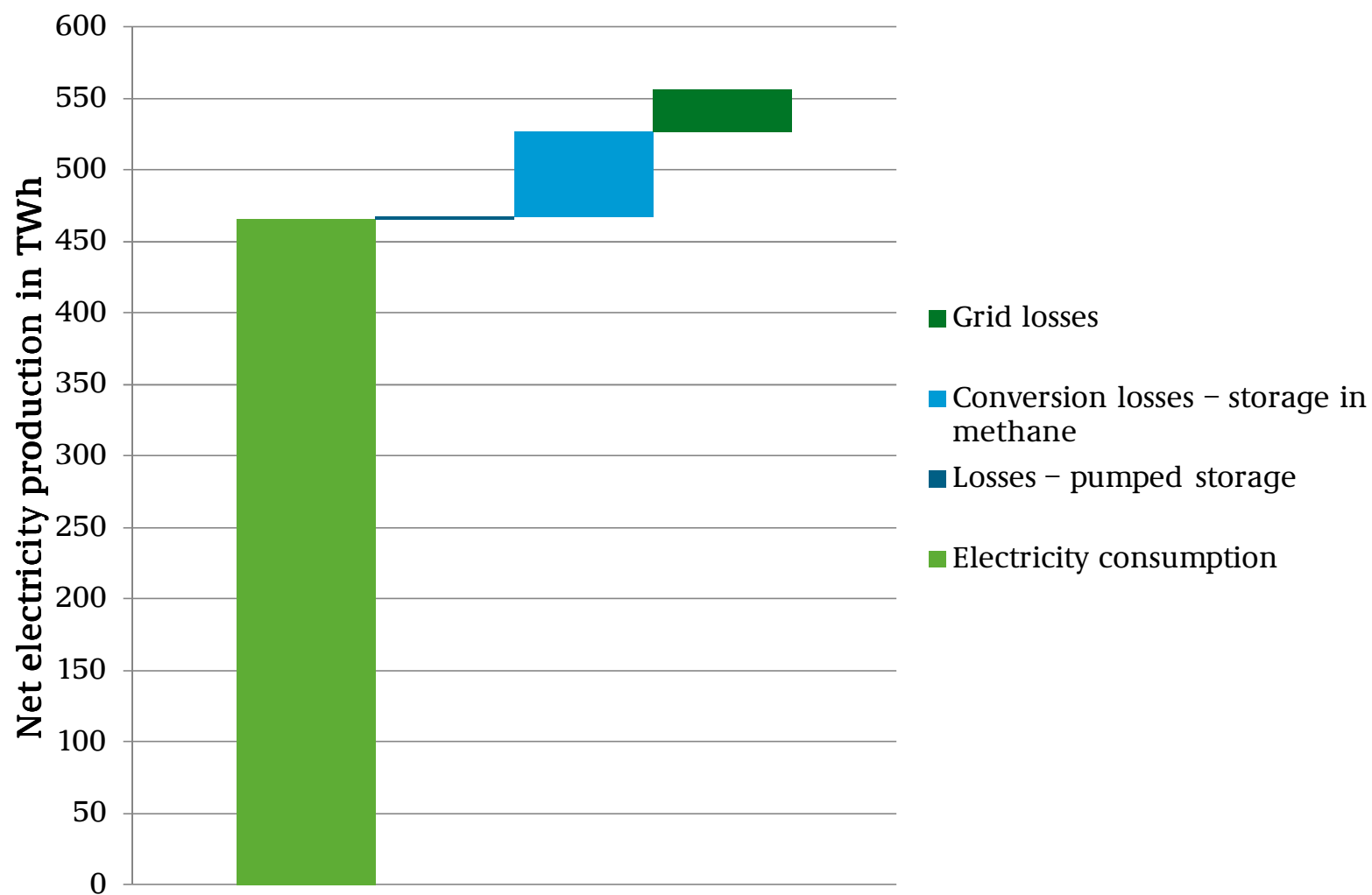
Comparison of final energy sources 2010 and 2050



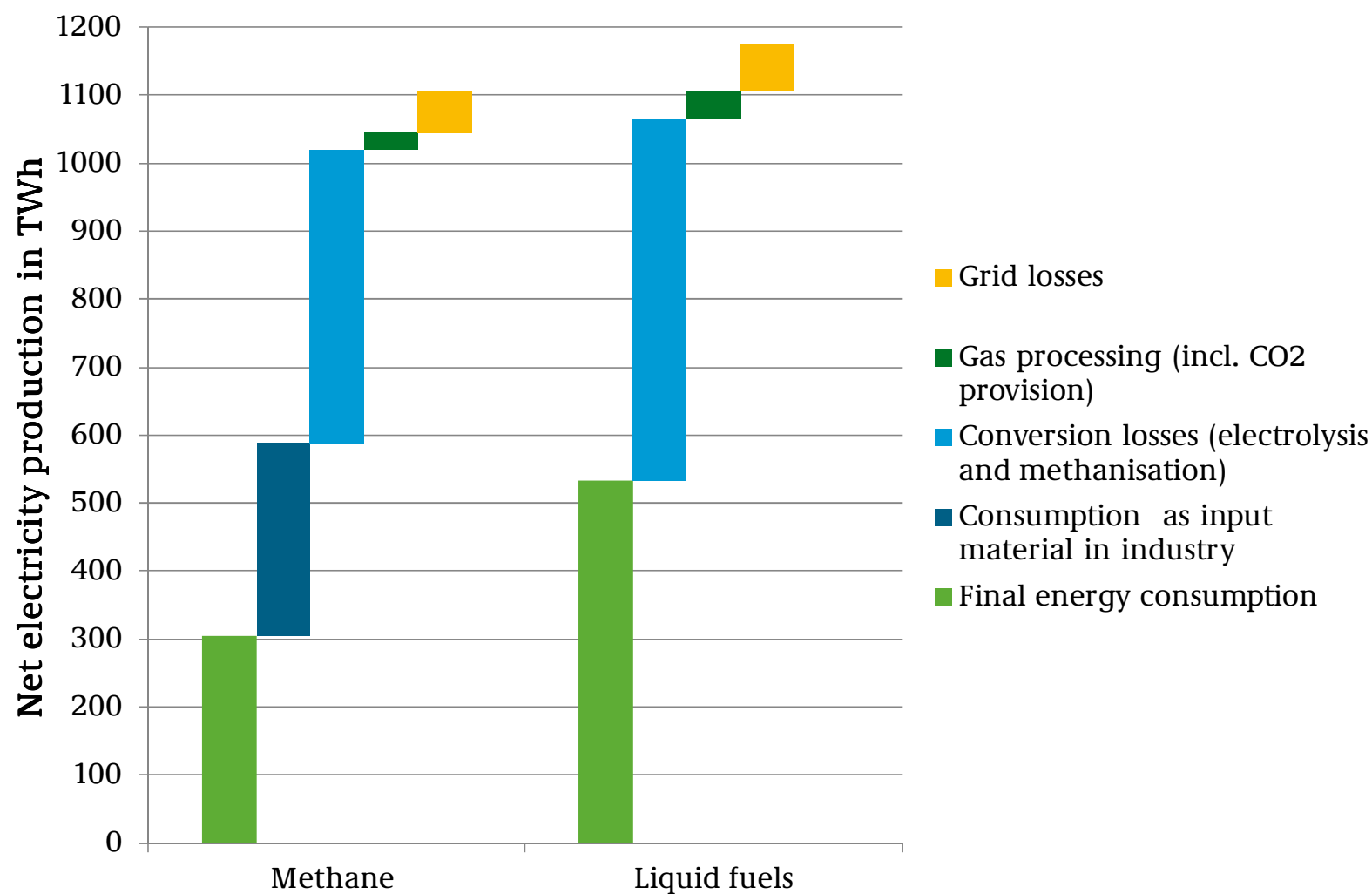
Energy flow



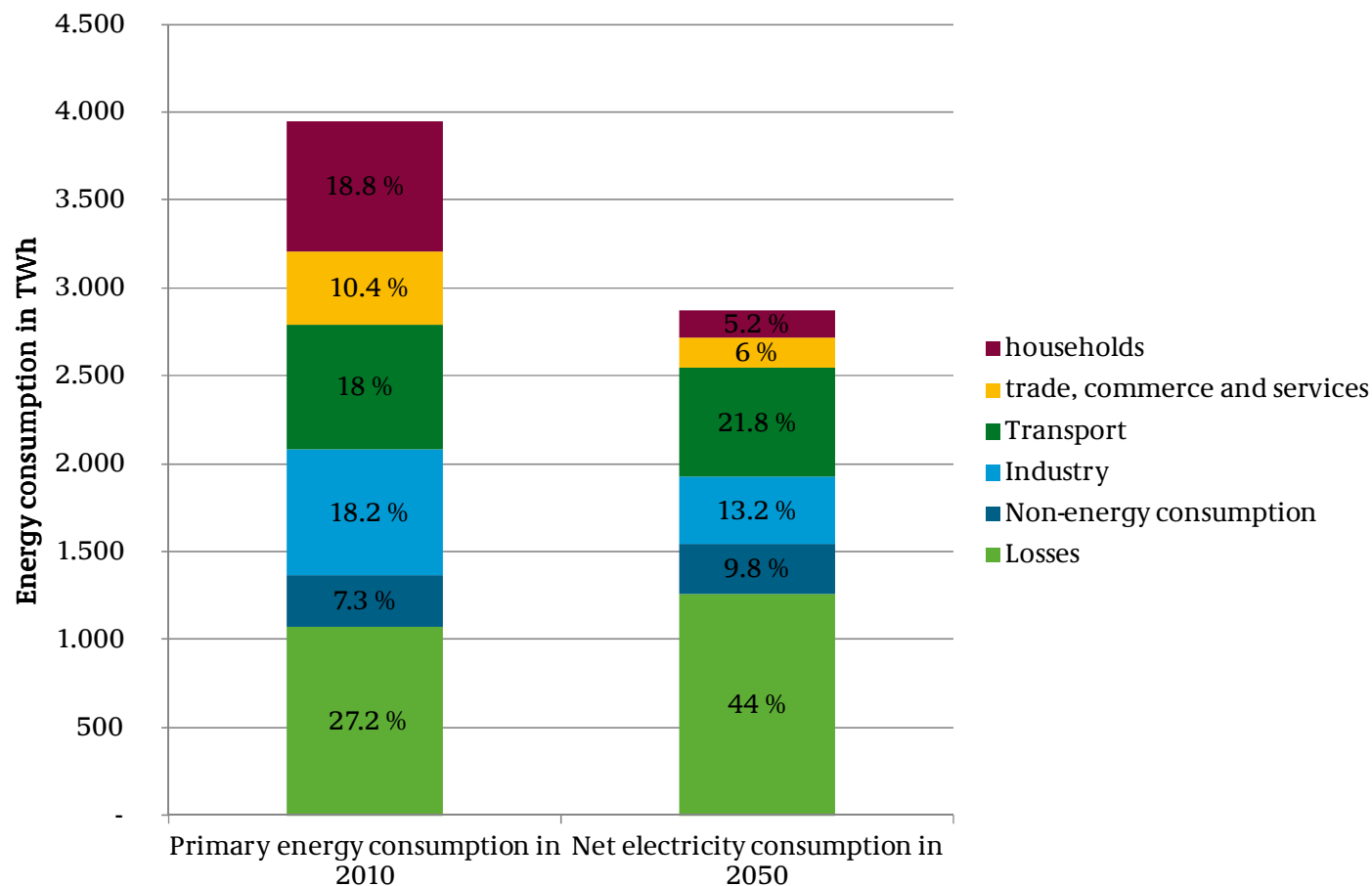
Net electricity production for direct electricity uses



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.**

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.