Climate Recon 2050:
Dialogues on Pathways and Policy

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Modelling net zero emissions

Common findings
to German, Nordic and French examples

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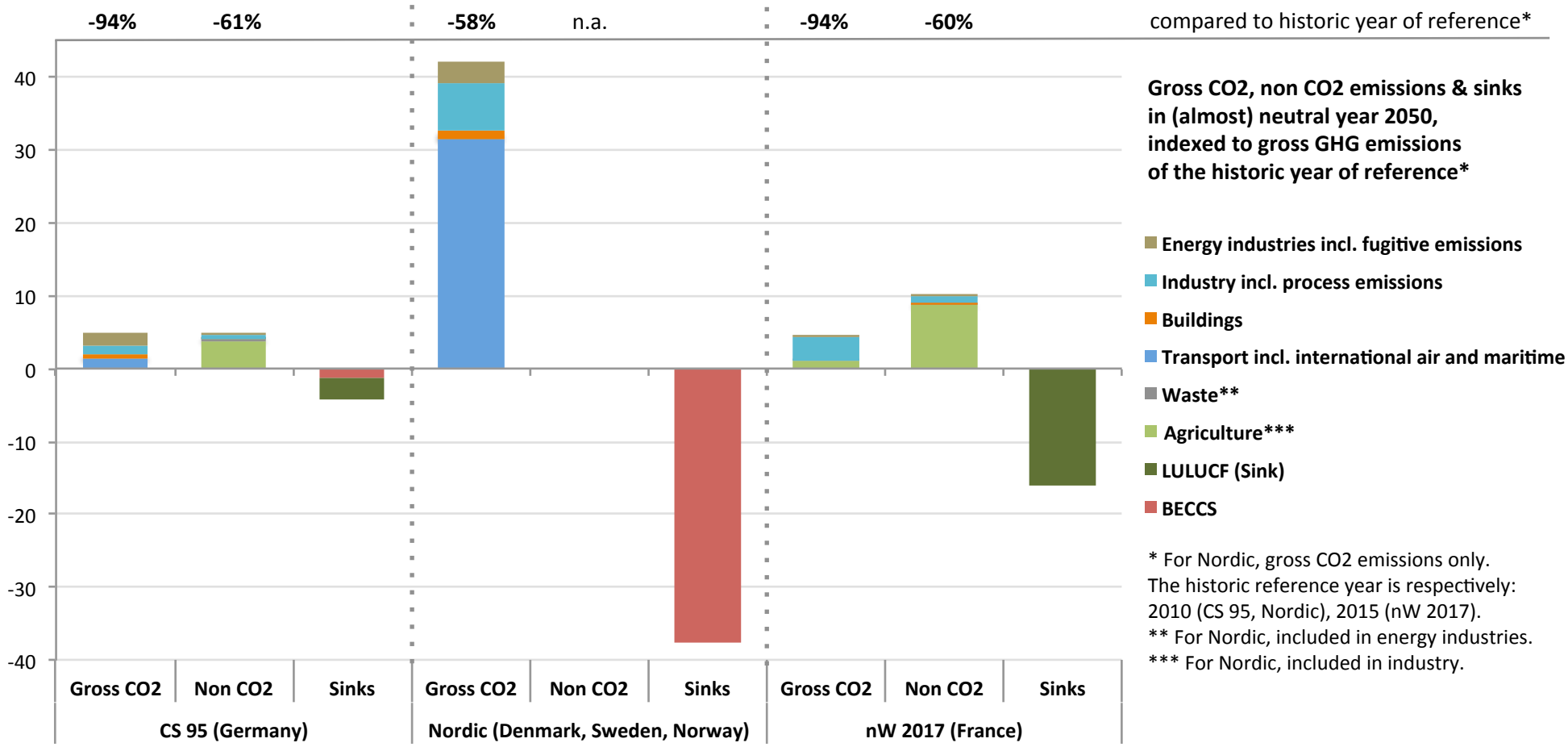
1. Evolution of GHG emissions



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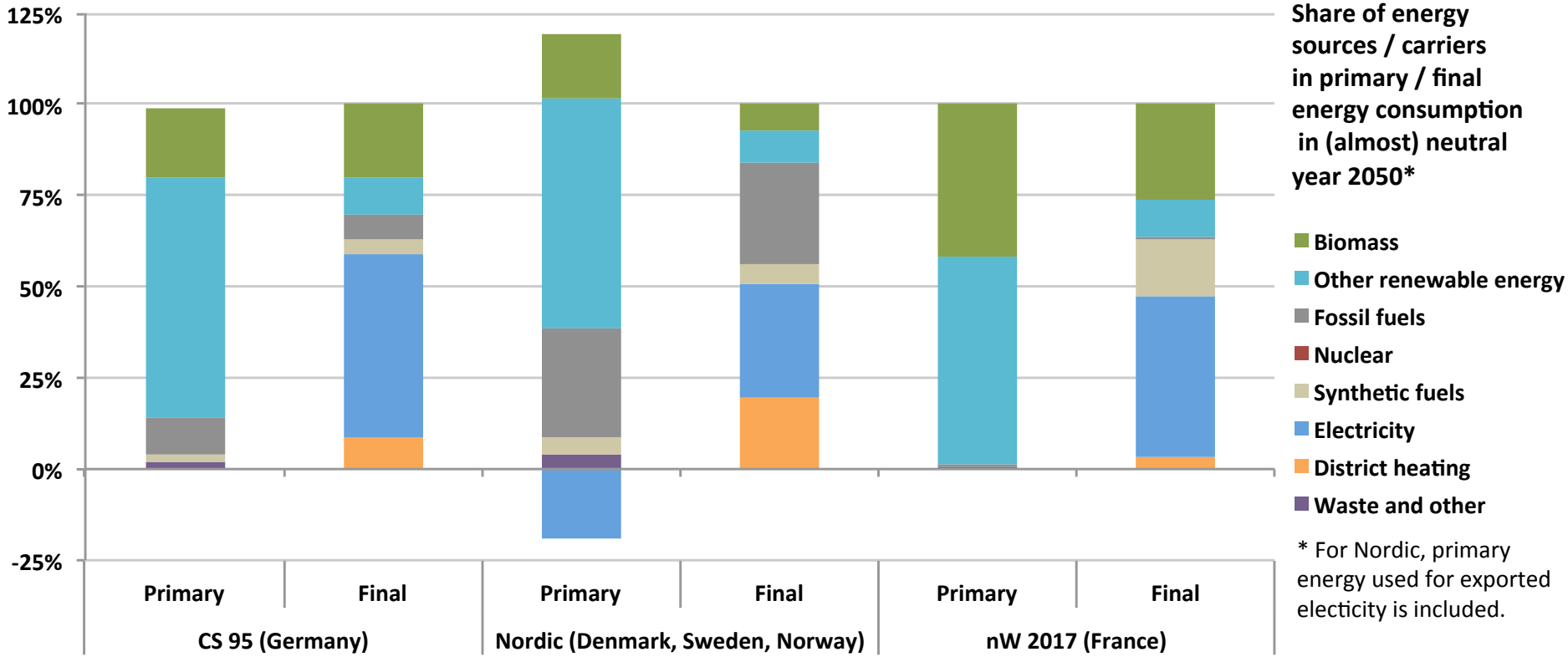
2. Energy carriers / primary energy sources



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3. Energy demand

	CS 95 (Germany)	Nordic (Denmark, Sweden, Norway)	nW 2017 (France)
Year of reference	**2010**	**2010**	**2015**
Primary energy, compared to historic reference	**-55%**	**-26%**	**-65%**
Final energy, compared to historic reference	**-53%**	**-23%**	**-57%**
… in industry	-43%		-51%
… in residential	-58%		-63%
… in tertiary	-57%		-54%
… in transport	-57%		-60%

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4. Common challenges for modelling

- **Extending the models:**
  → broaden the scope to all GHG emissions, starting with energy system / market models
  → integrate more cross-sectorial and “life cycle” analysis
  (especially when taking into account sustainability issues beyond climate change)
- **Shitfing in optimisation:**
  → beyond meeting net zero, need to minimize the cumulative amount of emissions (carbon budget)
  → consider the need for prolonged negative emissions afterwards
  → assess the potential for increasing natural sinks and/or deploying artificial ones (CCS, BECCS)
- **Taking care of footprint issues:**
  → integrate international airplane and ship transport (usually not accounted for)
  → discuss the need and conditions for mutualizing resources (biomass) and energy security (grid)
  → consider the impact of domestic changes on global emissions
  (ideally, develop a model of the carbon footprint of good and services)

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5. Potentials and options

- **Various balance of action** on demand (reducing the need for GHG emitting processes) and supply (subtituting low or non emitting resources and processes to emitting ones)
- **Energy demand:**
  - → Some energy efficiency is needed to allow for low-carbon energy supply to meet demand
  - → Further effort, including sufficiency, can reduce the technological challenge of substituting supply
- **Energy supply:**
  - → Balancing the use of energy carriers according to the availability of sustainable renewable resources and the potential for substituting in different sectors (focus on transports)
  - → Developing electric renewables (wind and PV) is generally less constrained than developing bioenergy, which remains however much needed
- **GHG emissions:**
  - → CO_2 in the energy system can generally be more reduced than other GHG emissions
  - → Non energy emissions (agriculture, industrial processes) become prioritary
  - → Carbon sinks are needed, but various visions about removal by LUCLUF and/or CCS and BECCS