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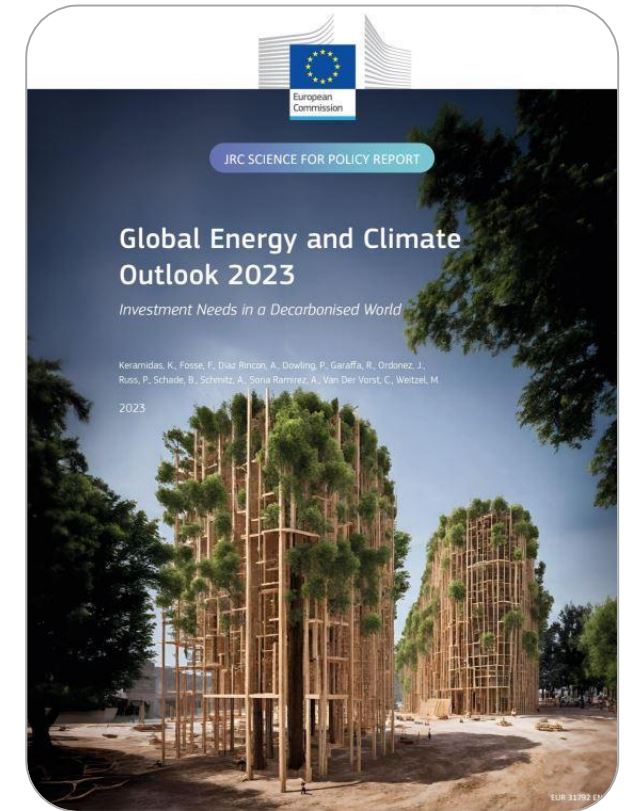
Global Energy and Climate Outlook 2023

Investment Needs in a Decarbonised World

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NDC Aspects & 4i-TRACTION Conference, Brussels (online)
10 July 2024

Introduction

- Urgent need for climate action to keep 1.5°C alive
 - Record-breaking investments in clean technologies, sales of electric vehicles, but barriers remain (e.g. buildings)
 - Avoid the lock-in on emissions intensive technologies (Bertram et al. 2021)
- Our contribution:
 - Deep dive into investments in clean technologies + associated supply chain effects in capital and labour
 - Extend earlier work (Garaffa et al., 2023; Vandyck et al., 2016)
 - Revised historical starting point
 - Revised technology cost projections
 - Supply chain implications of investments
 - Impacts on direct and indirect jobs

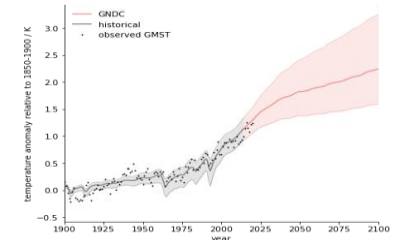
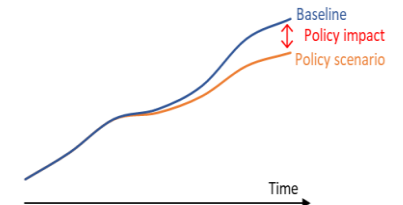
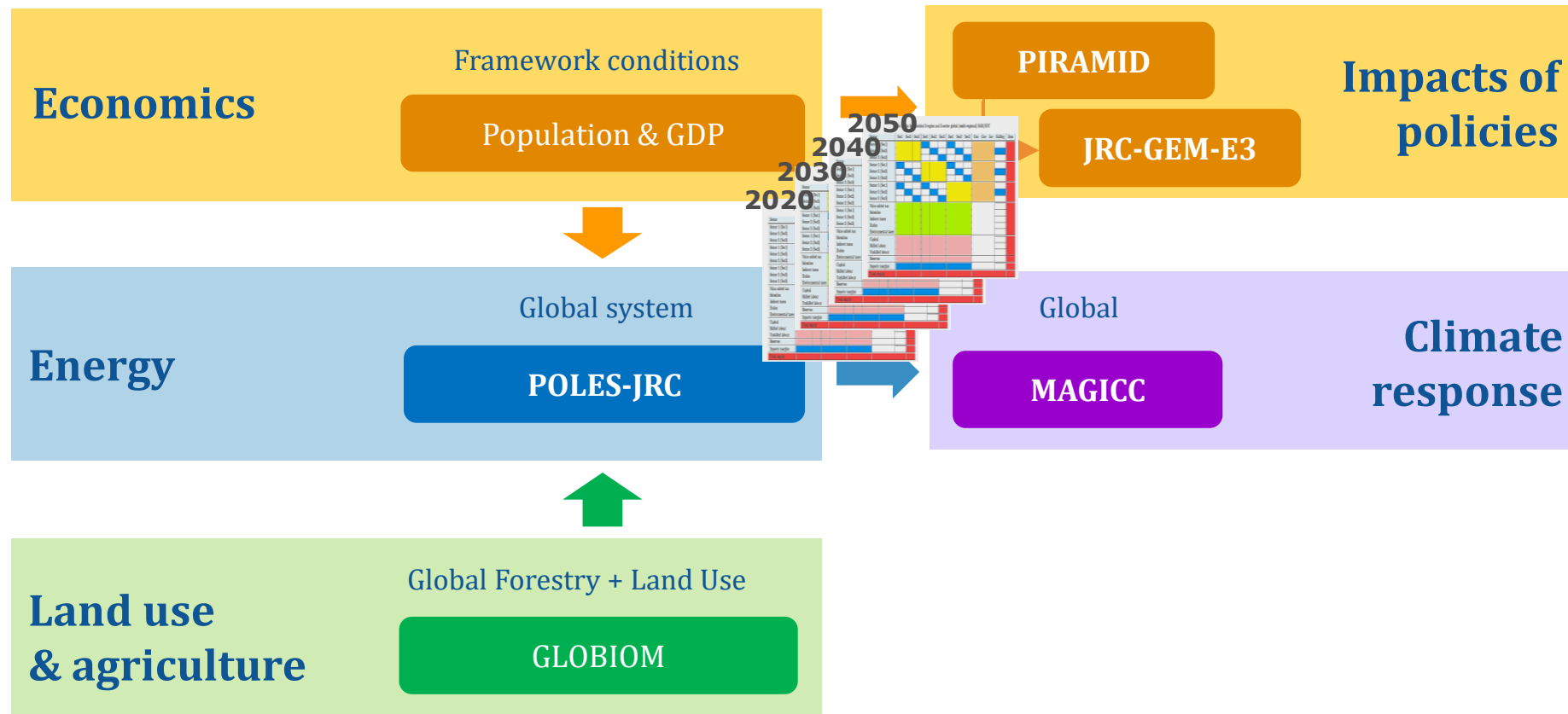


Global Energy and Climate Outlook – published since 2015

- Annual publication, energy and emission projections under various scenarios.
- Deep-dives into focus topics (e.g. impact of Covid-19, energy trade, investment needs).
- Supporting assessments from the IPCC and UNEP Gap Report, and model comparison projects.

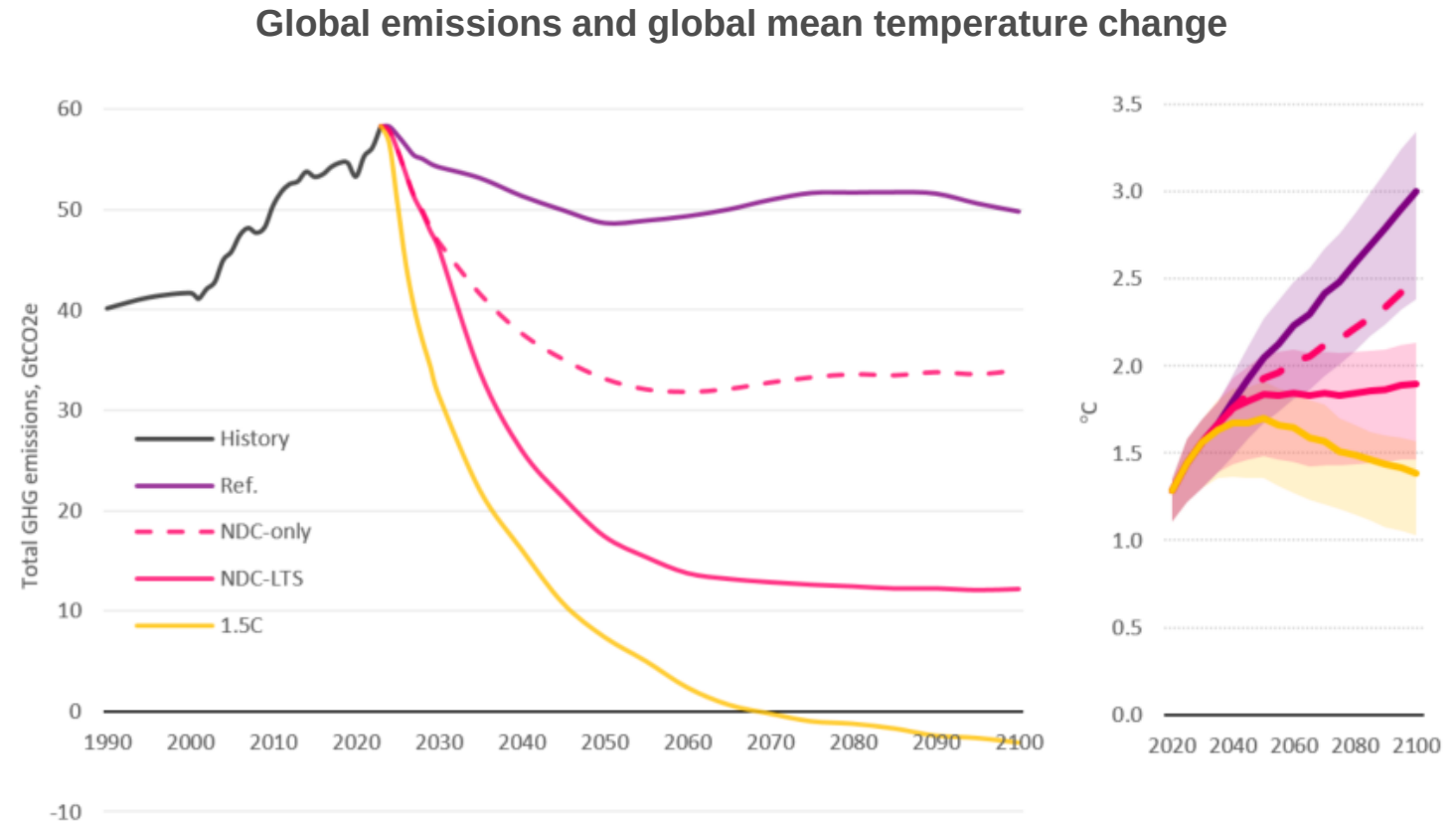


Several models for multidimensional analysis



Large implementation and ambition gaps remain

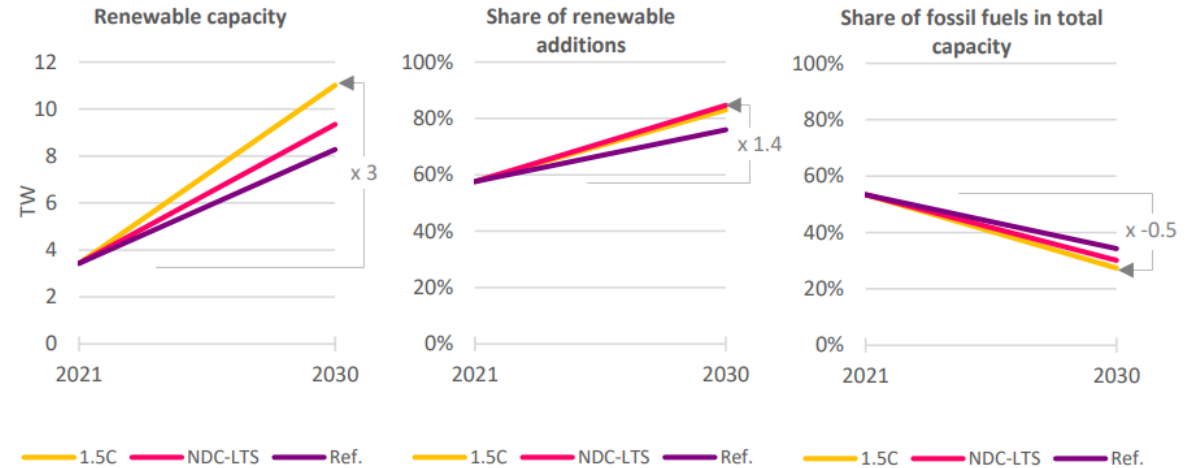
- 8 GtCO₂eq of implementation in 2030 and 10 GtCO₂eq of ambition in 2050 are still missing.
- Progress is being made: GECO 2023 Reference scenario is at 3.0°C at the end of the century.
- Global emissions projected to peak in the middle of this decade in the Reference Scenario.



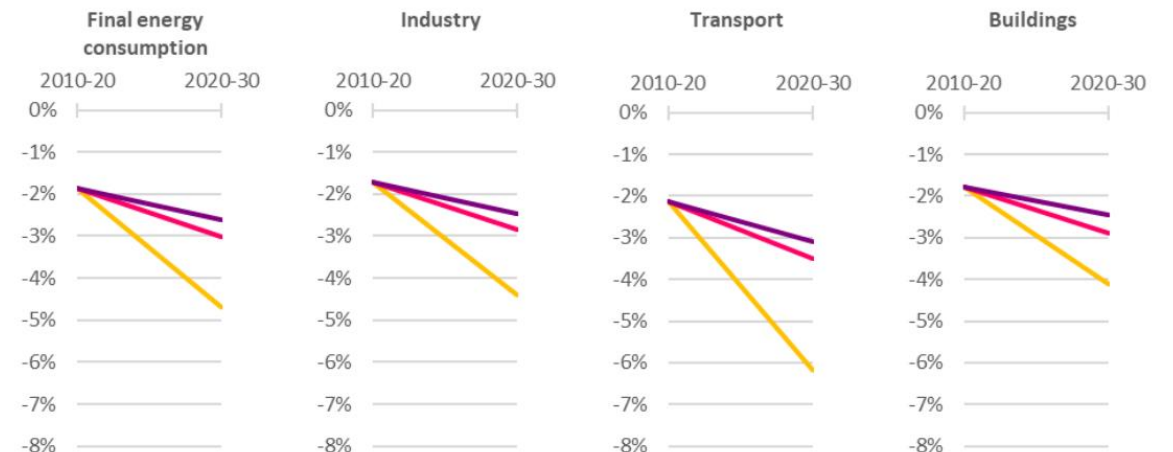
GECO was instrumental in the global RE and EE target discussions

- The GECO team was heavily involved in ENER discussions, along with IEA and IRENA.
- Current pledges fall short of achieving the RE target, more effort is needed, both for deploying RE and retiring FF capacities.
- For EE, the gap to what's required is larger than in RE. The largest potential exists in the transport sectors, largely via EVs.

RE target indicators, by scenario

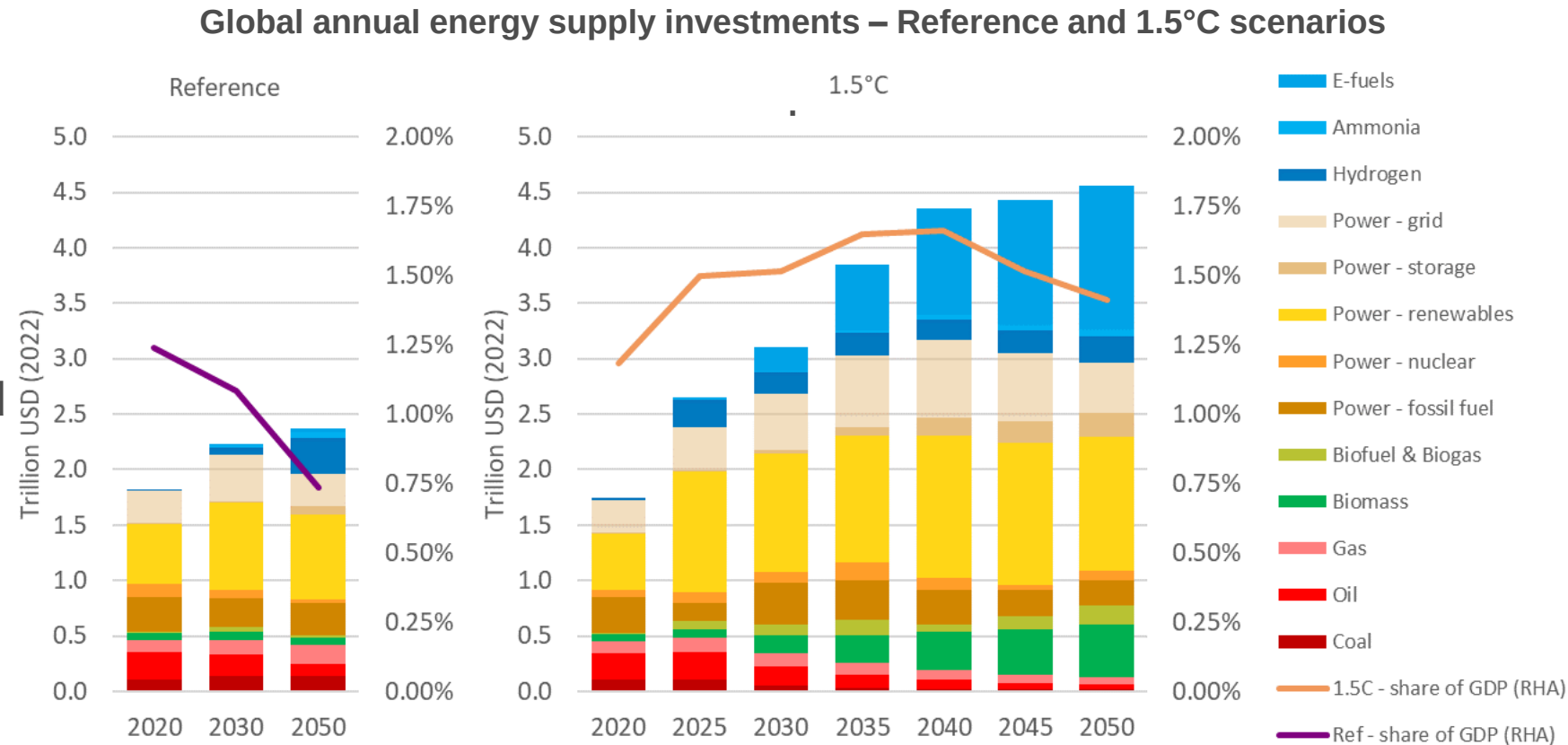


EE target indicators, by scenario



Energy supply investments are substantial, and achievable

- \$4 trillion annually by the middle of the century in the 1.5°C, up from <\$2 trillion today
- Energy supply investments as a share of GDP remain stable at around 1.5% of GDP (2000-2020: 1.3%)
- Large increase in investment needs to happen in this decade in renewables and H2 and H2-derived fuels

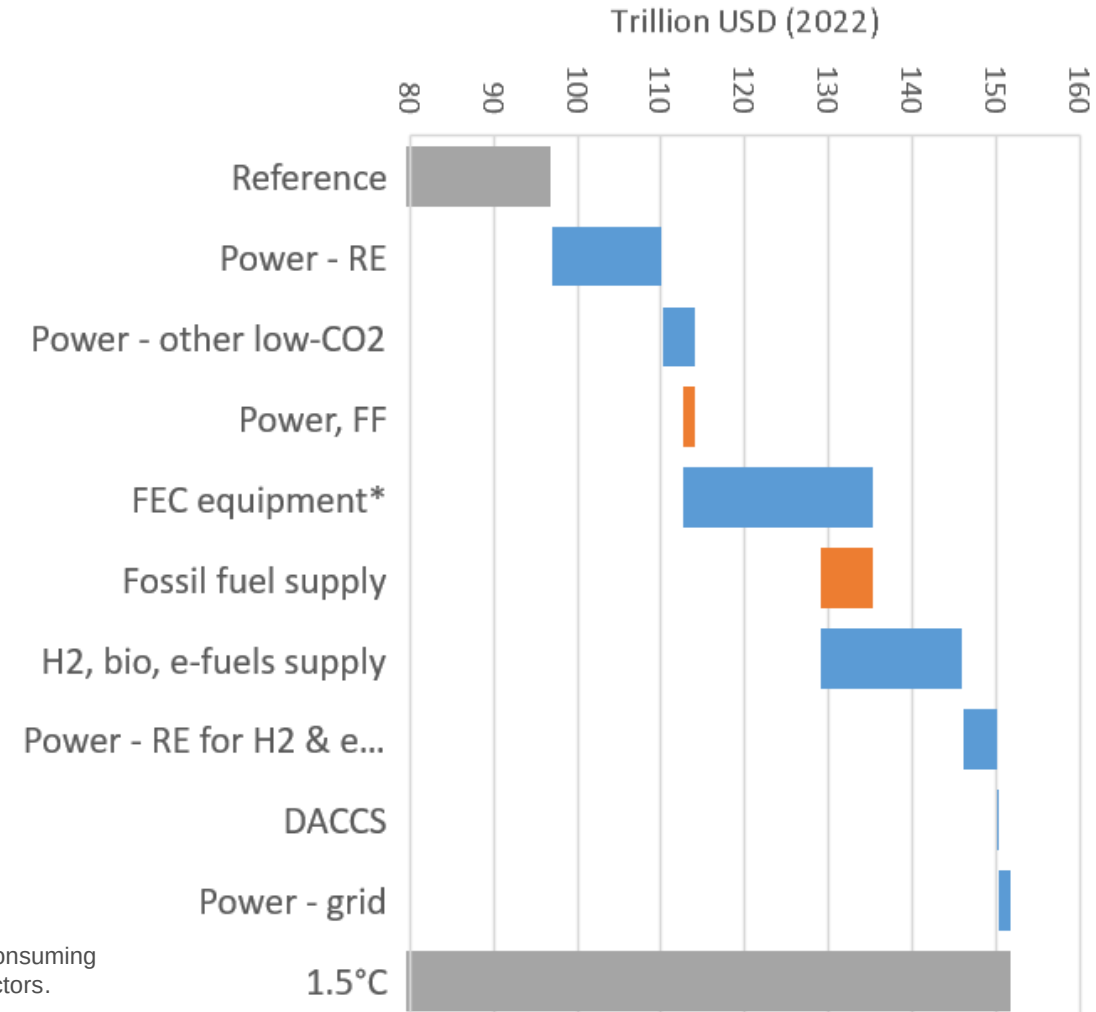


Source: GECO 2023 update (not yet published)

Large clean energy investments are offset by savings on fossil fuels in the 1.5°C scenario

Difference in cumulative (2020-2050) global energy sector investments between the Reference and 1.5°C scenario

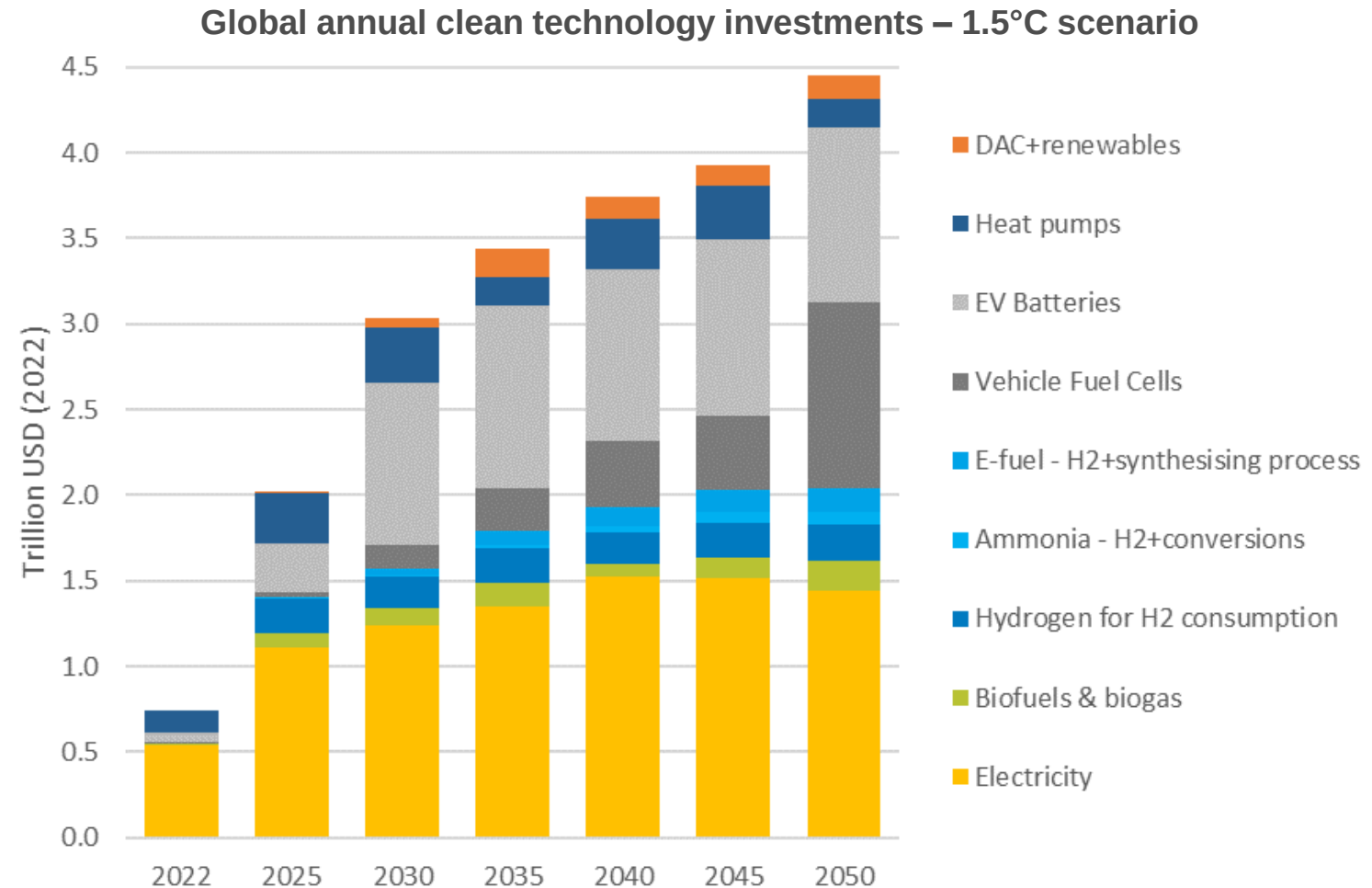
- The 1.5C needs approx. 50% more investment between today and 2050 than the Reference scenario.
- Increases in spending on renewables, more efficient end-use equipment, production on H2 and e-fuels.
- Offset by savings on the supply of fossil fuels and fossil fuel power generation



Note: "FEC equipment" refers to investments in energy-consuming equipment in the industry, transport and buildings sectors.

Clean tech investments increase 4-fold by 2030 in the 1.5°C scenario

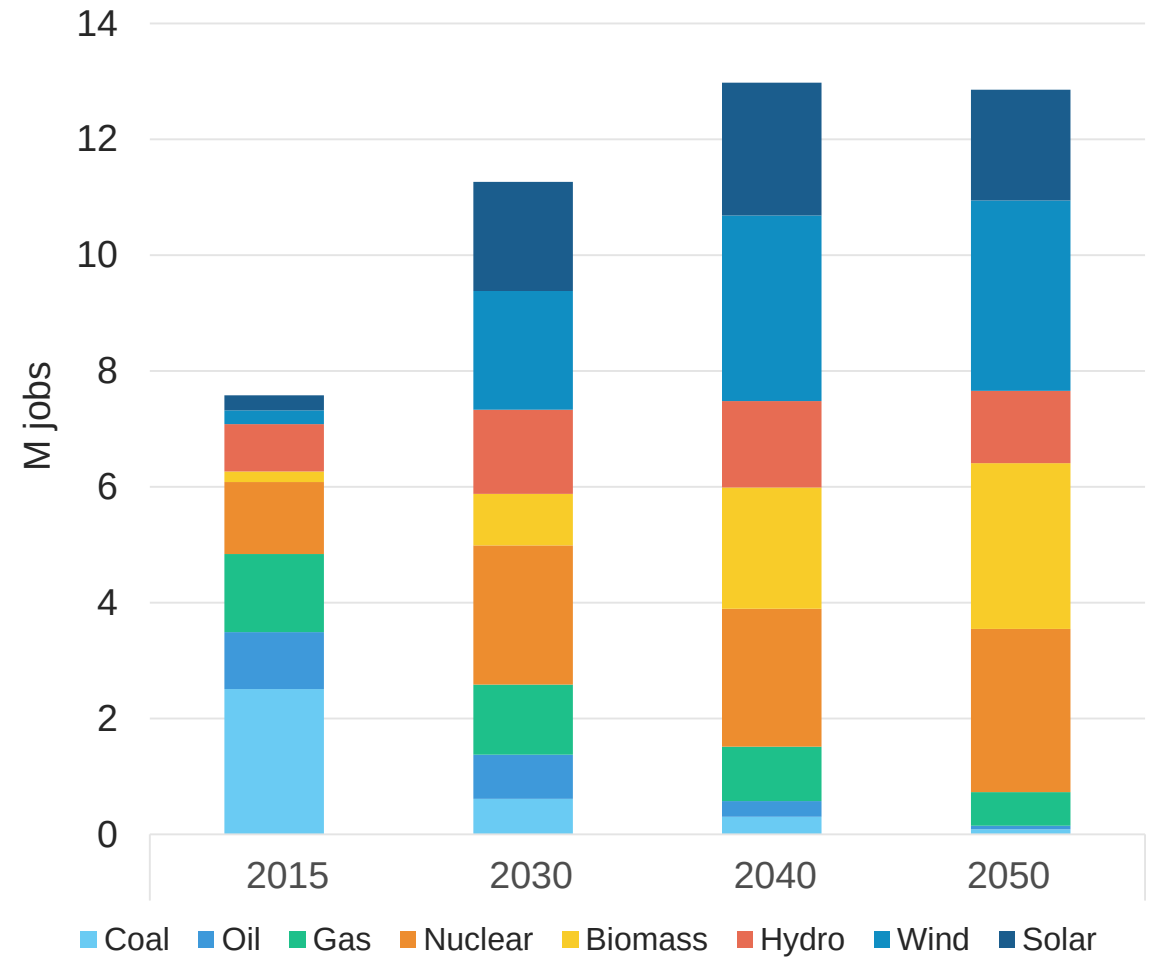
- Global annual clean tech investment increases from <\$1 trillion today to \$3 trillion in 2030
- Spending on batteries in EVs increases 16-fold to 2030, to represent the largest investment in clean technology



Source: GECO 2023 update (not yet published)

Direct jobs in power generation in the 1.5C scenario

- Global transition of jobs from fossil-fuel power generation
- Bioenergy and nuclear lead to increased job opportunities
- Expansion of wind and solar contribute the most to the creation of 4.7 million direct jobs in 2050



Investments matrix to capture sectoral linkages

- Investment by one sector (e.g. to renovate a building) implies demand for other sectors producing the capital good (e.g. construction, equipment)
- We capture these linkages through an investment matrix:
 - Originally implemented in selected sectors (Tamba et al., 2022)¹
 - Extend methodology to all sectors (Norman-López et al., 2023)² in JRC-GEM-E3
 - EU countries using Eurostat Data
 - Non-EU countries (EU27 average assumed in selected sectors) → recently updated with OECD data

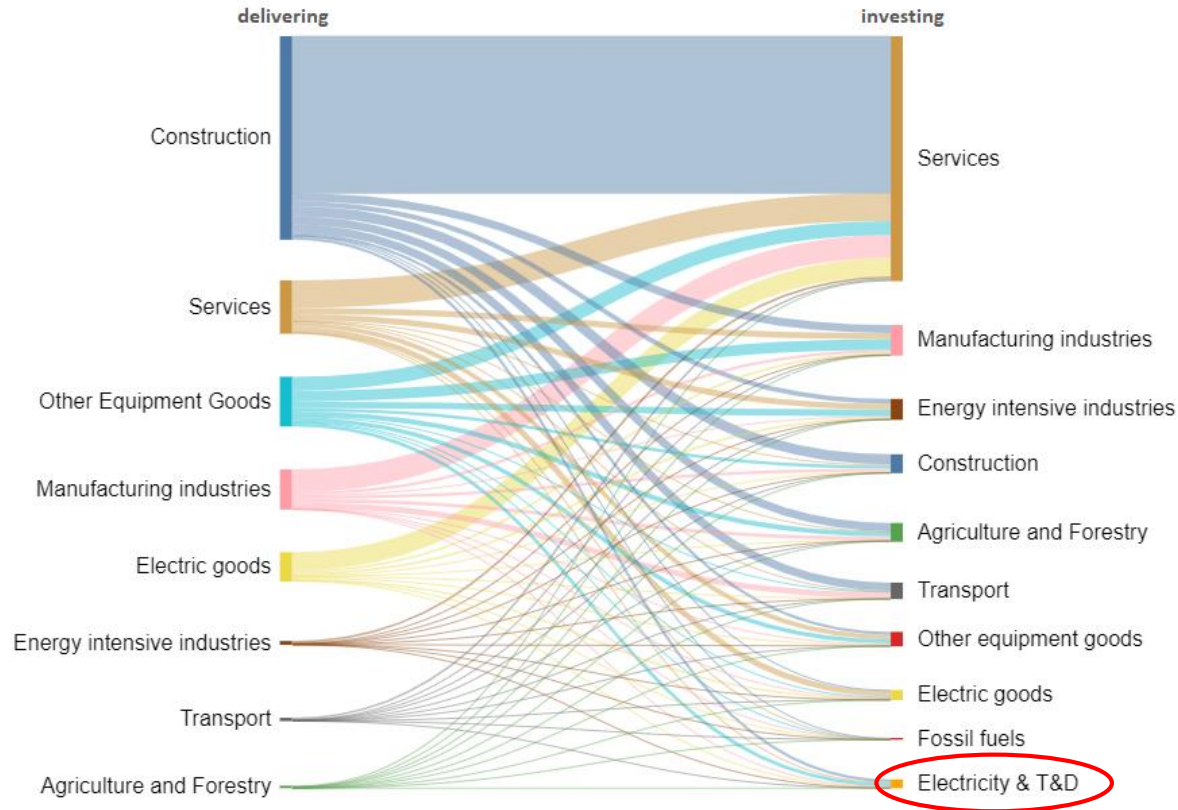
Delivering		Investing
Crops		
Electric goods		
Transport equipment		GTAP 10 Power Database
Other equipment goods	→	(GTAP sectors +
Construction		Power generation tech detail)
Transport (land)		
Market services		
Other		

¹ Economy-wide impacts of road transport electrification in the EU, Technological Forecasting and Social Change, Vol. 182, 2022, <https://doi.org/10.1016/j.techfore.2022.121803>

² Data and methods for building a disaggregated EU investment matrix. JRC Technical Report. JRC134919, Joint Research Centre. doi: 10.2760/99423

Energy investments constitute only a fraction of aggregate investment

Global investment in 2040 by delivering (left) and investing (right) sectors in the 1.5°C scenario

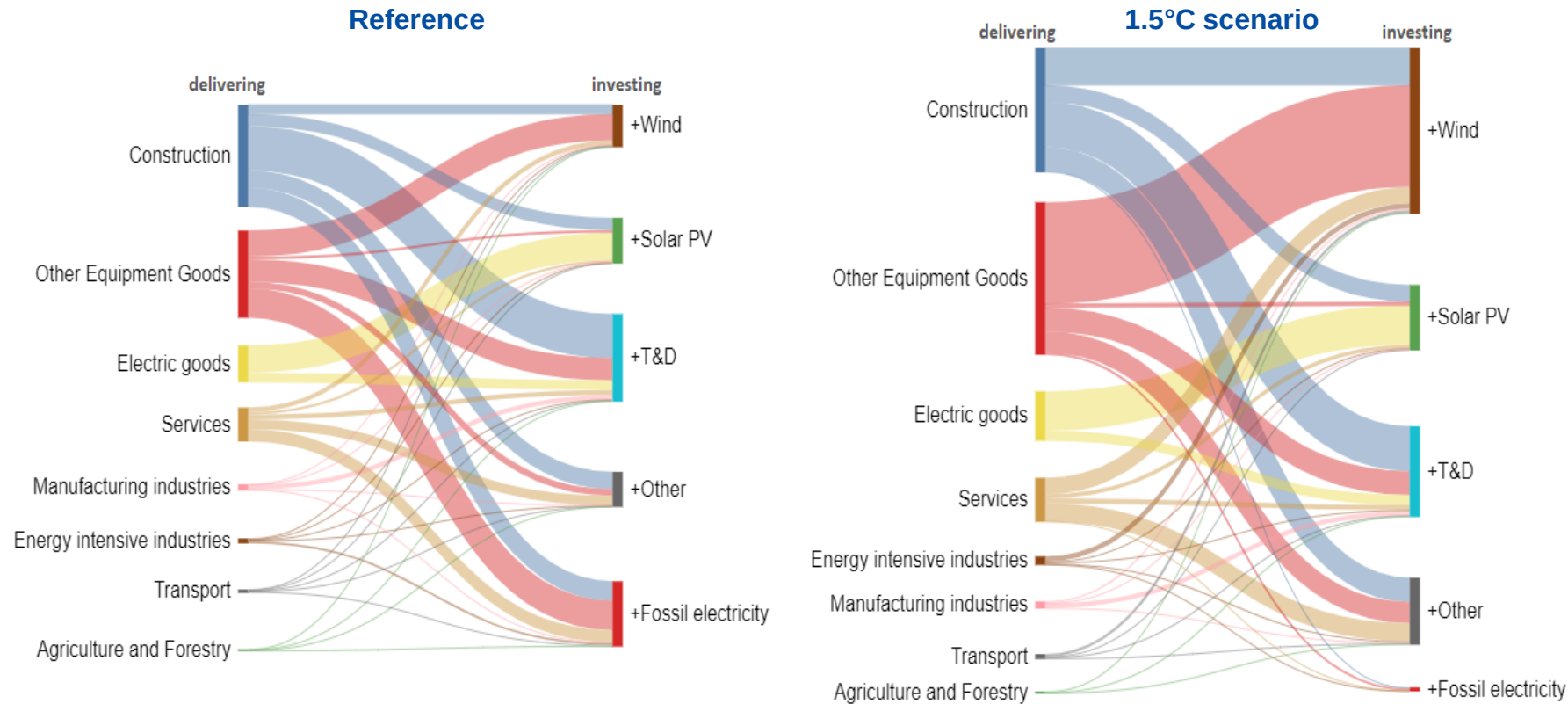


- Large relative increase in energy investment, but the additional investments constitute only a fraction of aggregate investment
- Energy investments (investing sectors) have a positive effect upstream of the value chain (delivering sectors)

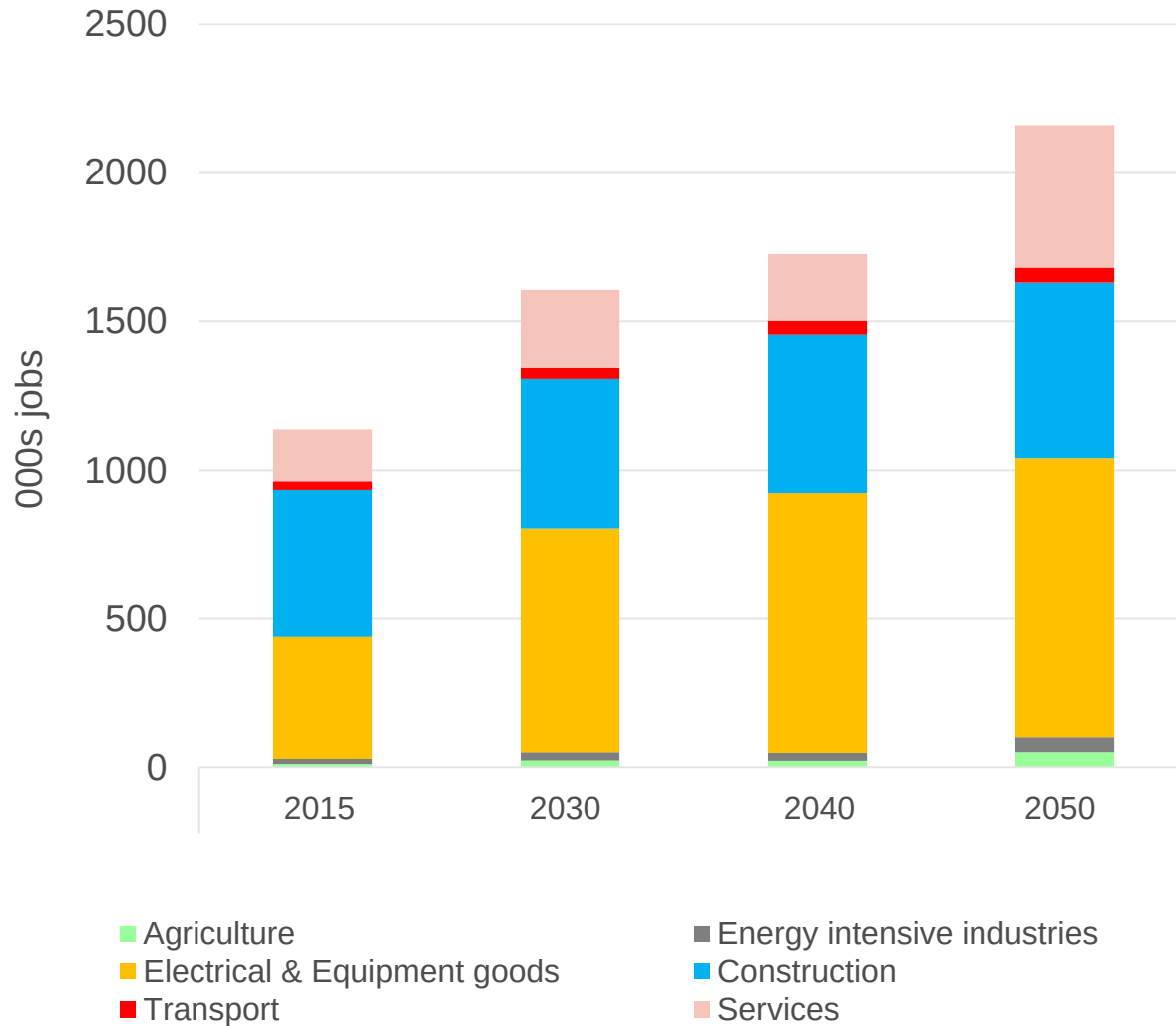
Investments in electricity generation and transmission and distribution (T&D)

- Wind power, solar PV and T&D represent the bulk of investments in the 1.5C
- Fossil fuel investments become negligible

Global investment in 2040 by delivering and investing sectors (left and right of the Sankeys) in the Reference and 1.5°C scenario



Job creation in upstream sectors from investment in the 1.5C scenario (indirect jobs)



- Investments in power generation technologies contribute differently to job creation
- Jobs in the construction sector increase due to the infrastructure expansion required
- Job creation in the electrical and equipment goods driven by the expansion of solar PV and wind in power generation

Conclusions

- **The current decade is crucial:** 1.5°C-compatible emission reductions are particularly steep, requiring a considerable increase in the deployment of low-emissions equipment
- **1.5°C is possible:** investment in energy supply is close to historical average
- Investment in low-emission technologies stimulates output. Decarbonising creates **jobs opportunities** both in the energy sector and in adjacent sectors
- + Upcoming 2024: tech cost update; investment patterns update; investment matrix non-EU countries; GTAP11 database
- Report and data available at <https://ec.europa.eu/jrc/en/geco>

Thank you

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