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science for global insight

Which clean energy pathway?

The power sector under different mitigation strategies.

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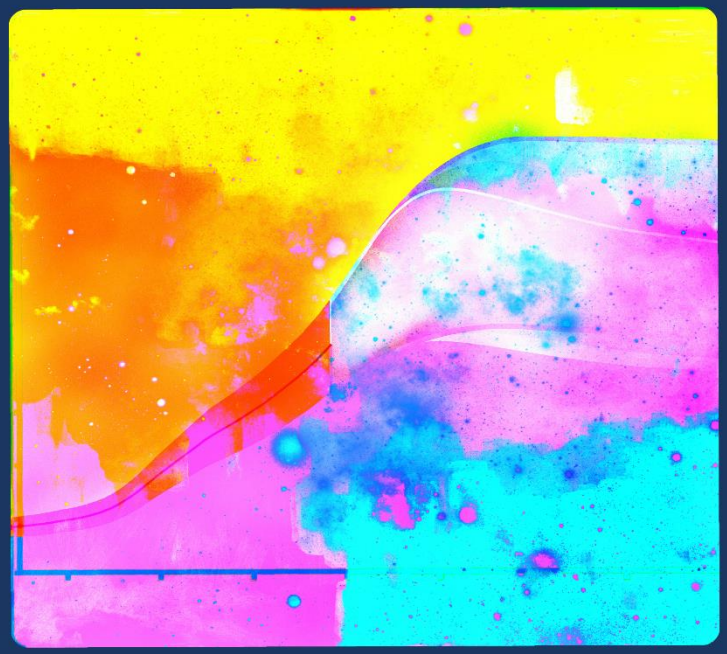
Vienna Energy Transition Forum,6 June 2019

ipcc
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

Global Warming of 1.5°C

An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.



Systems transitions

- Limiting warming to 1.5°C would require rapid, far-reaching changes on an unprecedented scale:
  - Deep emissions cuts in all sectors
  - A range of technologies
  - Behavioural changes
  - Increase investment in low carbon options

Peter Essick / Aurora Photos

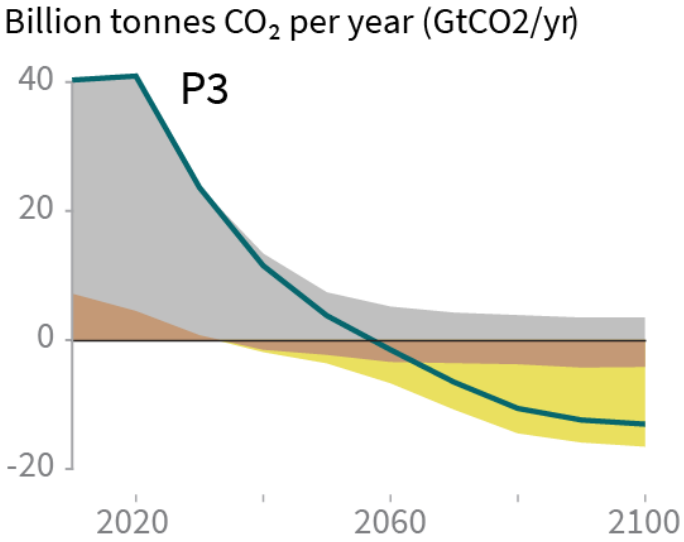
Peter Essick / Aurora Photos

Systems transitions - general trends

I. Improve energy efficiency
   Limiting final energy demand in 2050
   to +20 to -10% rel. to 2010 levels
II. Decarbonize the power sector
   (carbon-intensity of electricity about 0 or negative in 2050)
III. Electrify energy end use
   (mobility, buildings, industry)
IV. Replace residual fossil fuels with low-carbon options
   (e.g. gas for heating, petrol for driving with bio-based fuels)

- Different roles for different type of fuels

SPM3b | Characteristics of four illustrative model pathways: EXAMPLE



Fossil fuel and industry

AFOLU

BECCS

P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

(Fricko et al, 2017)

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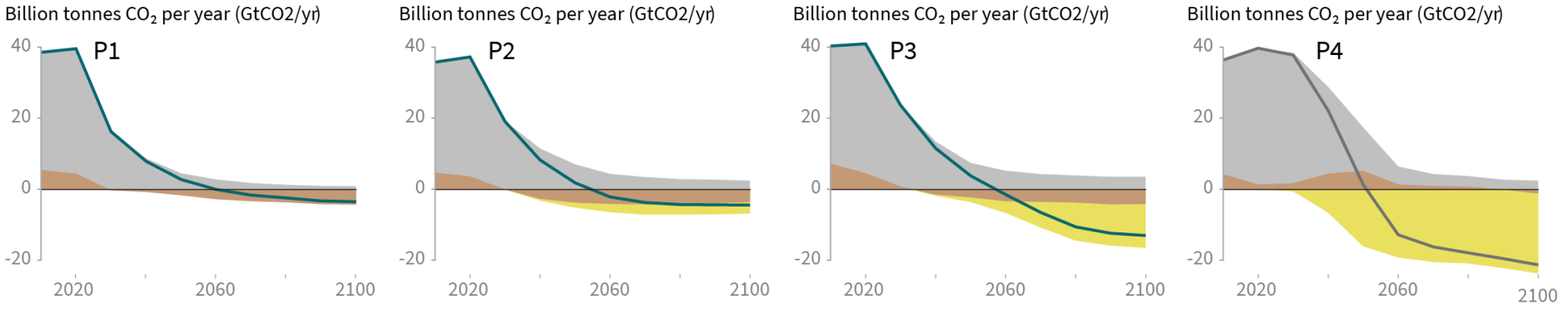
SPM3b | Characteristics of four illustrative model pathways

Fossil fuel and industry AFOLU BECCS



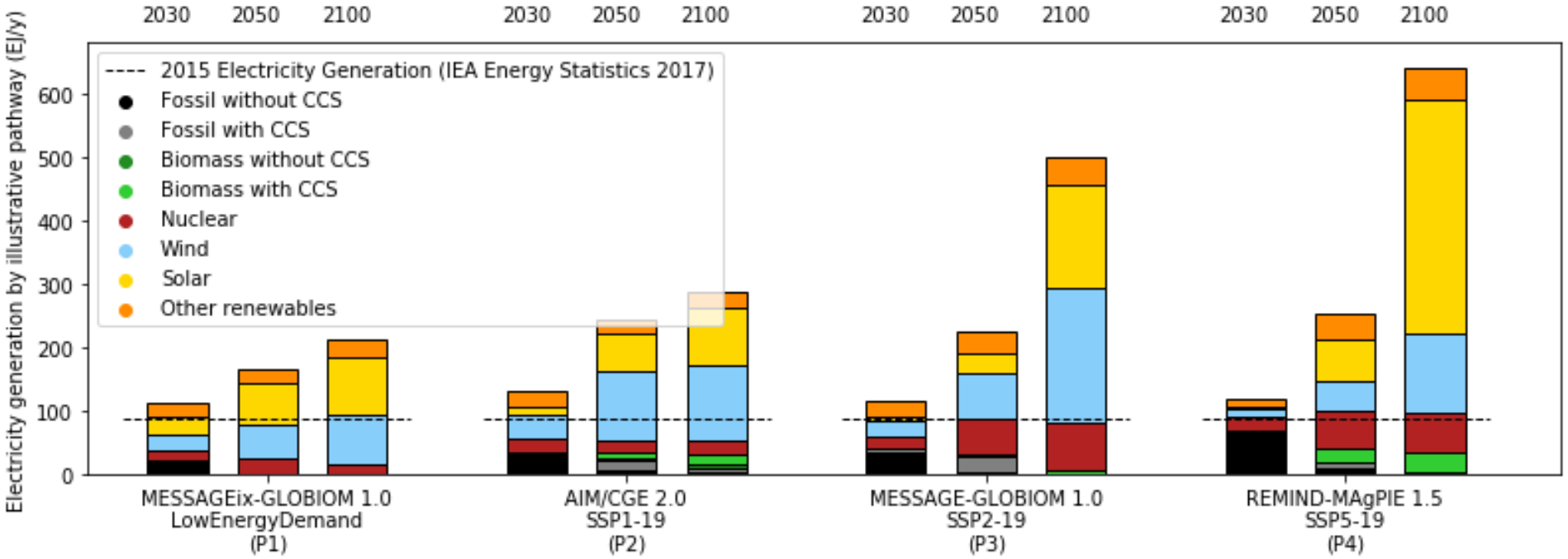
P1: A scenario in which social, business, and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A down-sized energy system enables rapid decarbonisation of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

P2: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

P4: A resource and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

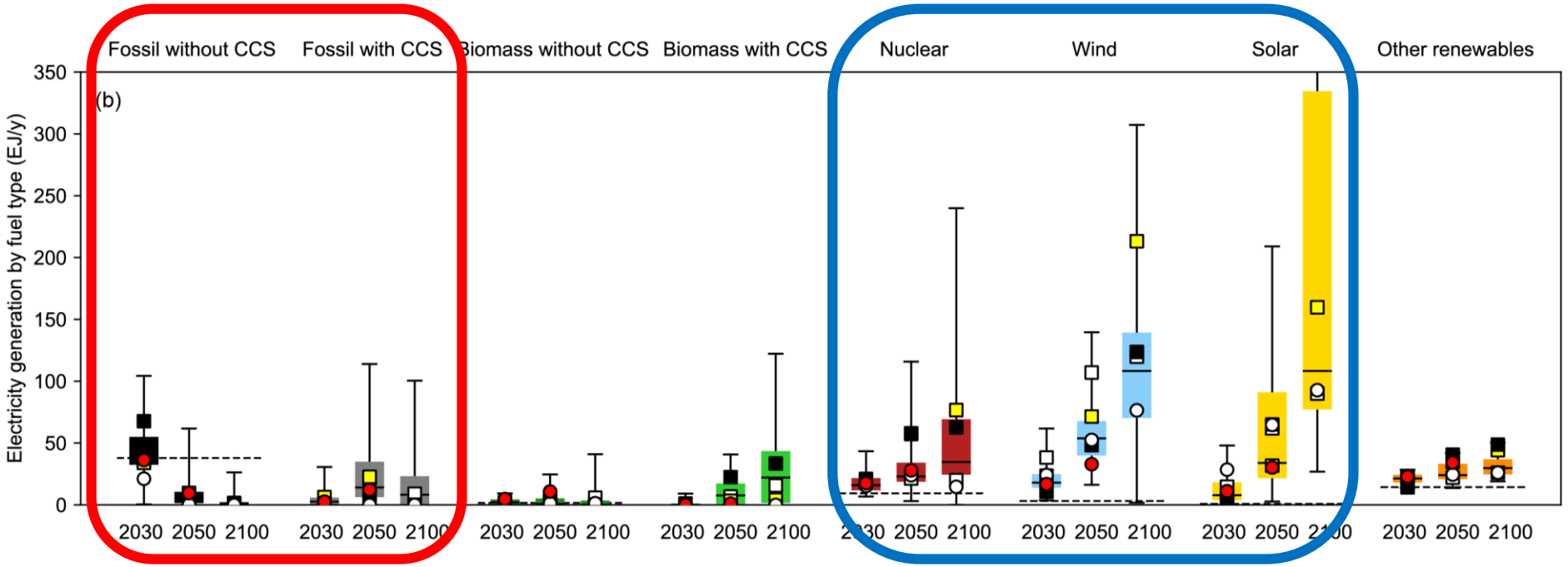
Energy system transitions – 1.5C
Global electricity generation



- Rapid reductions of fossil fuels: coal the most, gas the least
- Limited amount of fossil CCS (predominantly gas)
- Solar, wind gain the most

SR1.5 Chap. 2 Fig. 2.15

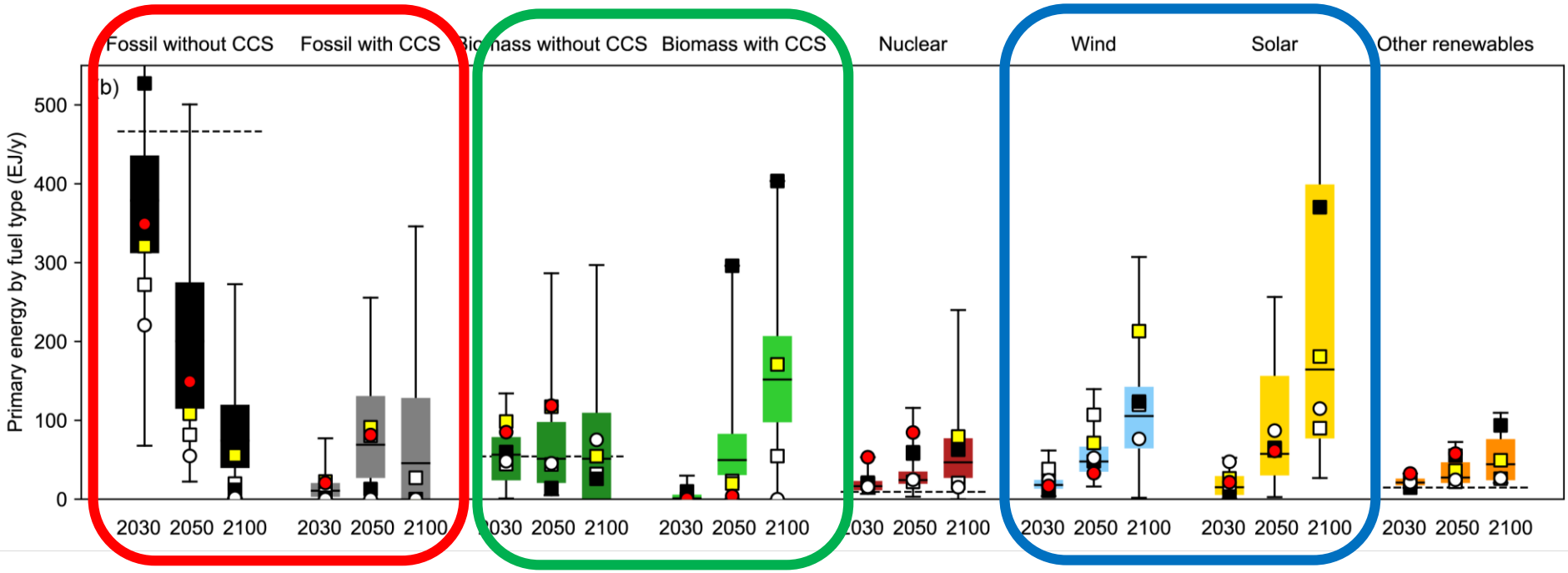
Electricity system transitions 1.5C
Full decarbonisation by mid-century



- Gas supplies 3-11% of electricity (depend. CCS)
- Coal is phased out as source for electricity (0-2%)
- Renewables supply 70-85% of electricity

SR1.5 Chap. 2 Fig. 2.16

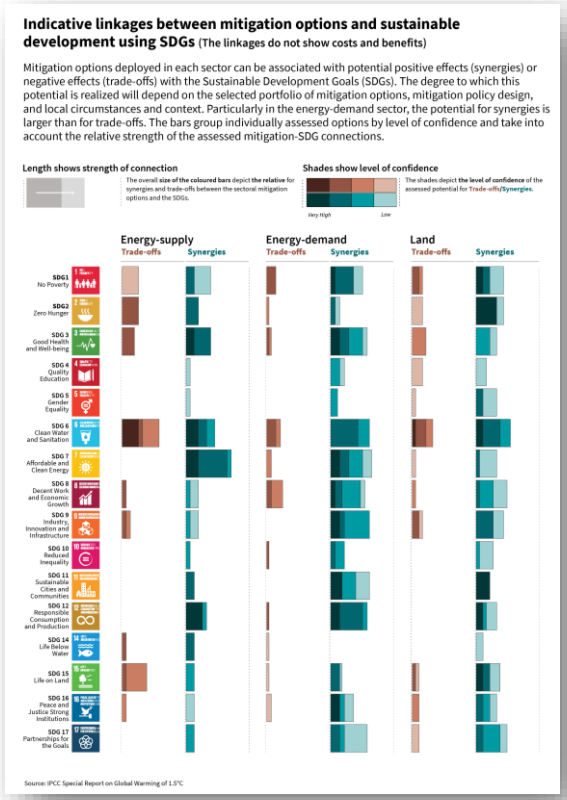
Energy system transitions – 1.5C
Global primary energy



- Rapid reductions of fossil fuels: coal the most, gas the least
- Limited amount of fossil CCS (predominantly gas)
- Solar, wind, bioenergy with CCS gain the most

SPM4 | Indicative linkages between mitigation and sustainable development using SDGs

(the linkages do not show costs and benefit)



Three aggregated sectors

illustrating different mitigation strategies:

- Energy supply-side measures
- Energy demand-side measures
- Land-based measures

Length shows strength of connection

The overall size of the coloured bars depict the relative for synergies and trade-offs between the sectoral mitigation options and the SDGs.

Shades show level of confidence

The shades depict the level of confidence of the assessed potential for **Trade-offs/Synergies**.

Very High Low

SPM4 | Indicative linkages between mitigation and sustainable development using SDGs

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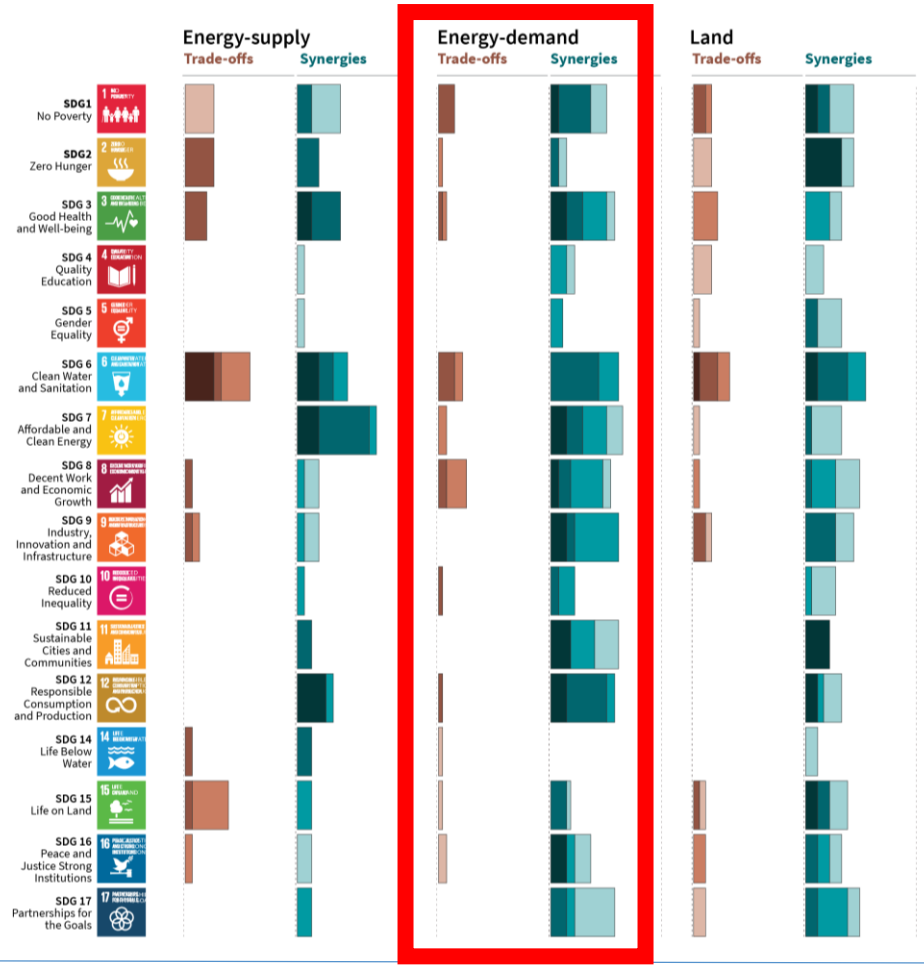
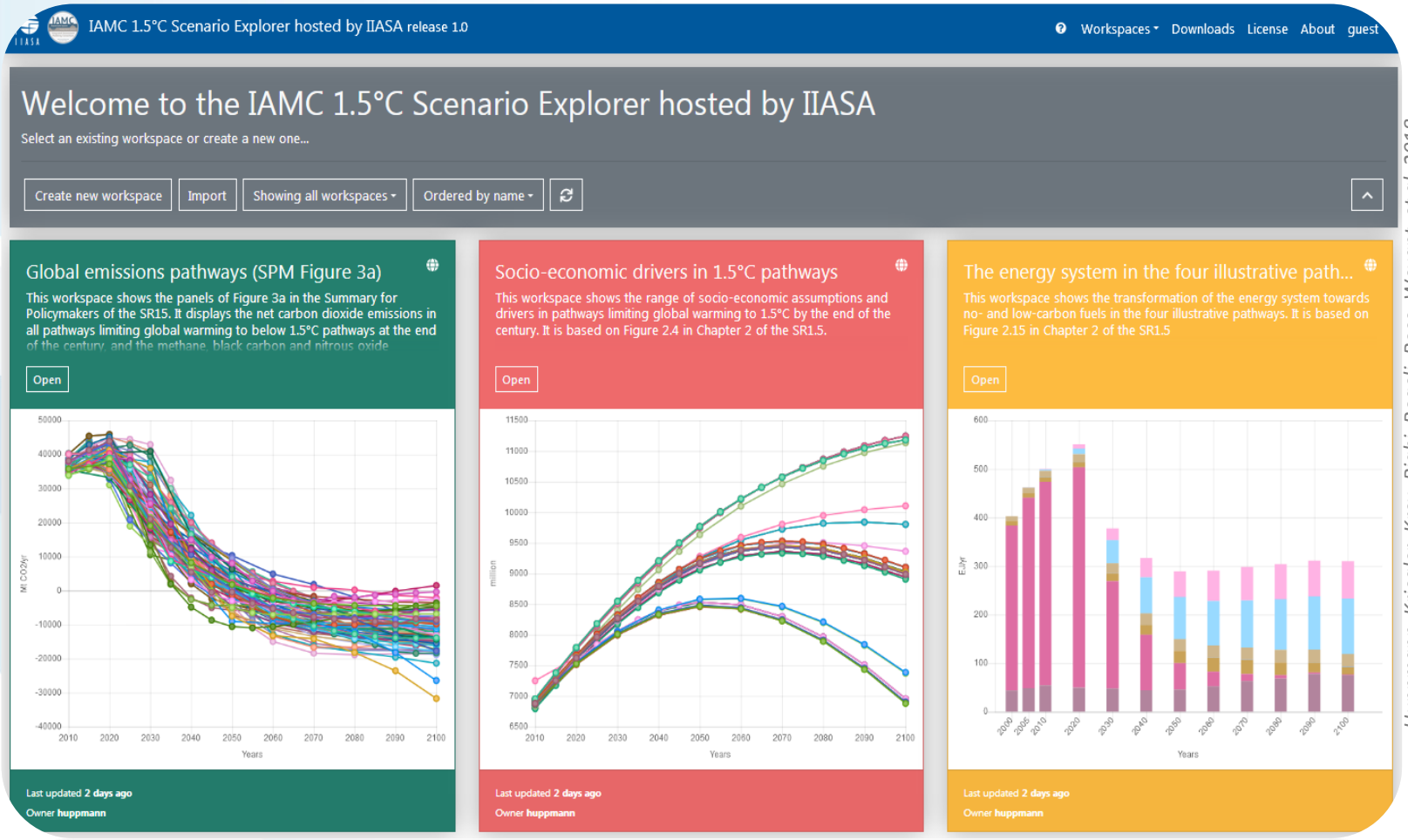


Climate change mitigation and SDGs

- More potential synergies than trade-offs with the SDGs have been identified
- Particularly strategies focussing on **energy-demand** show many synergies
- Potential trade-offs do not have to materialize and can be resolved with **careful management** and policies
- Choices about the **mitigation portfolio** can have an important effect on the SDGs

1.5°C Scenario Explorer

The underlying data is available online, with "workspaces" to manage figures & data tables, and pre-defined panels replicating SR15 figures



Huppmann, Kriegler, Krey, Riahi, Rogelj, Rose, Weyant et al, 2018

Visit the Scenario Explorer at https://data.ene.iiasa.ac.at/iamc-1.5c-explorer

ENGAGE project

- **E**xploring **N**ational and **G**lobal **A**ctions to reduce **G**reenhouse gas **E**missions
- H2020 project, 28 global partners
- Develop new emission pathways
  - Reflect Paris Agreement
  - Multidimensional feasibility
- Stakeholder process
  - First stakeholder meeting in Vienna on 19 Sept 2019

Thank you!

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