Energy Technology Perspectives 2017

The Role of CCS in Deep Decarbonisation Scenarios

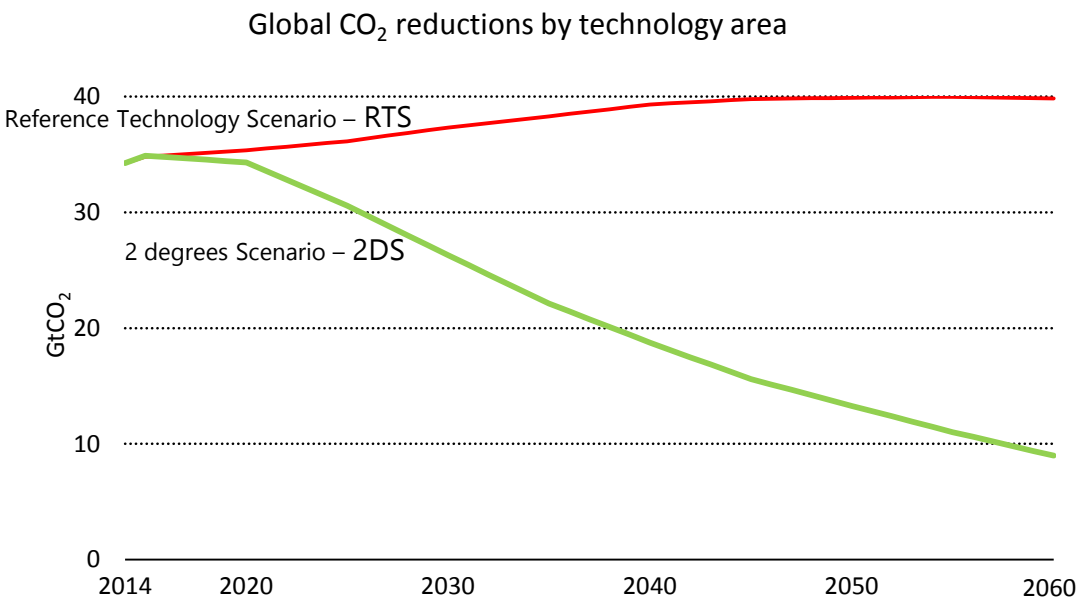
Dr. Uwe Remme, IEA

International Energy Workshop, 19 June 2018, Gothenburg

IEA

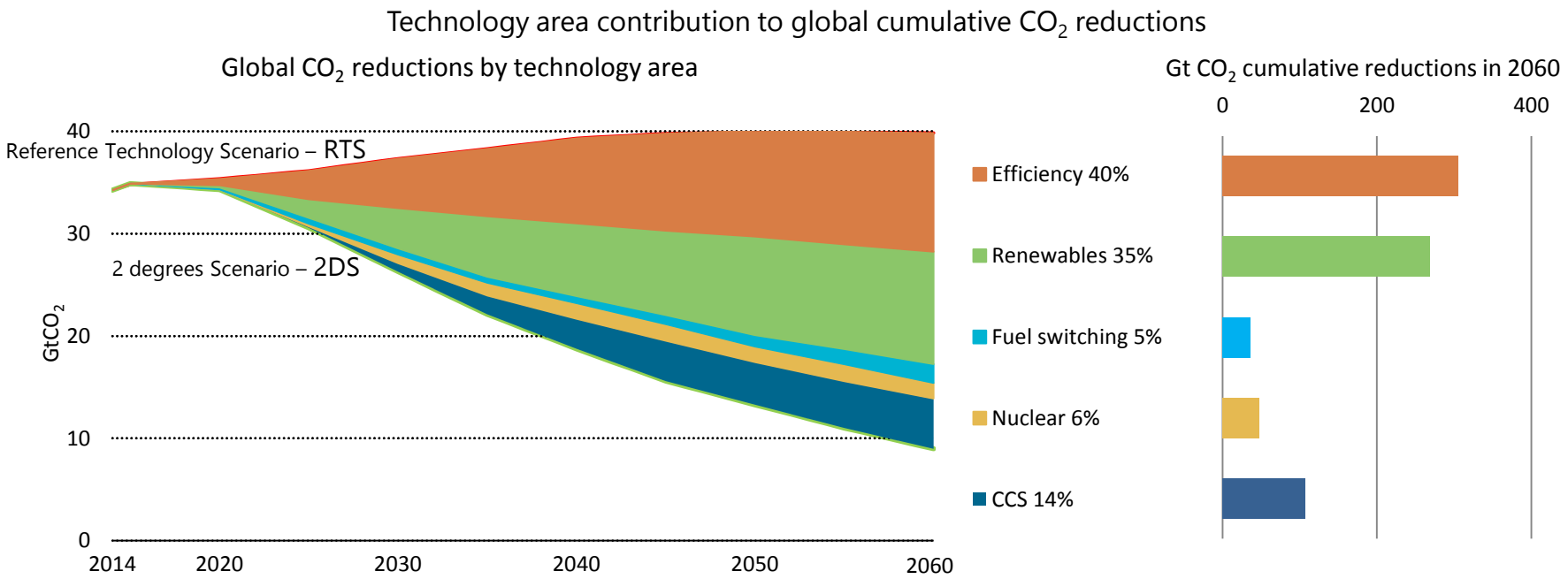
How far can technology take us?

Technology area contribution to global cumulative CO_2 reductions



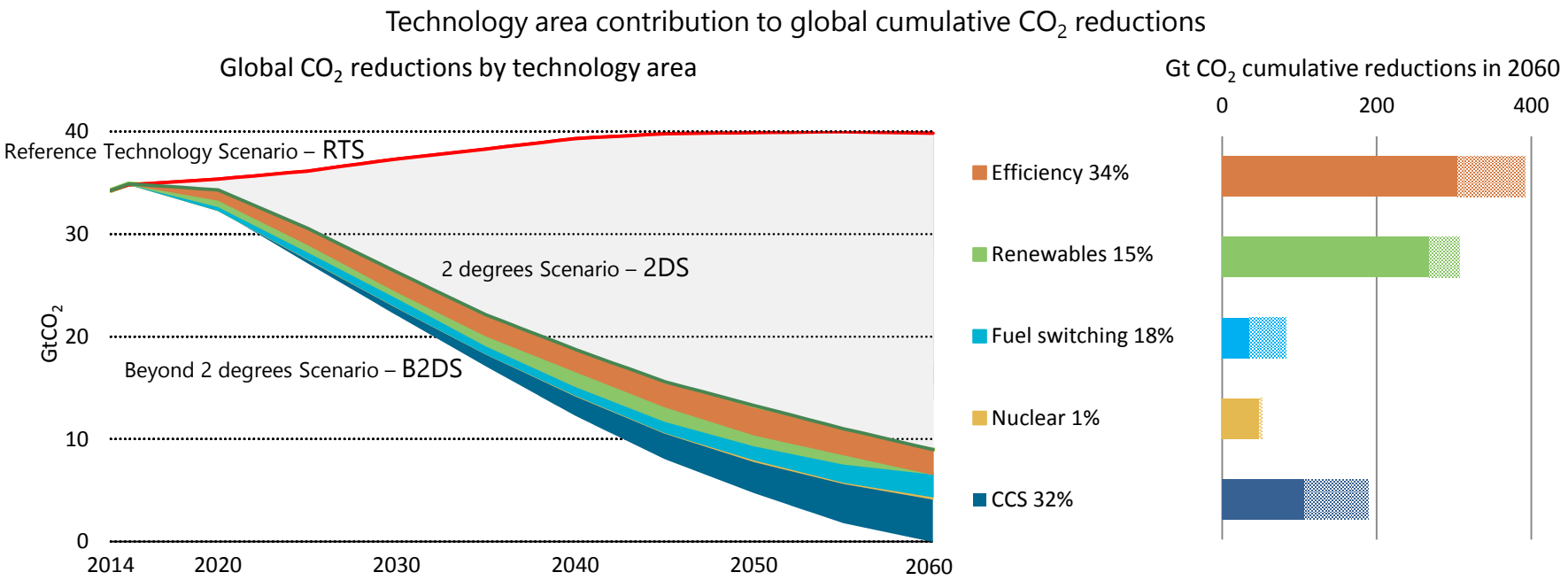
Pushing energy technology to achieve carbon neutrality by 2060 could meet the mid-point of the range of ambitions expressed in Paris.

How far can technology take us?



Pushing energy technology to achieve carbon neutrality by 2060 could meet the mid-point of the range of ambitions expressed in Paris.

How far can technology take us?



Pushing energy technology to achieve carbon neutrality by 2060 could meet the mid-point of the range of ambitions expressed in Paris.

Tracking Clean Energy Progress: only 4 technologies “on track”

Power

- Renewable power
  - Solar PV
  - Onshore wind
  - Offshore wind
  - Hydropower
  - Bioenergy
  - Geothermal
  - Concentrating solar power
  - Ocean
- Nuclear power
- Natural gas-fired power
- Coal-fired power
- CCS in power

Industry

- Cement
- Chemicals
- Steel
- Aluminum
- Pulp and paper
- CCS in industry

Transport

- Electric vehicles
- International shipping
- Fuel economy
- Trucks
- Transport biofuels
- Aviation
- Rail

Buildings

- Building envelope
- Heating
- Cooling
- Lighting
- Appliances & equipment
- Data centres and networks

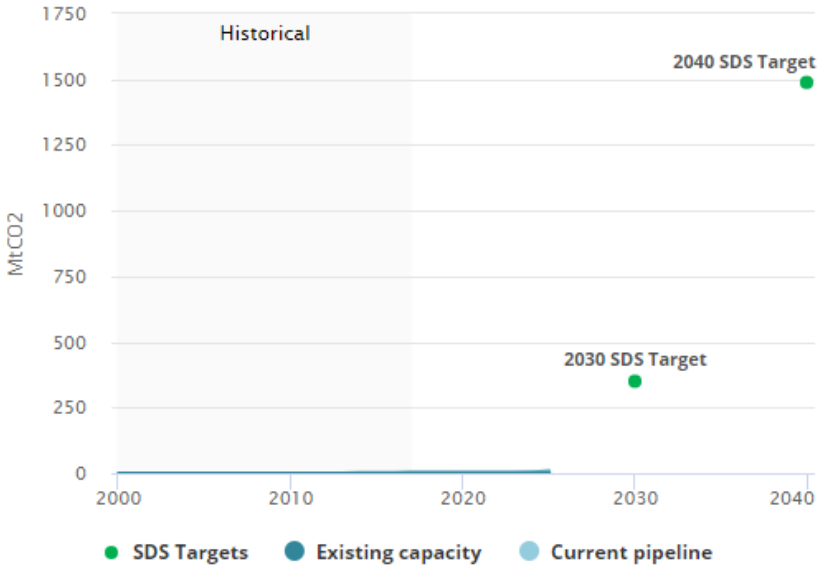
Energy Integration

- Energy storage
- Smart grids
- Demand response
- Digitalization
- Hydrogen
- Renewable heat

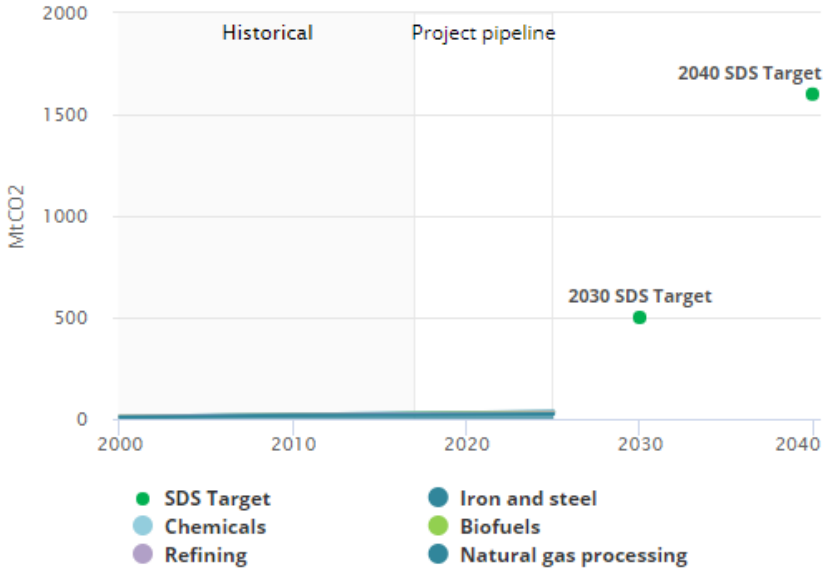
Source: IEA (2018), *Tracking Clean Energy Progress, www.iea.org/tcep*

Large-scale CCS projects power generation and fuel transformation

Power generation

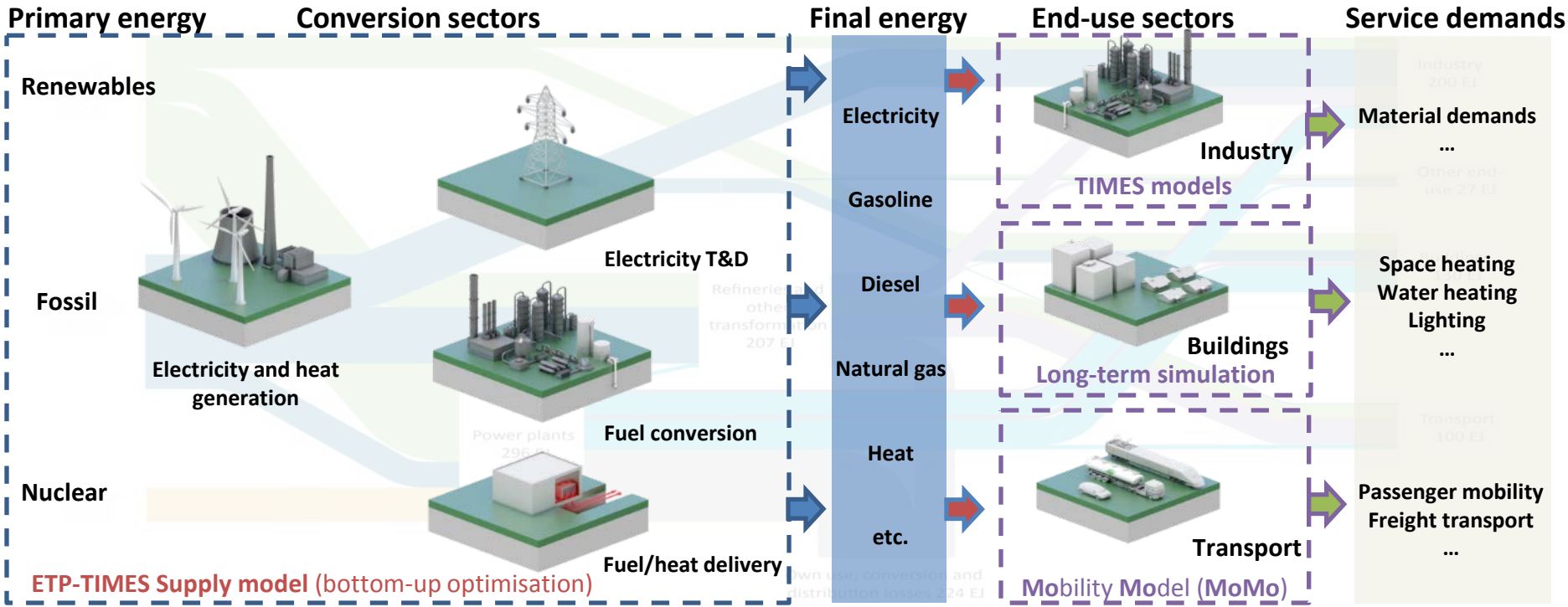


Industry and fuel transformation



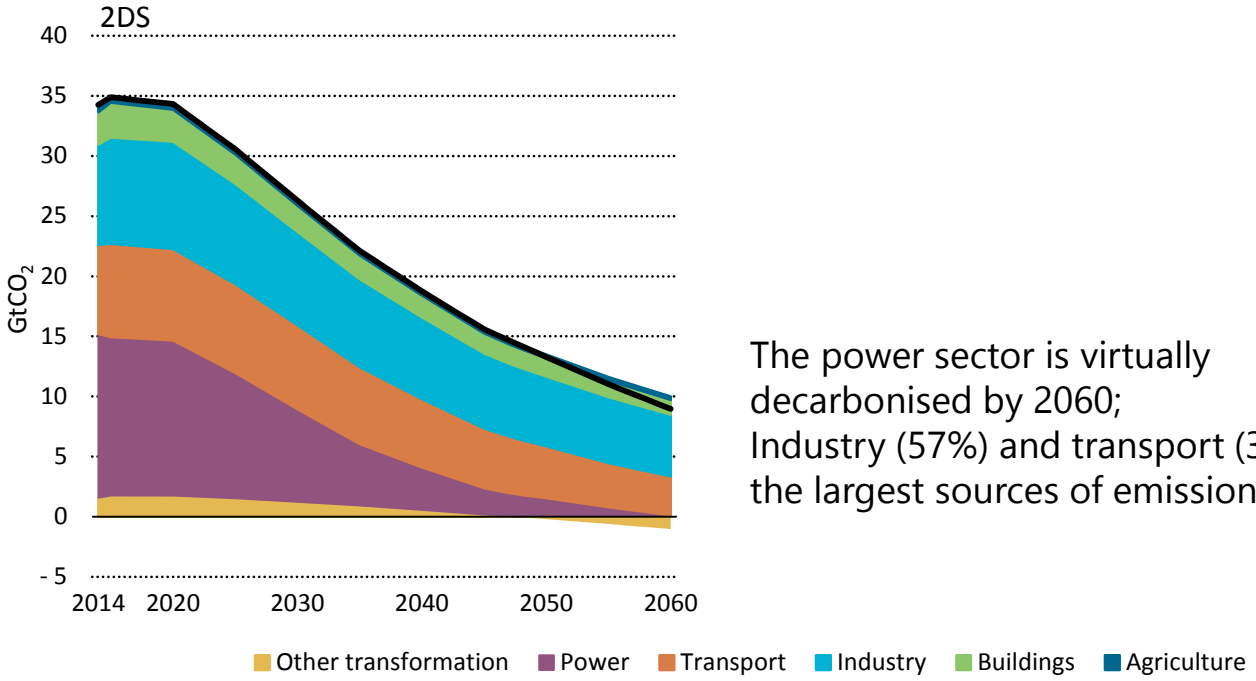
Carbon capture, utilisation and storage remains far off track from the 2030 goal.

ETP modelling framework



- Four soft-linked models based on simulation and optimisation modelling methodologies
- Model horizon: 2014-2060 in 5 year periods
- World divided in 28-42 model regions/countries depending on sector
- For power sector linkage with TIMES dispatch model for selected regions to analyse electricity system flexibility

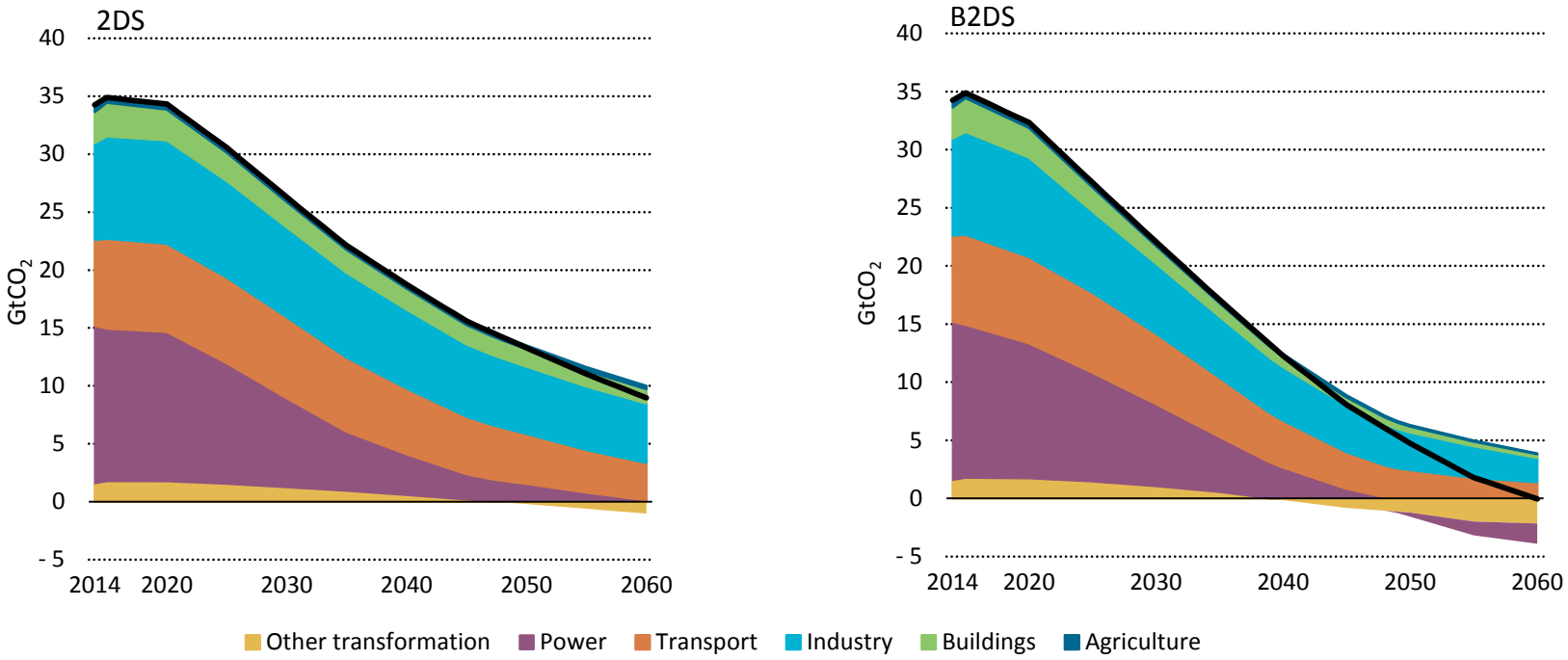
Remaining CO_2 emissions in the 2DS and B2DS



The power sector is virtually decarbonised by 2060;
Industry (57%) and transport (36%) are the largest sources of emissions in 2060

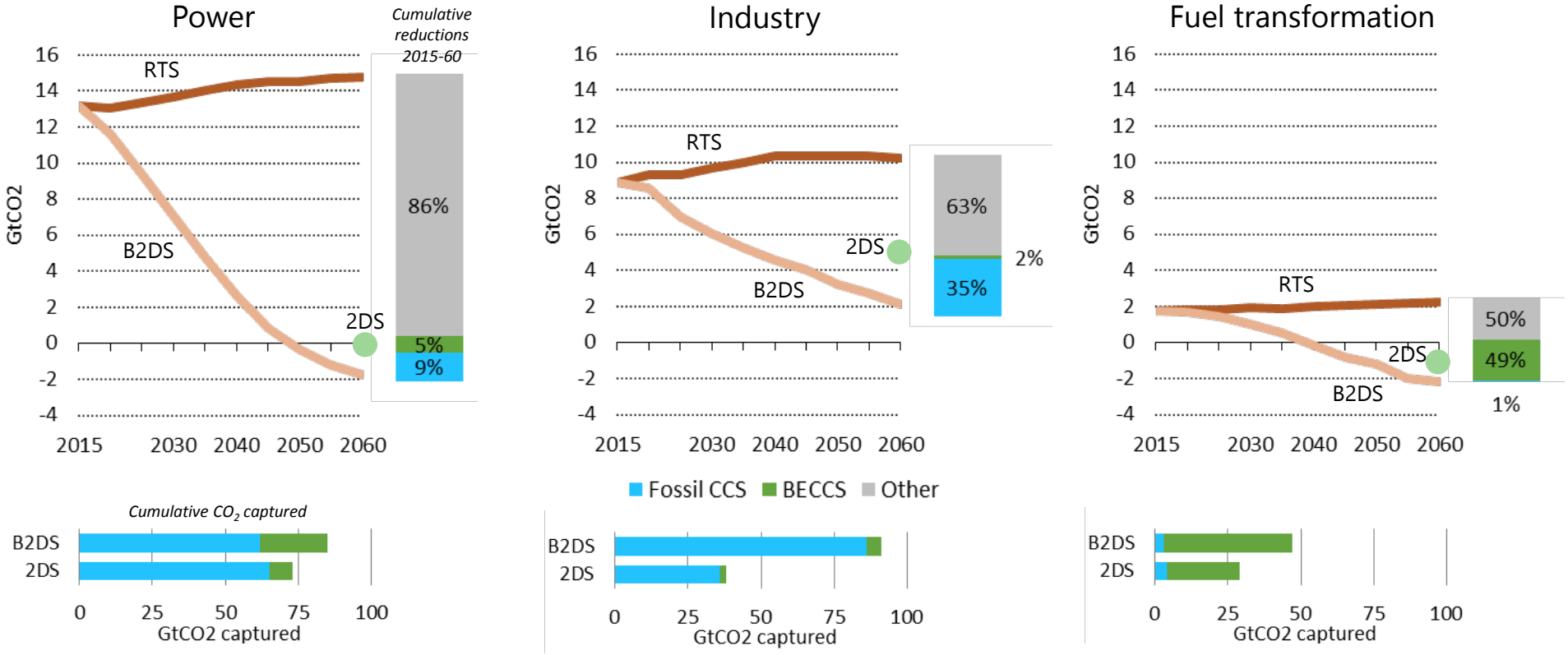
The remaining CO_2 emissions in industry and power must be targeted for the B2DS
Negative emissions are necessary to achieve net-zero emissions in 2060

Remaining CO_2 emissions in the 2DS and B2DS



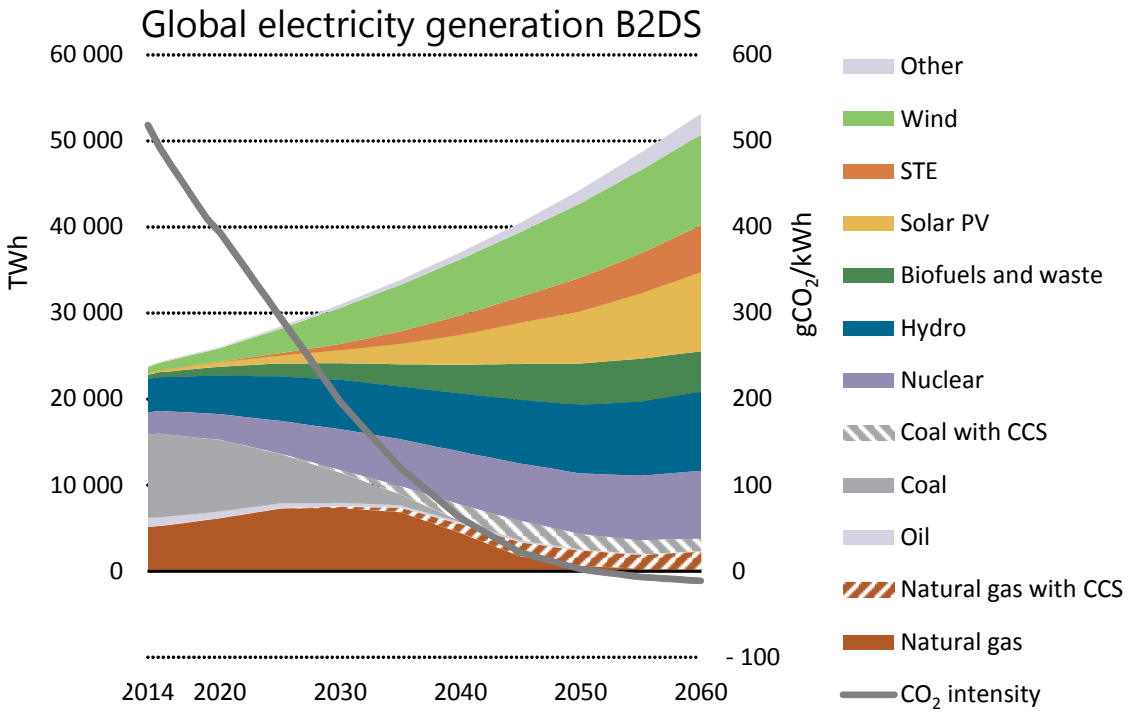
The remaining CO_2 emissions in industry and power must be targeted for the B2DS
Negative emissions are necessary to achieve net-zero emissions in 2060

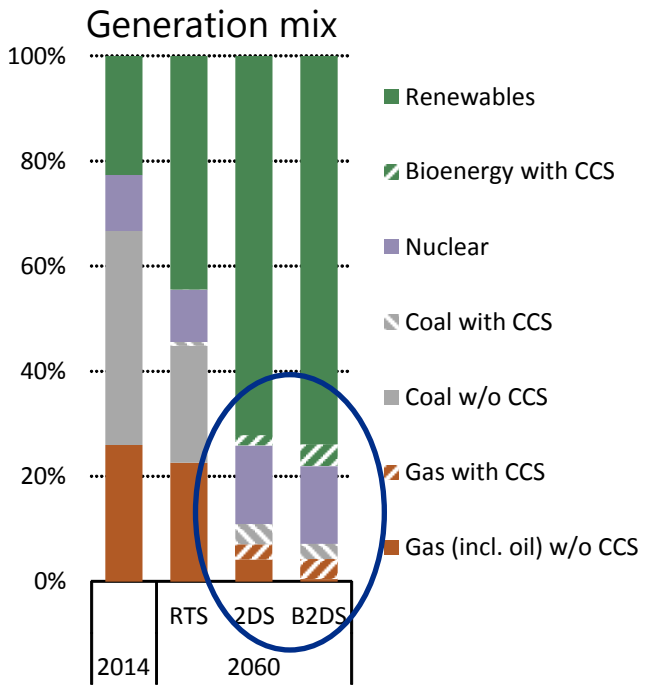
Role of CCS in CO_2 emission reductions in the B2DS



CCS crucial for tackling process emissions in industry, while BECCS in power and fuel transformation provides negative emissions to offset hard-to-decarbonise parts in transport and industry.

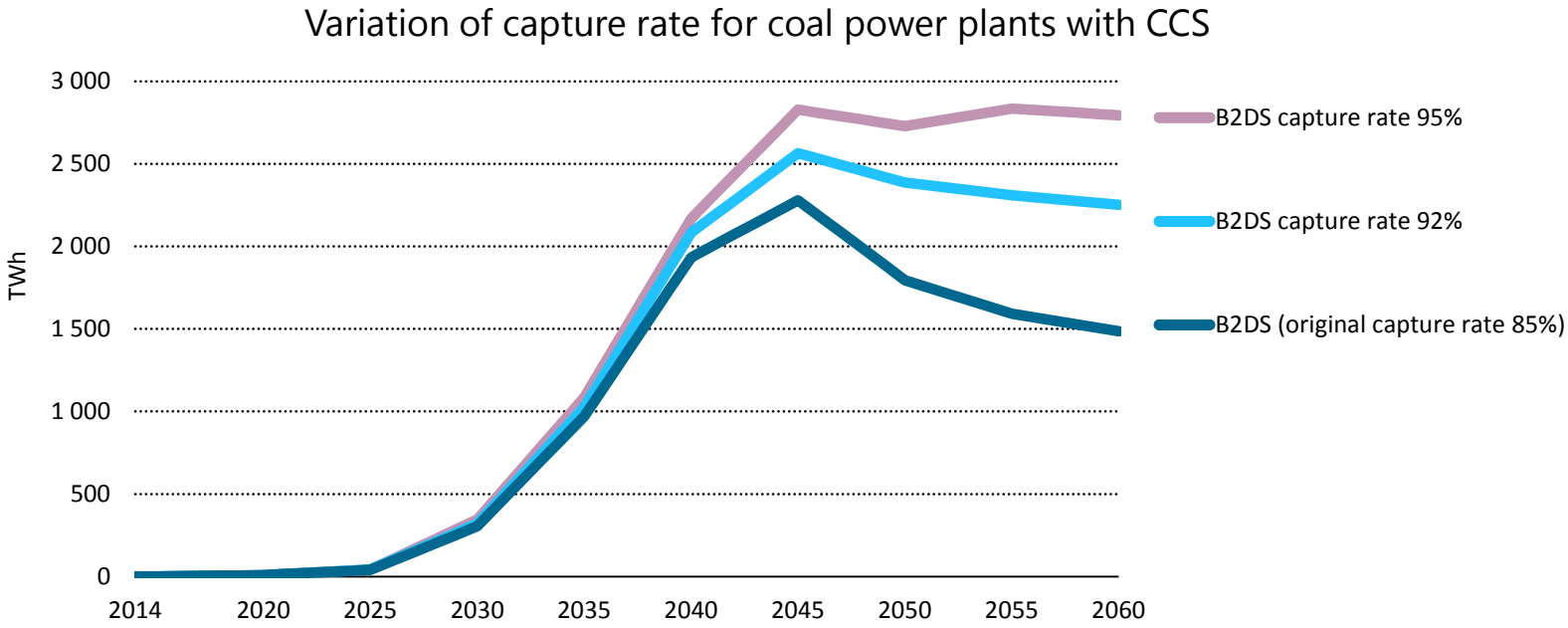
Decarbonising electricity





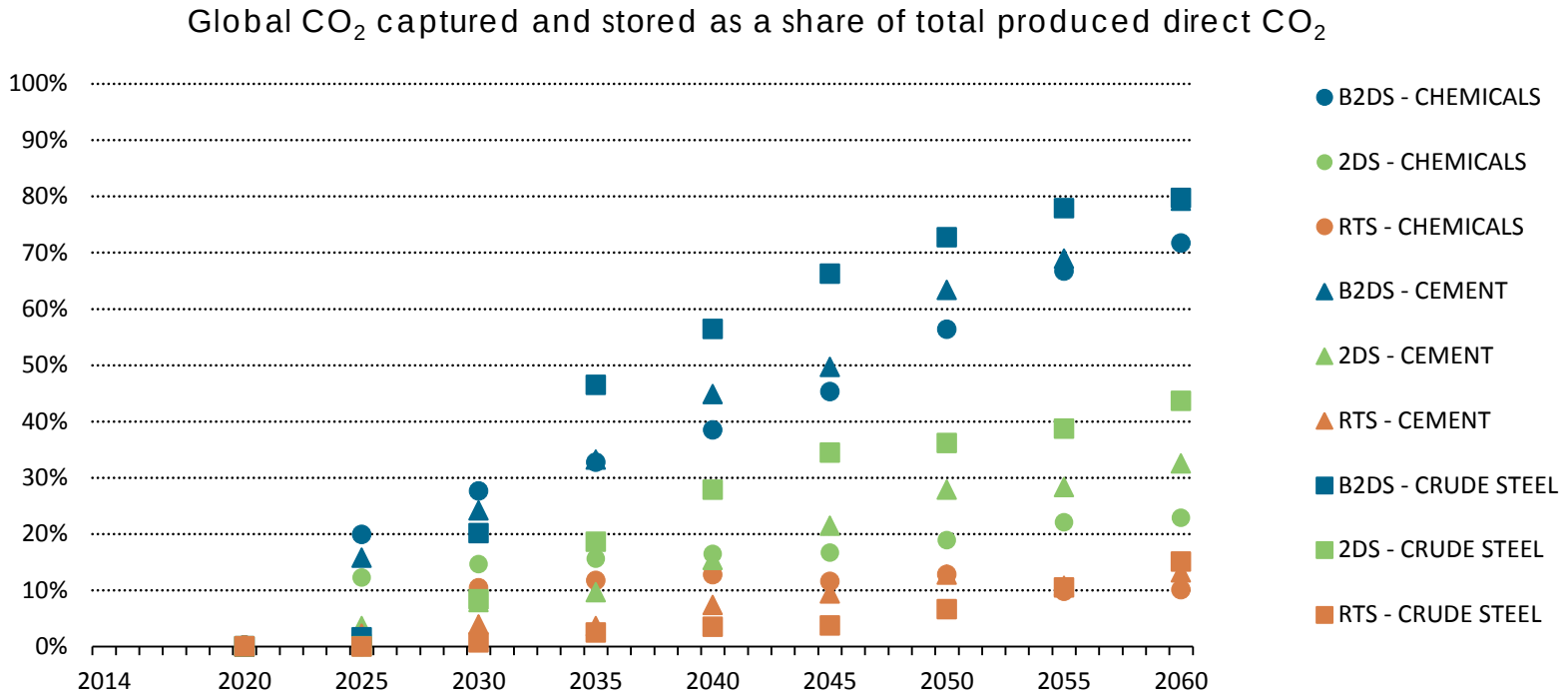
Renewables dominate electricity generation in the 2DS and B2DS. Thanks to bioenergy with CCS, the average global CO_2 intensity falls below zero after 2050.

With higher capture rates, CCS with coal gets more hours



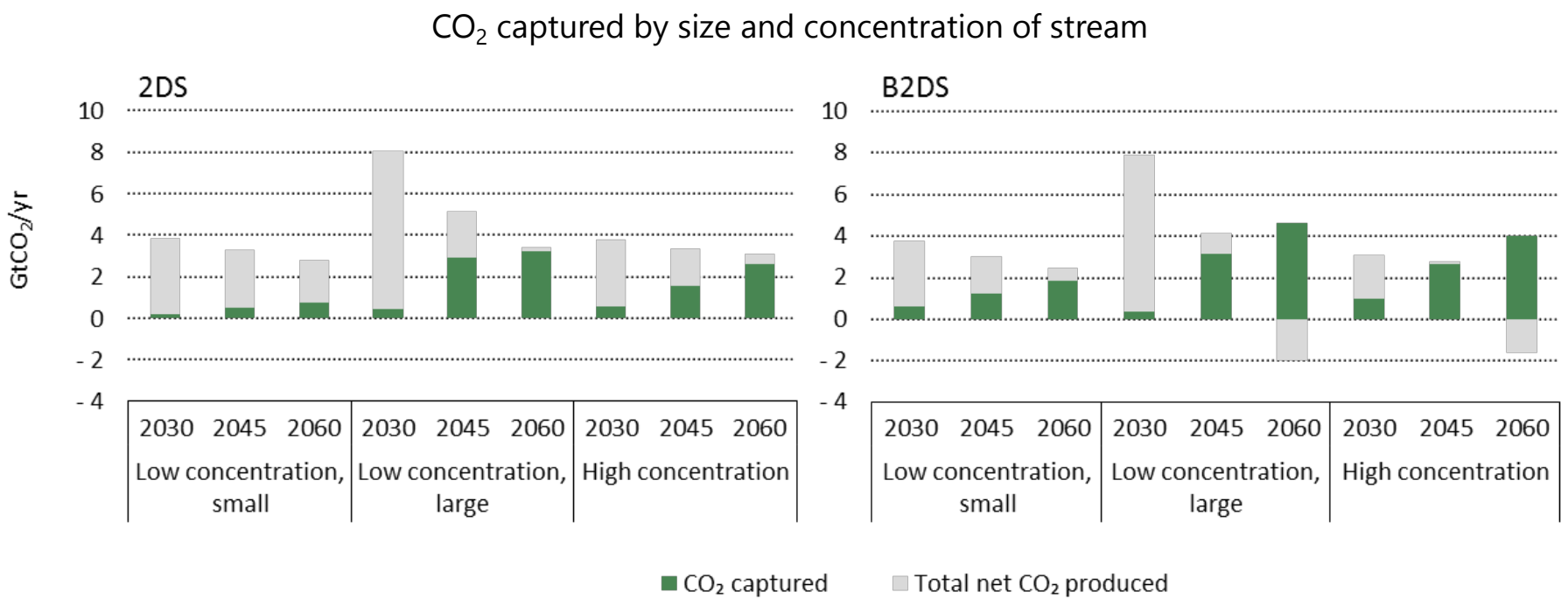
The B2DS calls for higher capture rates lowering the remaining emissions from generation with fossil CCS.

CCS: a cross-cutting strategy of increasing importance in B2DS



Key energy-intensive industrial sectors approach the 70-80% level of CO_2 emitted being captured and stored by 2060 in the B2DS

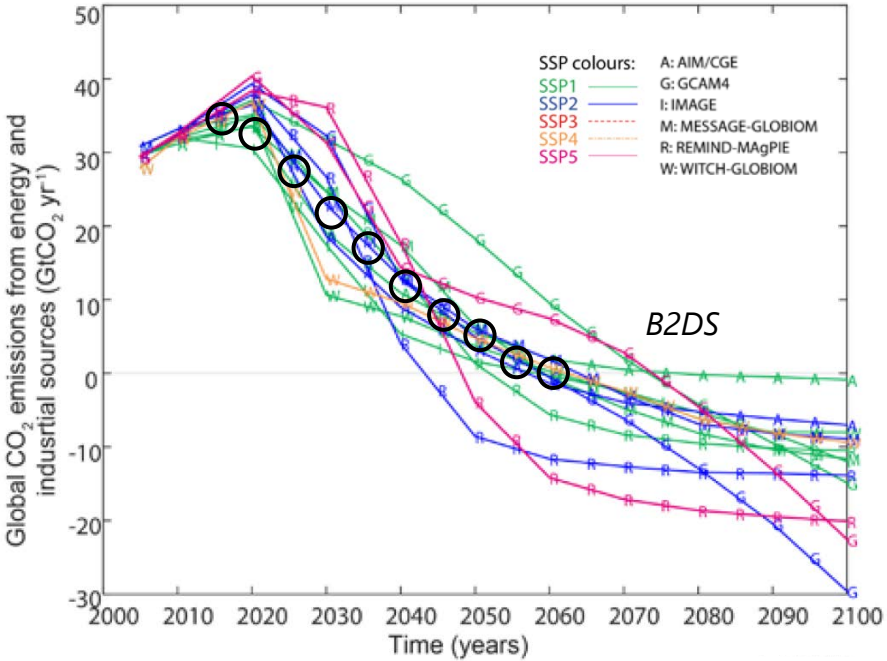
More CCS in B2DS, but from smaller sources



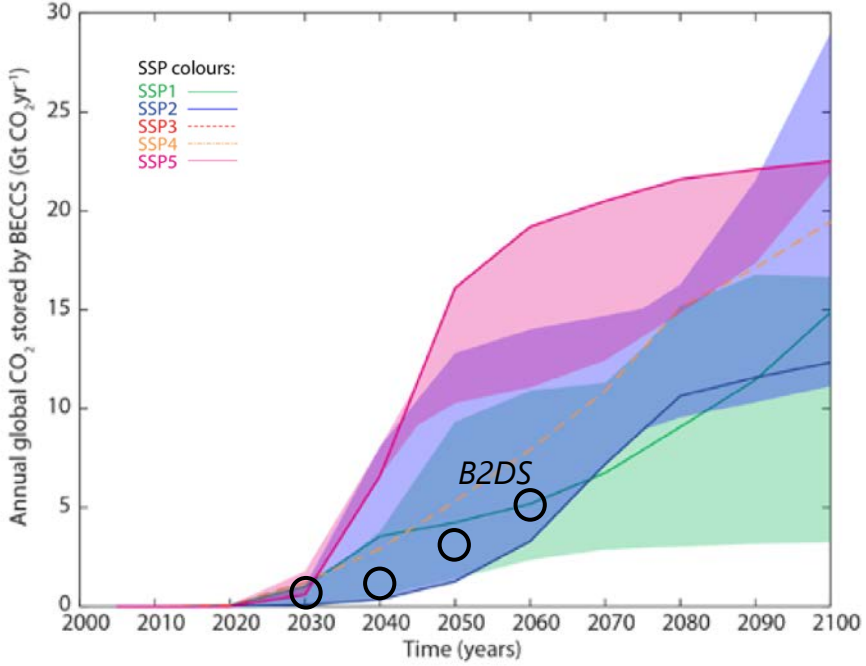
More CO_2 is captured from more expensive, lower-concentration and smaller sources in the B2DS.

BECCS in 1.5 °C scenarios

Global CO_2 emissions



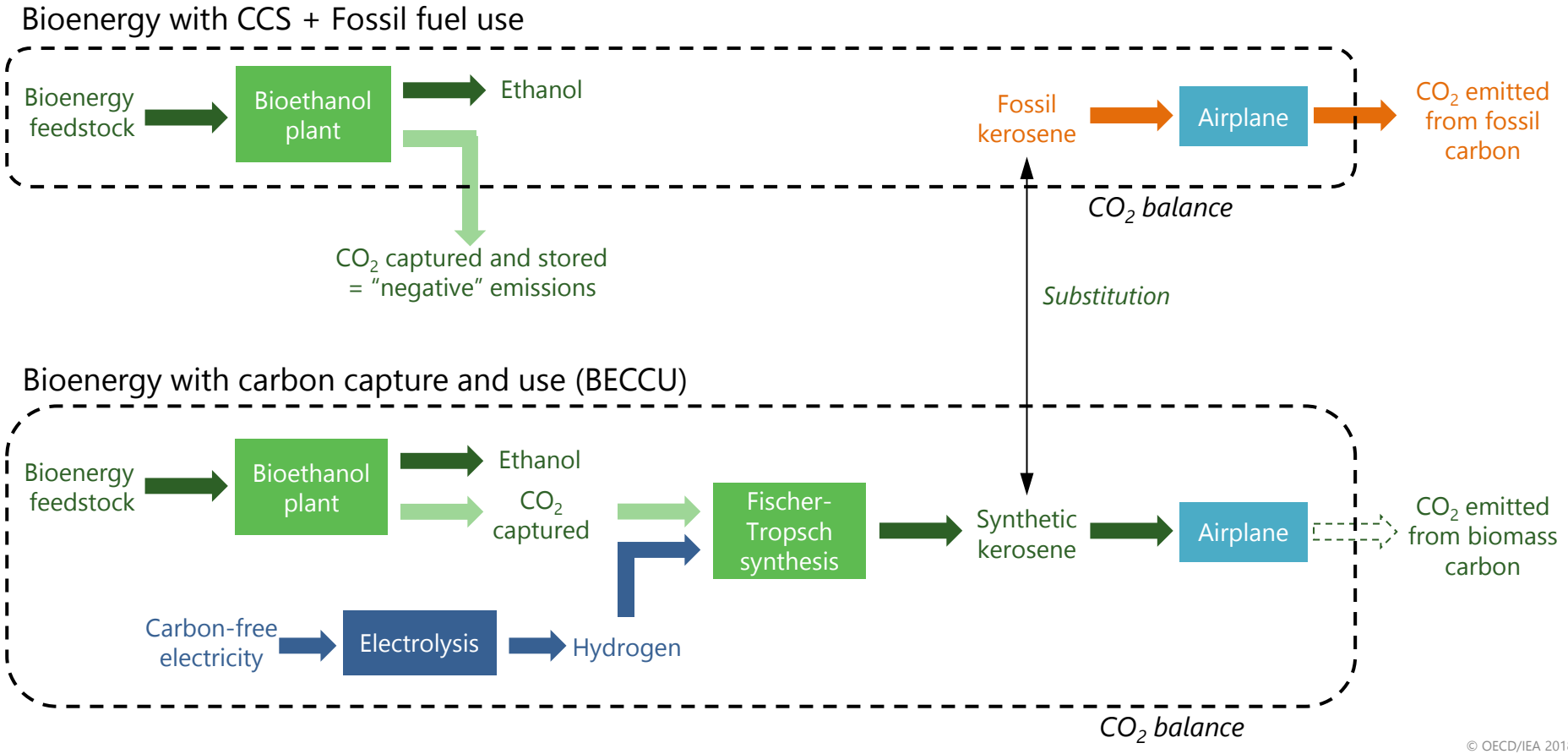
Annual CO_2 stored by BEECS



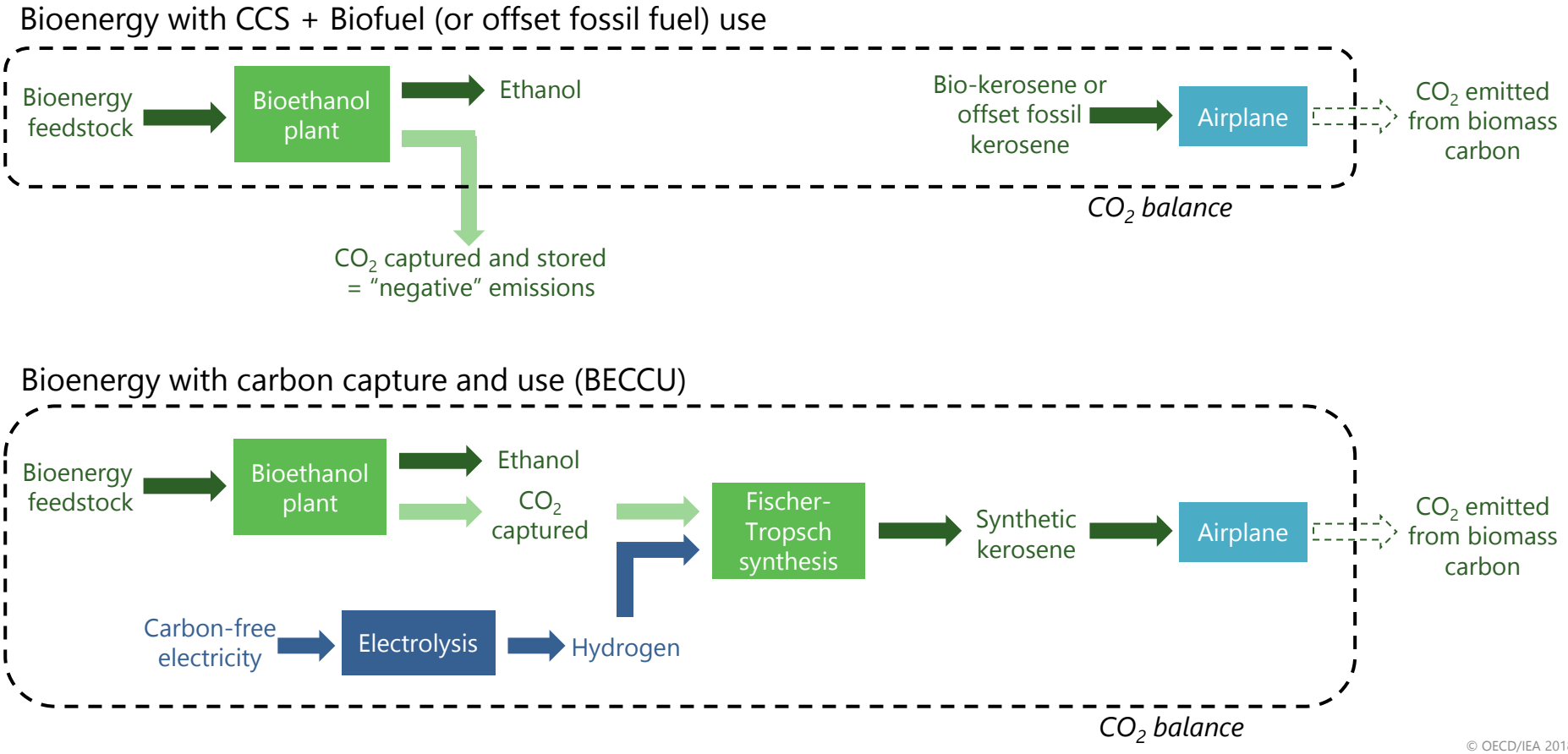
Source: Rogelj et al., (2018) *Scenarios towards limiting global mean temperature increase below 1.5 °C*

Negative emission technologies, such as BECCS, needed to reach globally net-negative emissions in the second half of the century.

BECCS or BECCU?



BECCS or BECCU?



Conclusions

- Lack of progress in deployment of CCS:
  - 17 large-scale CCUS projects in operation today, with an annual capture capacity of around 30 $MtCO_2$.
  - Only one large-scale project has taken a final investment decision since 2014 (Yanchang CCS project in China).
  - CCUS investment accounted for 0.1% of global investment in clean energy in 2016.

- Current trends in stark contrast to the need for CCS with increasing climate ambition, with CCS providing 17% of cumulative CO_2 reductions by 2060 (relative to RTS):
  - Very few alternatives to CCS for hard-to-decarbonise industrial processes.
  - Coal with CCS in power becomes at some point too carbon-intensive in the B2DS; R&D aiming at higher capture rates could allow for an extended operation.
  - BECCS needed to offset emissions in parts of the energy system more difficult to decarbonise and to potentially turn emissions net negative in the second half of the century, but availability of sustainable biomass limiting factor.

- More CO_2 captured in B2DS, but from more diluted and smaller sources, in particular industry:
  - Often more isolated locations, presenting a challenge for transport and storage.
  - Innovation is needed to improve the performance of capture technologies with small and diluted sources of CO_2.

Explore the data behind *ETP*

www.iea.org/etp

www.iea.org

IEA

Available on the App Store

GET IT ON Google play

Download from Windows Phone Store

www.iea.org/statistics