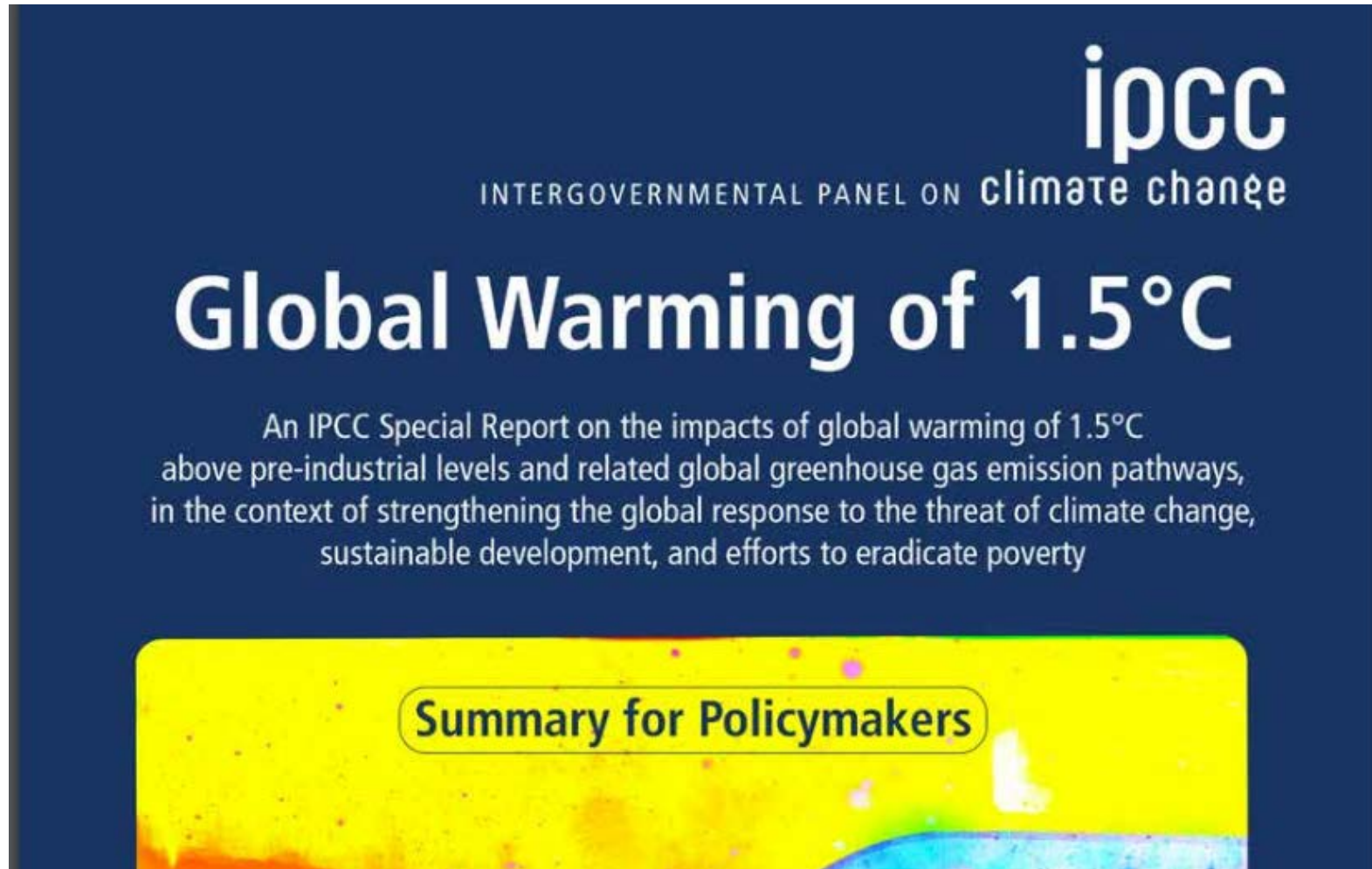


ROLE OF CCS IN IPCC PATHWAYS TO 1.5 DEGREES

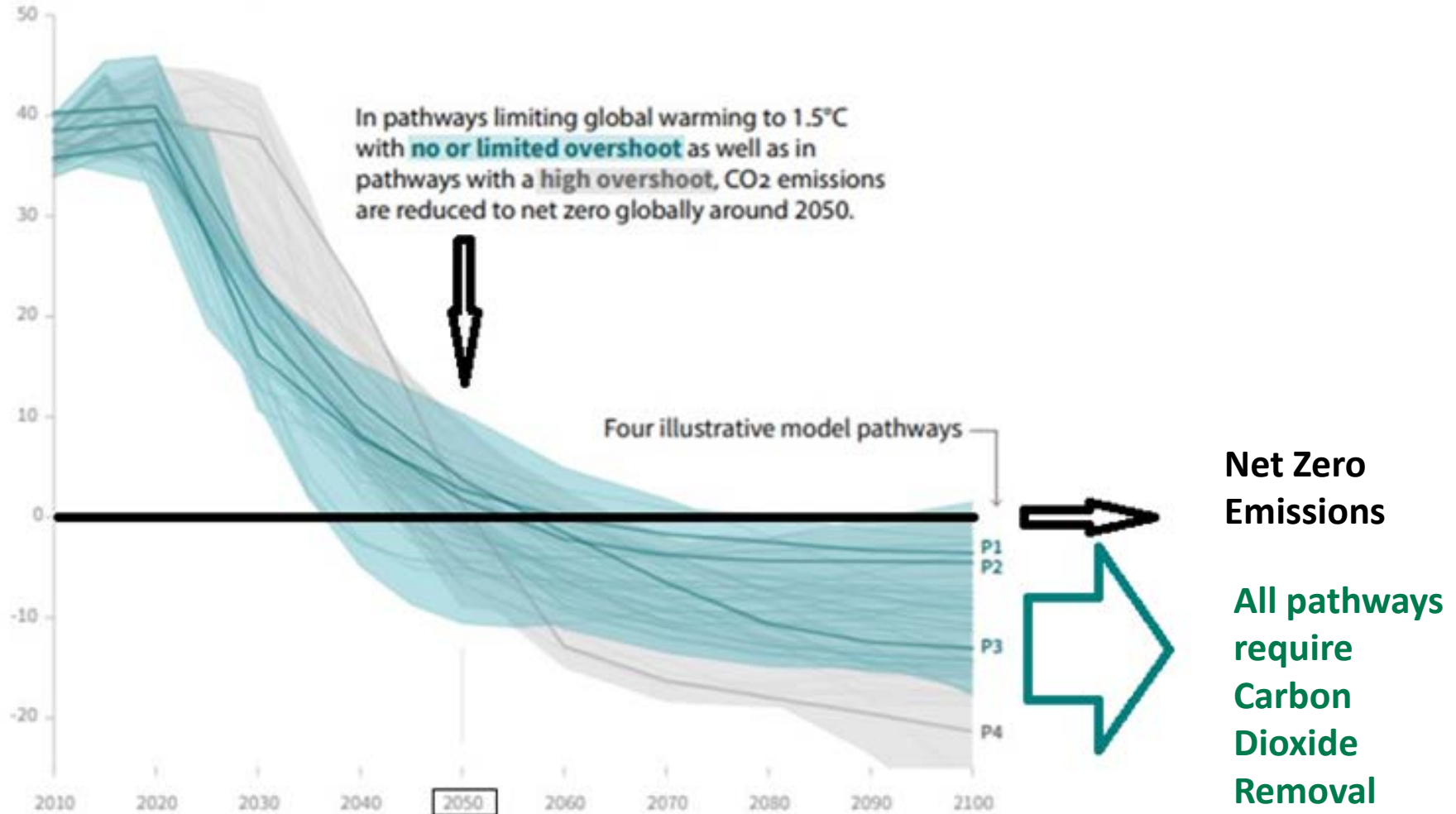
KARL HAUSKER, PH.D.
SENIOR FELLOW



1.5°C PATHWAYS REQUIRE NET-ZERO BY MID-CENTURY

Global total net CO₂ emissions

Billion tonnes of CO₂/yr

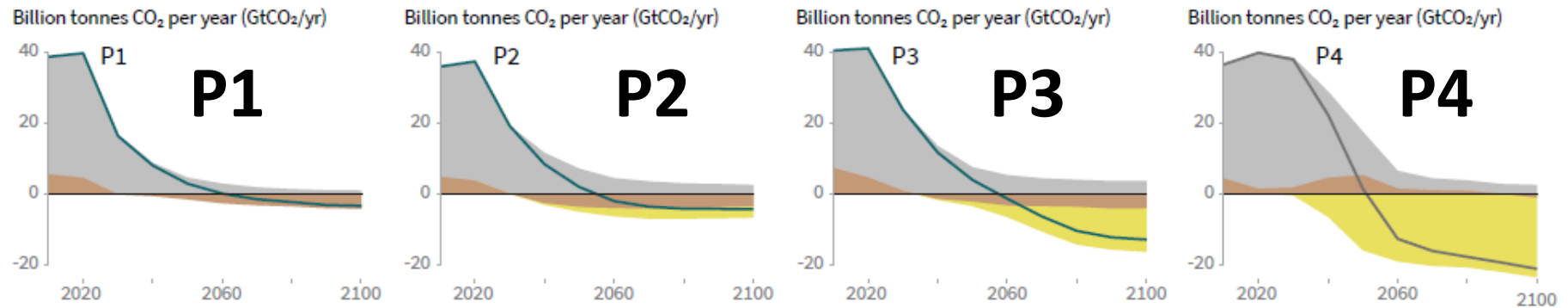


FOUR ILLUSTRATIVE PATHWAYS – CO₂

- Major transformations needed in power, buildings, transport, industry
- Carbon dioxide removal (CDR) needed via afforestation, BECCS, and/or other technologies and processes (e.g. Direct Air Capture and Storage – DACS)
- P1, P2 and P3: “no or limited overshoot” P4: “high overshoot”

Breakdown of contributions to global net CO₂ emissions in 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.

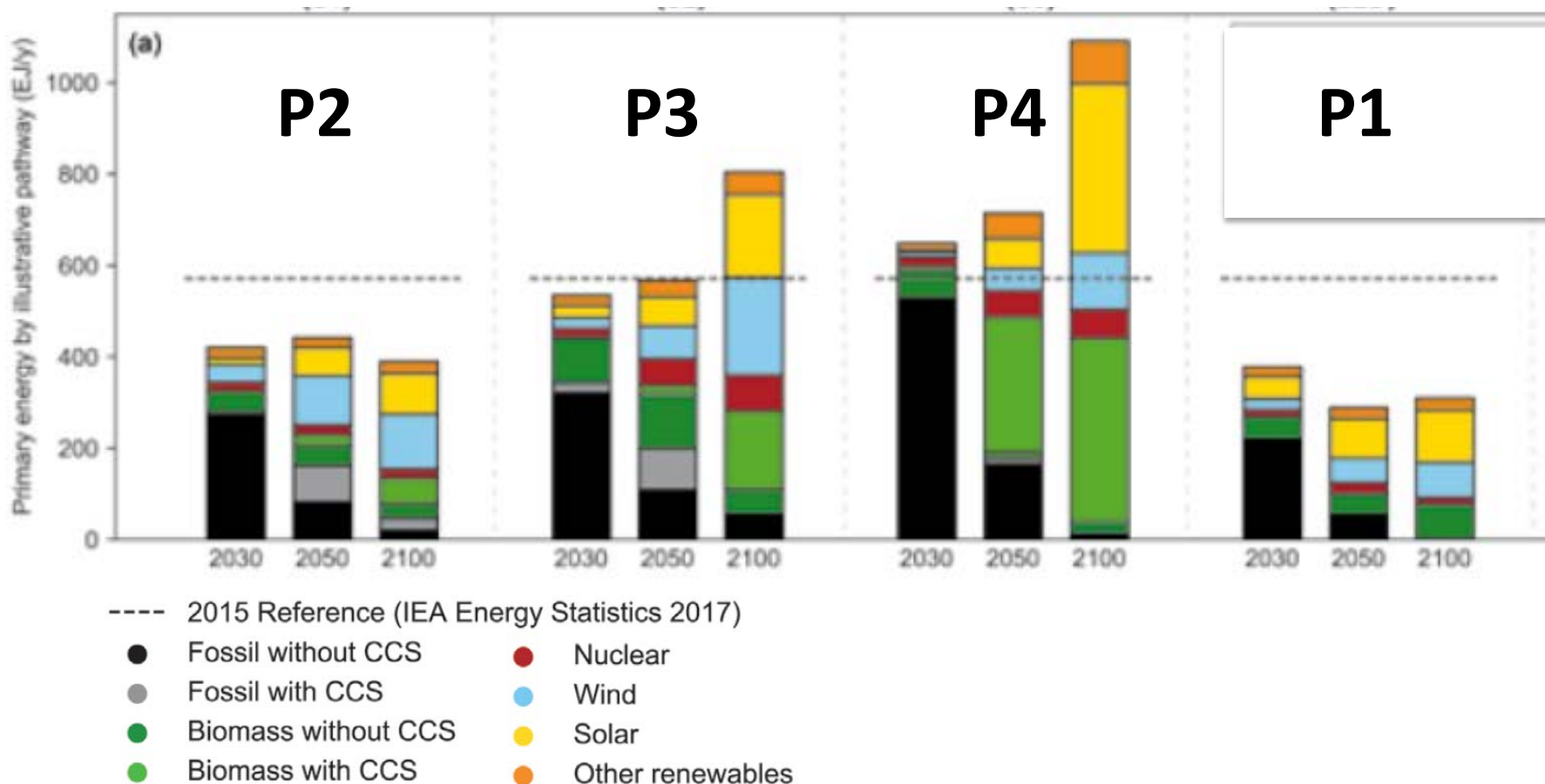
IPCC FOUR PATHWAYS: PRIMARY ENERGY SUPPLY

Renewables grow exponentially. CCS and nuclear play key roles.

P1 and P2: global energy decreases from ~600 EJ/yr to ~400 EJ/yr by 2030

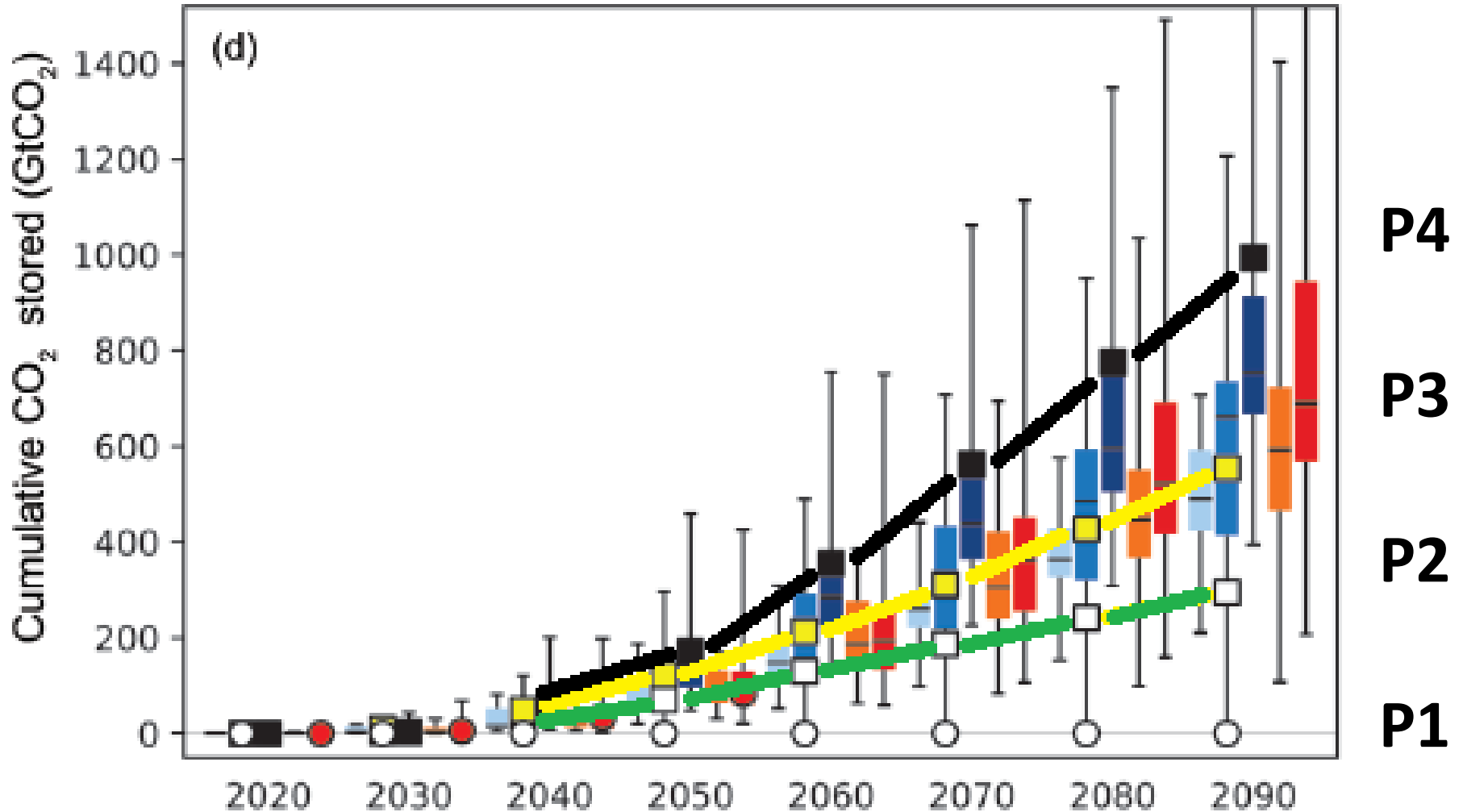
P3: slight decrease by 2030; back to ~600 EJ/yr by 2050.

P4: slow growth through 2050



IPCC FOUR PATHWAYS: CUMULATIVE CO₂ STORED

All sources: fossil (power and industry) and bioenergy with CCS (BECCS)

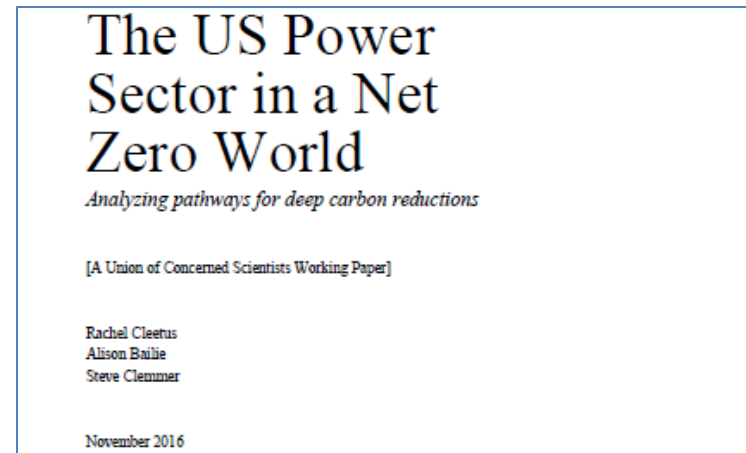


IPCC: ROLE OF CCS IN INDUSTRIAL SECTOR

- “CCS plays a major role in decarbonizing the industry sector in the context of 1.5°C and 2°C pathways, especially in industries with higher process emissions, such as cement, iron and steel industries.”
- “Given the projected long-lead times and need for technological innovation, early scale-up of industry-sector CCS is essential to achieving the stringent temperature target.”

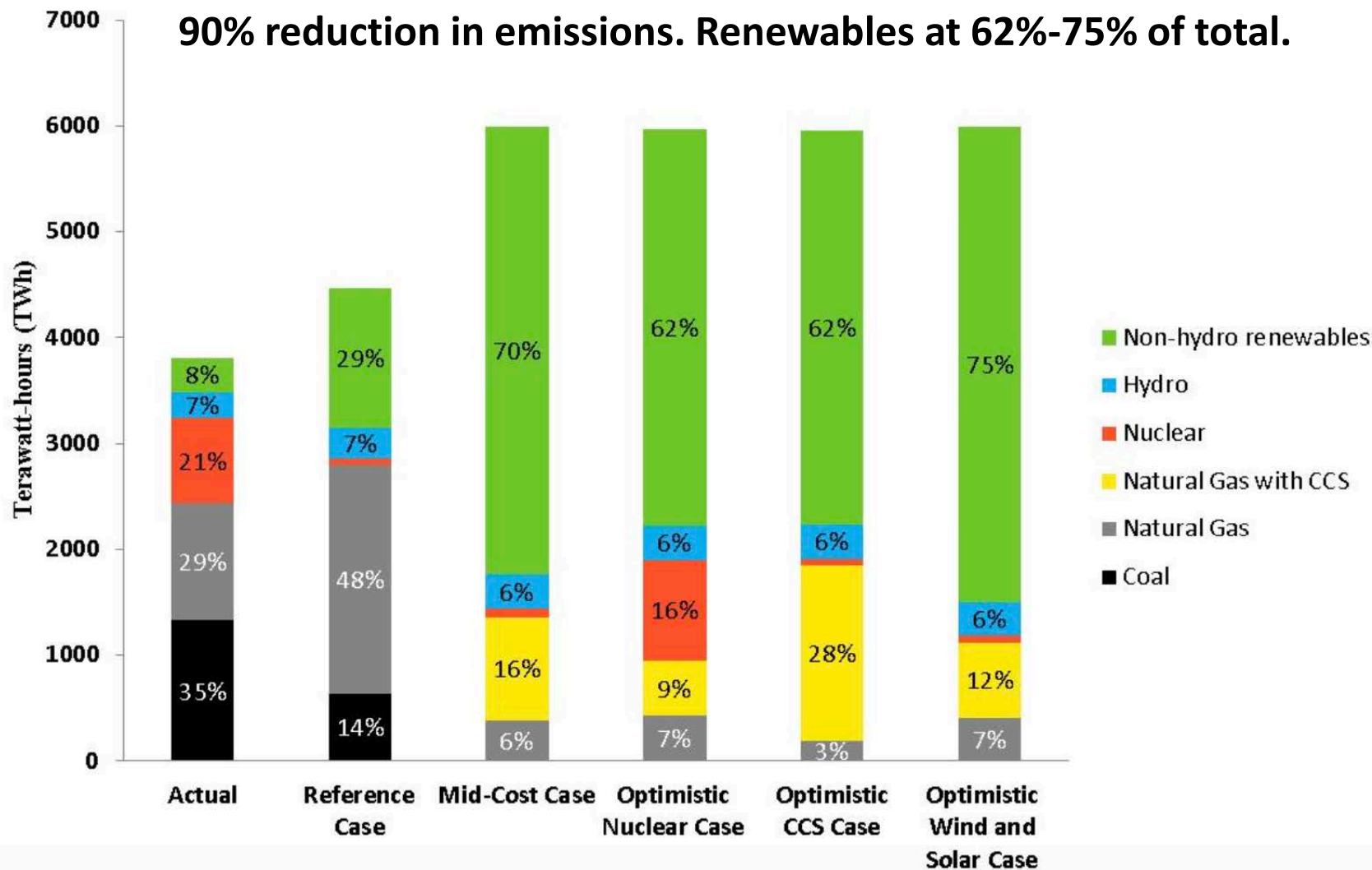
FOUR RECENT STUDIES PATHWAYS FOR THE U.S. 50%-75% WIND AND SOLAR IS A COMMON SCENARIO.

“BEYOND XX%, SYSTEM COSTS INCREASE SHARPLY”



https://unfccc.int/files/focus/long-term_strategies/application/pdf/mid_century_strategy_report-final_red.pdf
www.riskybusiness.org/fromrisktoreturn/
<https://www.nrdc.org/resources/americas-clean-energy-frontier-pathway-safer-climate-future>
https://www.ucsusa.org/sites/default/files/attach/2016/11/UCS-Deep-Decarbonization-working-paper.pdf?_ga=2.263568588.1974402731.1534852232-1981528426.1534852232

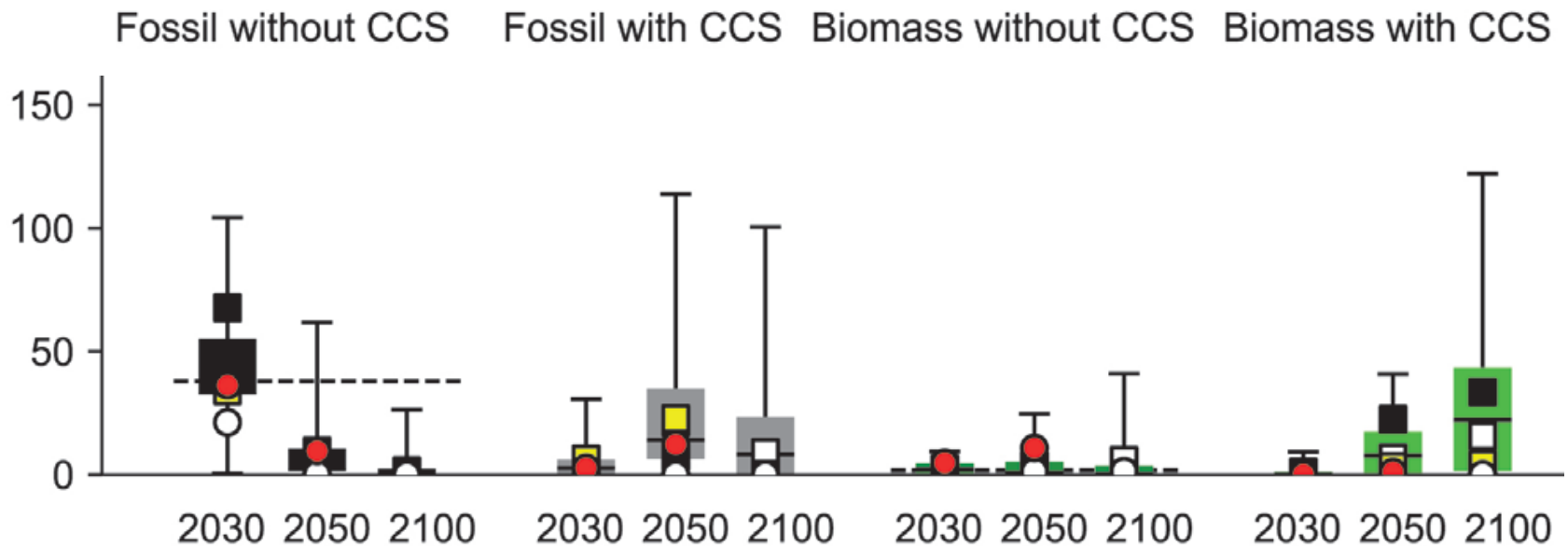
EXAMPLE OF ELECTRICITY GENERATION MIX: FOUR SCENARIOS, UNION OF CONCERNED SCIENTISTS



ADDITIONAL SLIDES

ROLE OF CCS IN 1.5 DEGREE PATHWAYS

- In round numbers:
 - Current fossil generation (without CCS) is ~40 EJ
 - By 2050, P3 and P4 pathways envision:
 - 10, 20, 30 EJ of fossil with CCS (or more)
 - 10, 20, 30 EJ of biomass with CCS



Vertical axis: electricity generation in EJ

THE RIDDLE OF “CHEAP RENEWABLES” AND “HIGH SYSTEM COSTS”

