Sixth Assessment Report
WORKING GROUP III – MITIGATION OF CLIMATE CHANGE

ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

CDR in the IPCC Work

CSLF Workshop on CDR
Bergen, 28 June 2022

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Treatment of CDR in the IPCC WG III Report

Chapter 3: Mitigation pathways compatible with long-term goals

Chapter 6: Energy systems

Chapter 11: Industry

Chapter 12: Cross-sectoral perspectives

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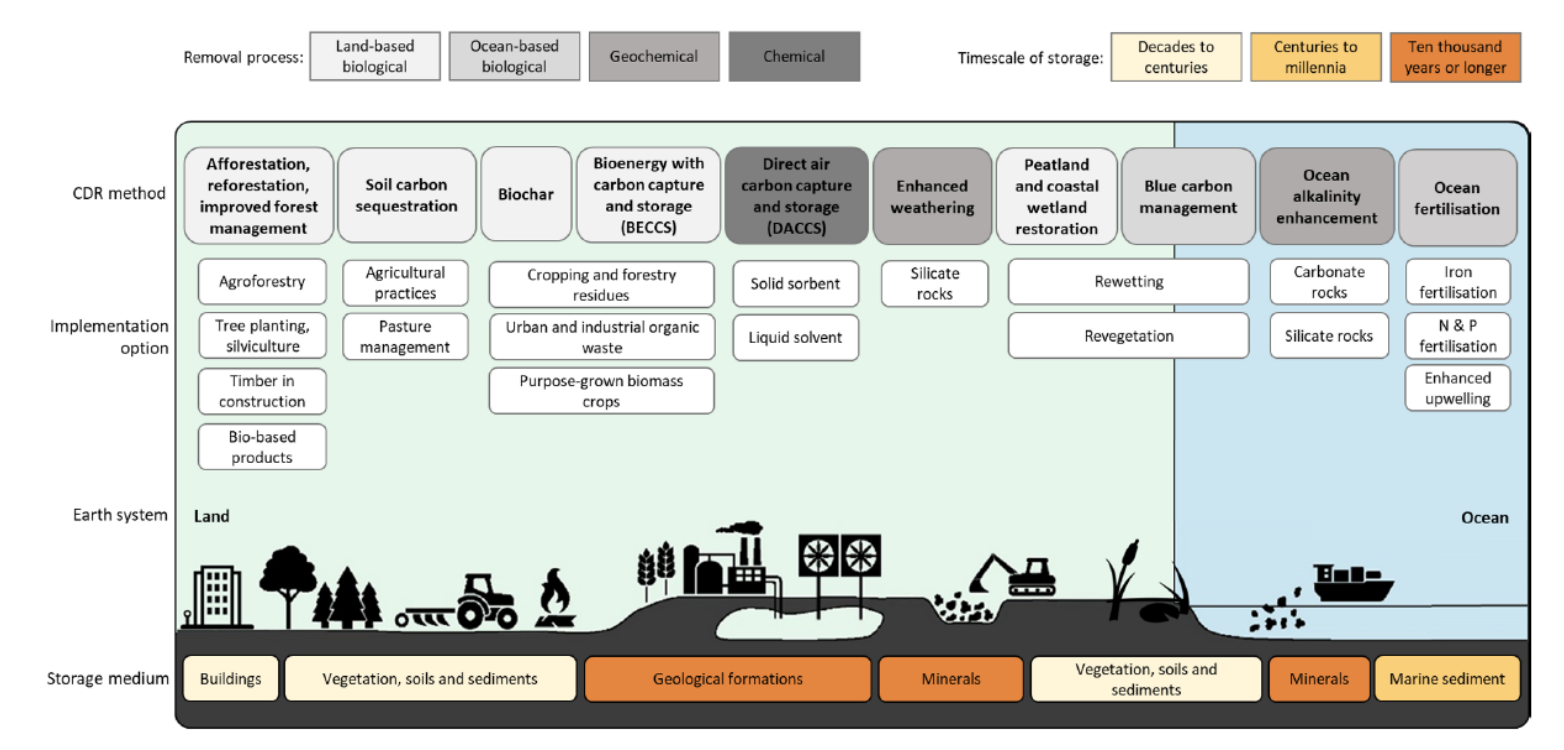
Chapter 6: Energy systems

Chapter 11: Industry

Chapter 3: Mitigation pathways compatible with long-term goals

CDR in Chapter 12: Cross-sectoral perspectives



- **essential** to **achieve net zero**
- required to **counterbalance hard-to-eliminate** emissions
- through **biological** methods: reforestation, and soil carbon sequestration
- **new technologies** require more **research**, up-front **investment**, and proof of concept at **larger scales**
- **agreed methods** for measuring, reporting and verification required

CCUS in Chapter 6: Energy systems - deployment

- "At present, there are ***28 commercially operating CCUS facilities*** with a CO2 removal capacity of around 40 million tonnes yr-1 (Mtpa). Only two of these are associated with electricity production; ***the majority are in industrial applications***. 2 commercial projects, accounting for about 75 Mtpa, are in various stages of development or construction."
- "***The public is largely unfamiliar with carbon capture***, utilization, and storage technologies, and many people may not have formed stable attitudes and risk perceptions regarding these technologies. In general, ***low support has been reported for CCS technologies***. When presented with neutral information on CCS, people favour other mitigation options such as renewable energy and energy efficiency"
- "***New investments in coal-fired electricity without CCS are inconsistent with limiting warming to well below 2°C.***"
- "Limiting warming to well below 2°C will strand fossil-related assets, including fossil infrastructure and unburned fossil fuel resources…. ***CCS can allow fossil fuels to be used longer, reducing potential stranded assets."***

CCUS in Chapter 6: Energy systems - technology

- "***Existing post-combustion approaches relying on absorption are technologically ready for full-scale deployment***. More novel approaches using membranes and chemical looping that might reduce the energy penalty associated with absorption are in different stages of development - ranging from laboratory phase to prototype phase"
- "***Several 2nd and 3rd generation capture technologies are being developed*** with the aim of not just lowering costs but also enhancing other performance characteristics such as improved ramp-up and lower water consumption. These include processes such as chemical looping, which also has the advantage of being capable of co-firing with biomass."
- ***The theoretical global geologic storage potential is about 10,000 Gt-CO_2***, with more than 80% of this capacity existing in saline aquifers***. Not all the storage capacity is usable*** because geologic and engineering factors limit the actual storage capacity to an order of magnitude below the theoretical potential, which is ***still more than the CO_2 storage requirement through 2100 to limit temperature change to 1.5ºC***"

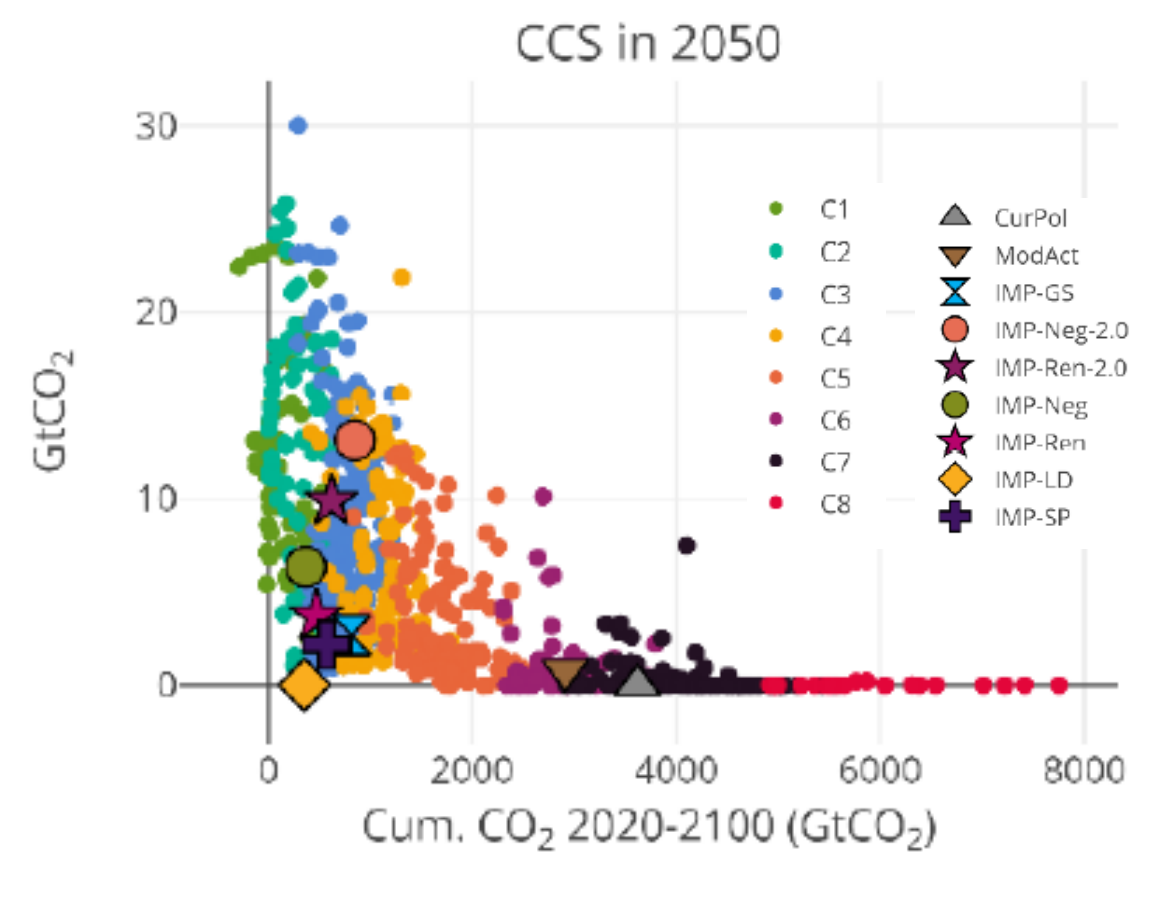
CCUS in Chapter 6: Energy systems - costs

- "CO_2 capture costs present a key challenge, remaining higher than USD 50 tCO_2^{-1} for most technologies and regions; novel technologies could help reduce some costs. ***The capital cost of a coal or gas electricity generation facility with CCS is almost double one without CCS***. Additionally, ***the energy penalty increases the fuel requirement for electricity generation*** by 13–44%, leading to further cost increases."
- "***Injecting CO_2 into hydrocarbon formations for enhanced oil or gas recovery can produce revenues and lower costs***."
- "***By clustering together of several CO_2 sources, overall costs may be reduced*** by USD 10 tCO_2^{-1}, but geographical circumstances determine the prospects of these cost reductions via economies-of-scale."

CCS and CCU in Chapter 11: Industry

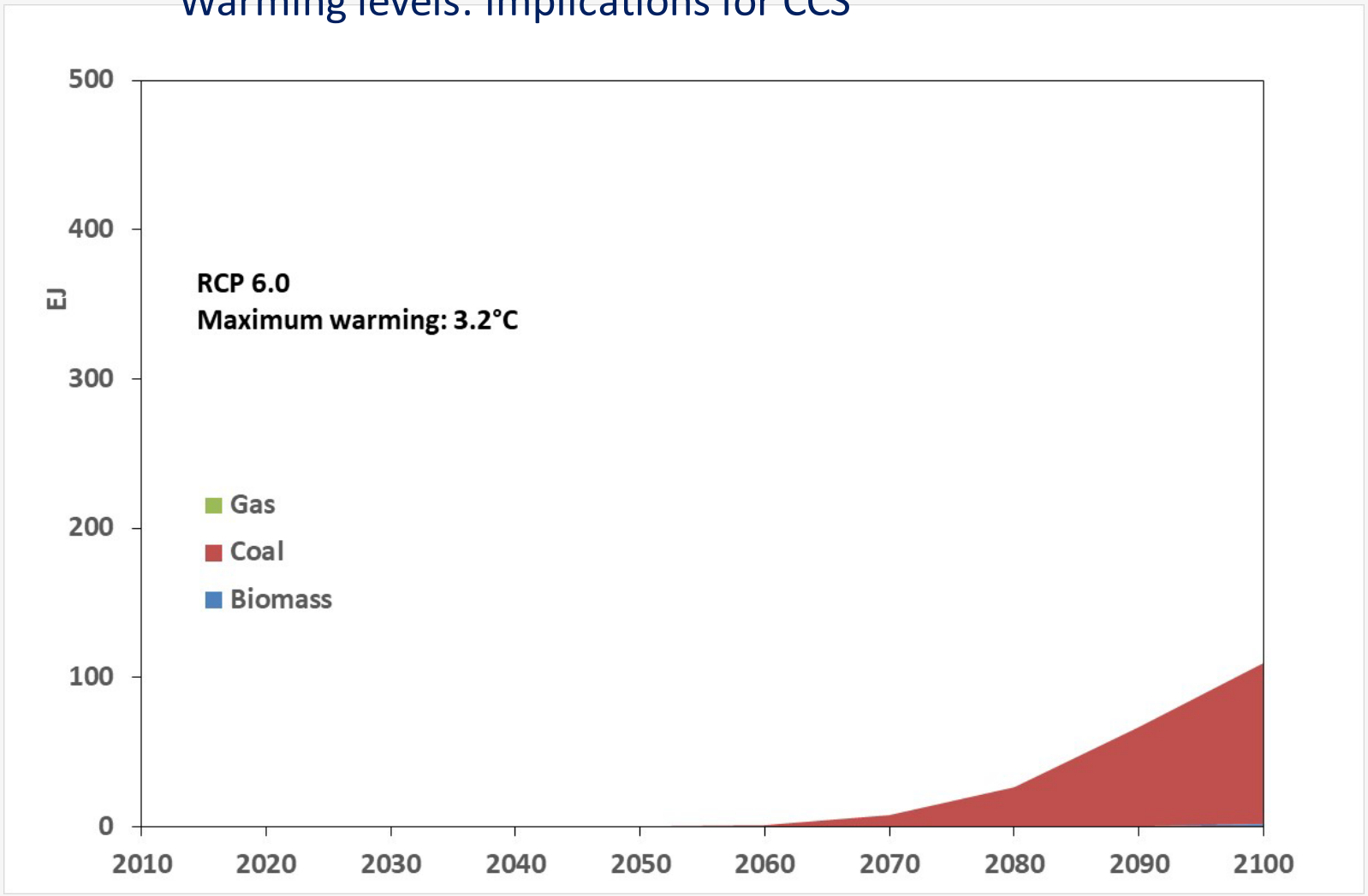
- "***The potentials and costs for CCS in industry vary considerably*** due to the diversity of industrial processes, as well as the volume and purity of different flows of carbon. As a general rule it is not possible to capture all the carbon dioxide emissions from an industrial plant. ***To achieve zero or negative emissions, CCS would need to be combined with some use of sustainably sourced biofuel or feedstock***, or the remaining emissions would need to be offset by CDR elsewhere."
- "Until new chemistries are mastered, ***deep reduction of cement process emissions will rely on*** already commercialised cementitious material substitution and ***the availability of CCS***."
- "***Reducing emissions from the production and use of chemicals would need to rely on*** a life cycle approach, including increased plastics recycling, fuel and feedstock switching, and carbon sourced through biogenic sources, and, ***depending on availability, CCU, direct air CO2 capture, as well as CCS.***"

CCS in Chapter 3: Mitigation pathways



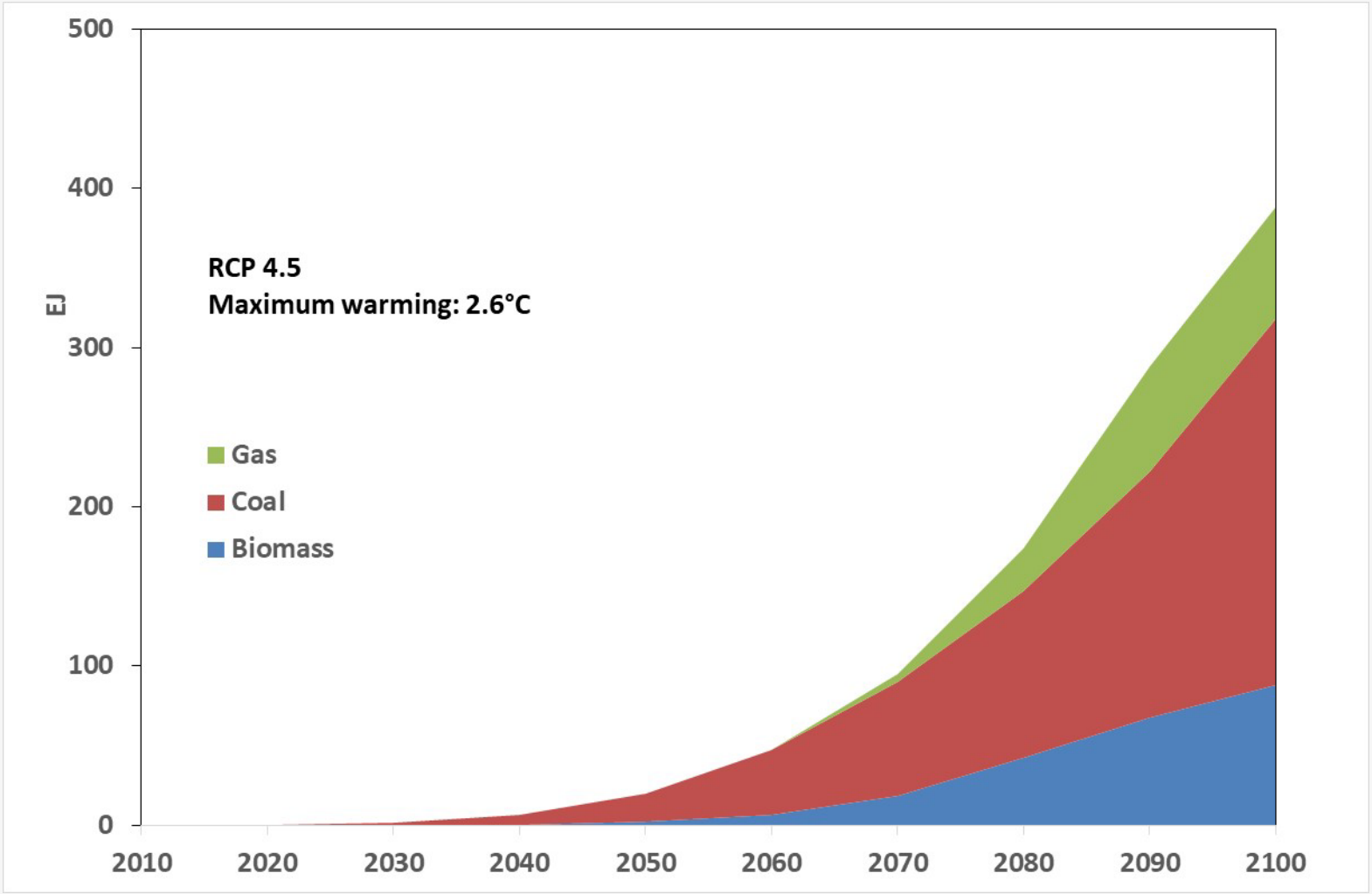
- "***Pathways that likely limiting warming to 2°C or below involve some amount of CDR to compensate for residual GHG emissions*** "
- "In all scenarios, fossil fuel use is greatly reduced and unabated coal use is completely phased out by 2050."
- "***In pathways that limit warming to 1.5°C, the global use of coal, oil and gas in 2050 is projected to decline*** with median values of about 95%, 60% and 45% compared to 2019."
- "***The use of coal, oil and gas without CCS in pathways that limit warming to 1.5°is projected to be reduced to a greater degree***, with median values of about 100%, 60% and 70% in 2050 compared to 2019."

Warming levels: implications for CCS



Source: 1.5°C Scenario Explorer, MESSAGE-GLOBIOM SSP2

Warming levels: implications for CCS



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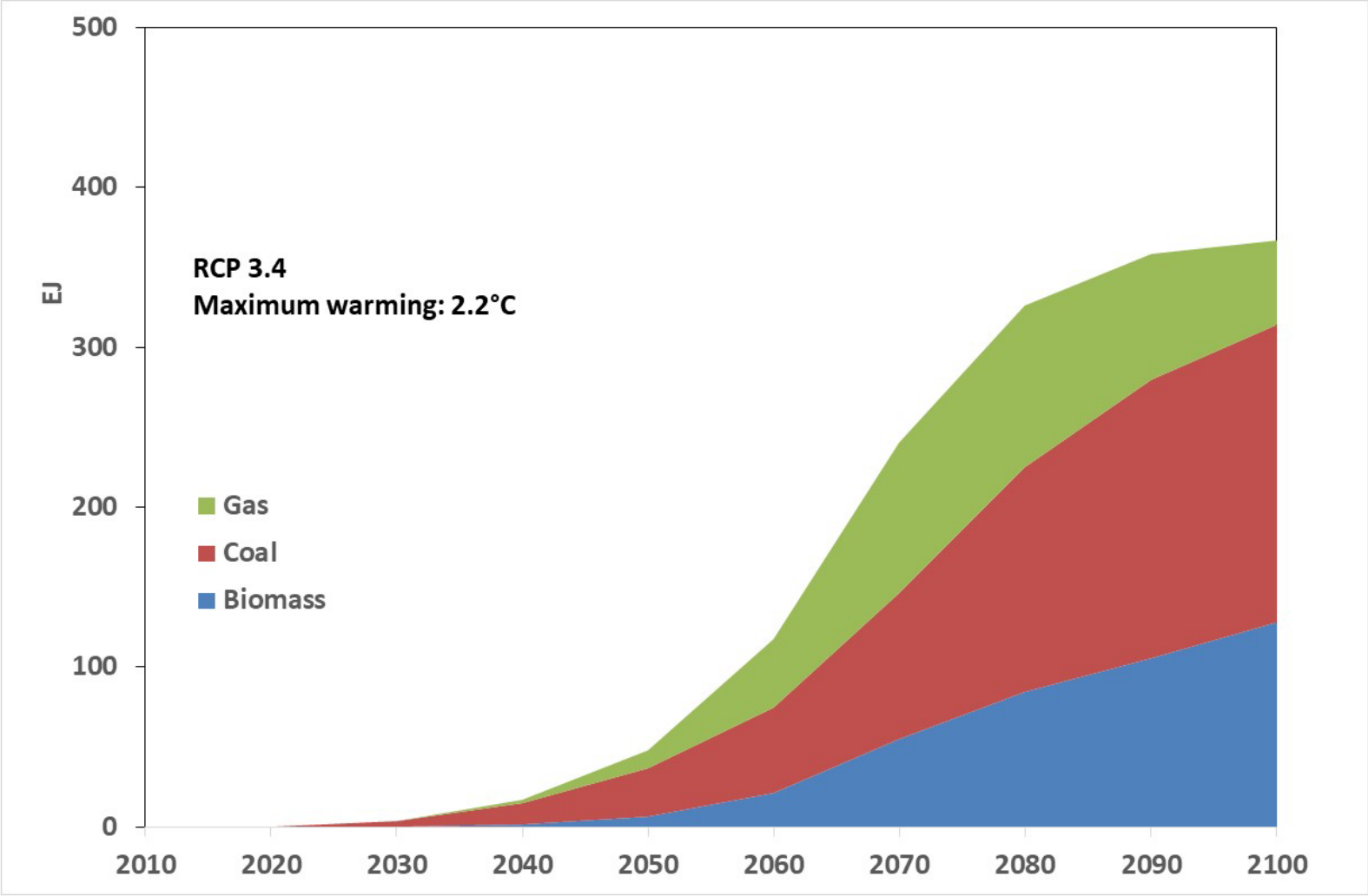
Warming levels: implications for CCS



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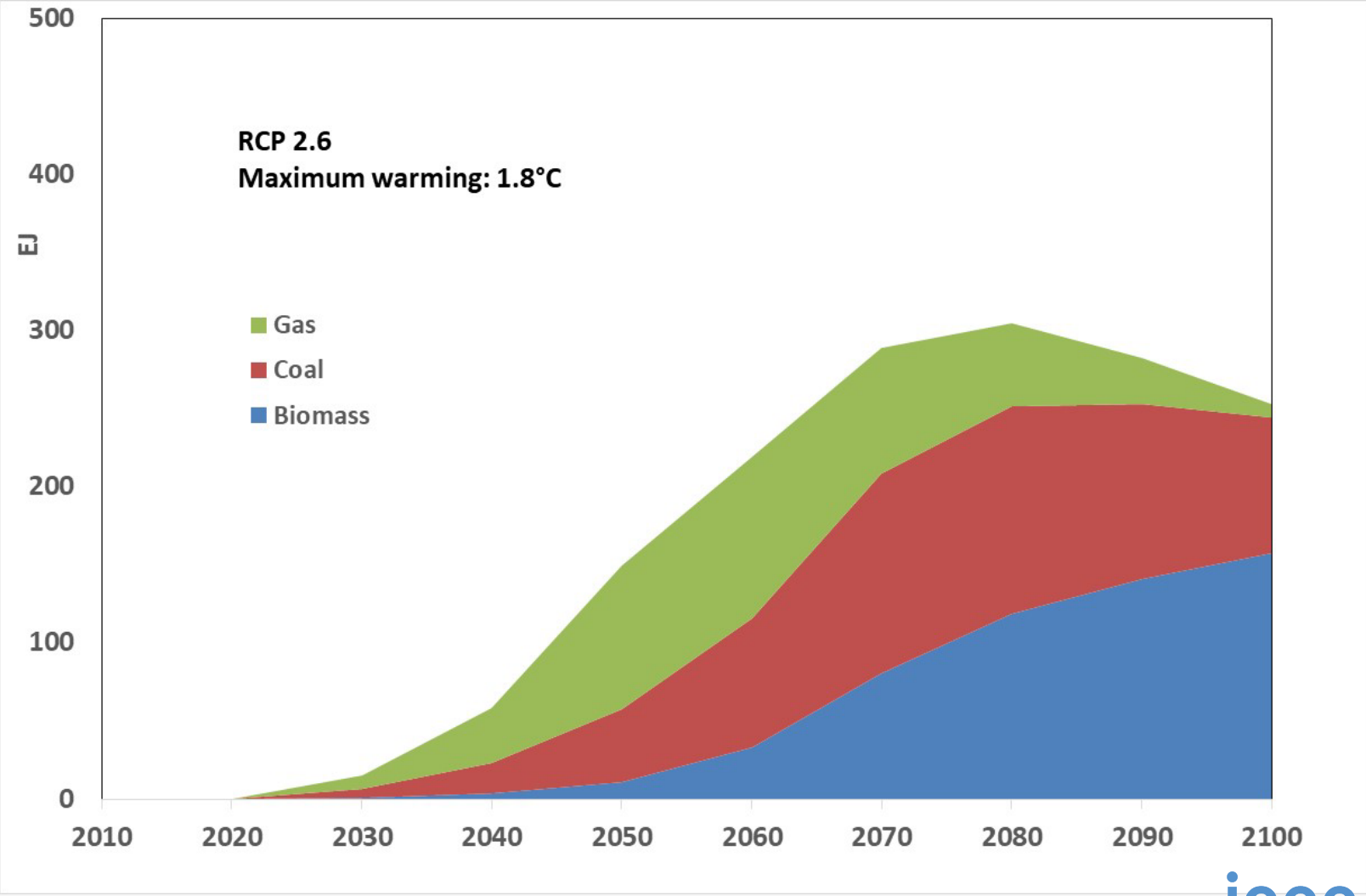

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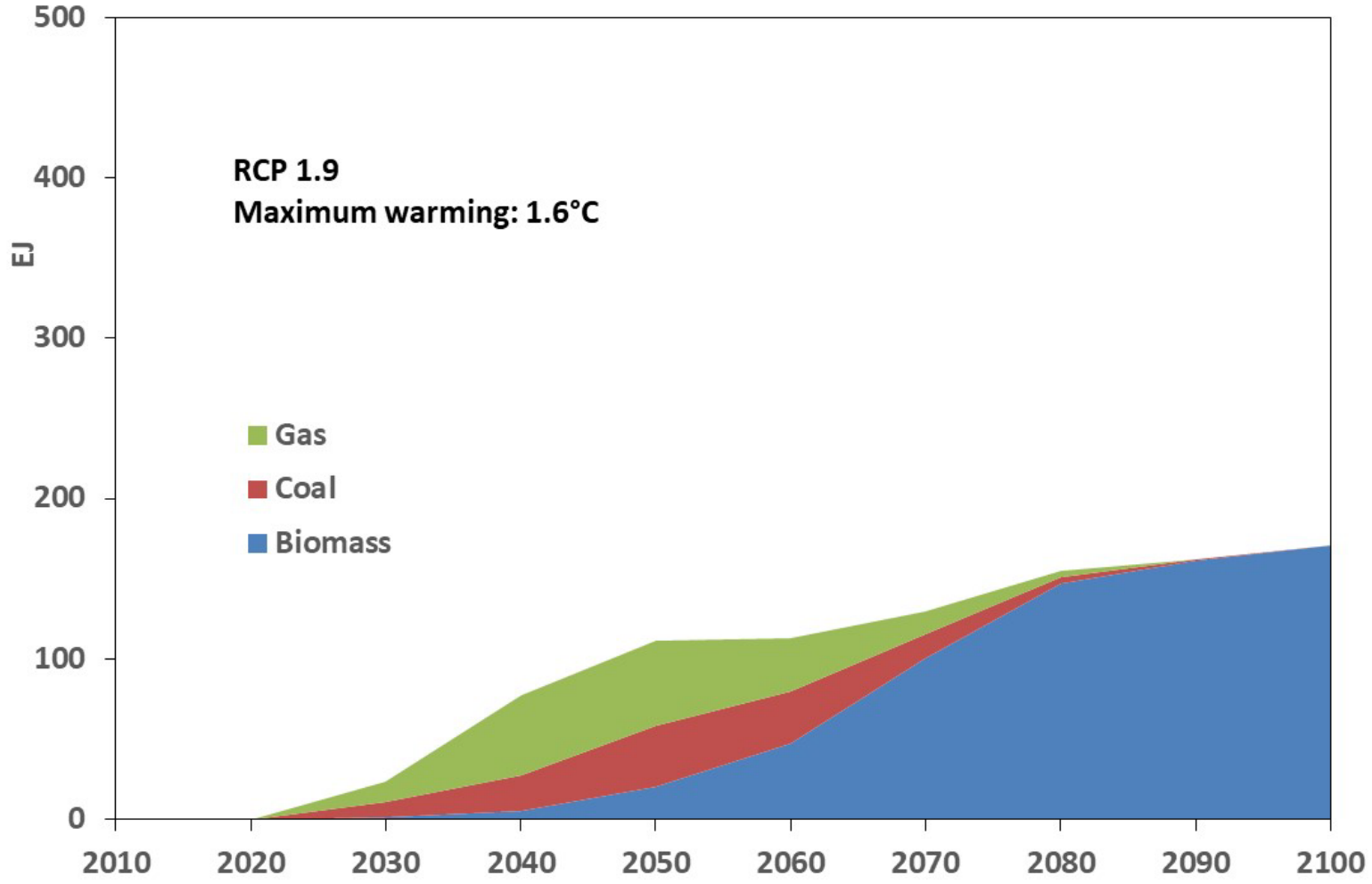

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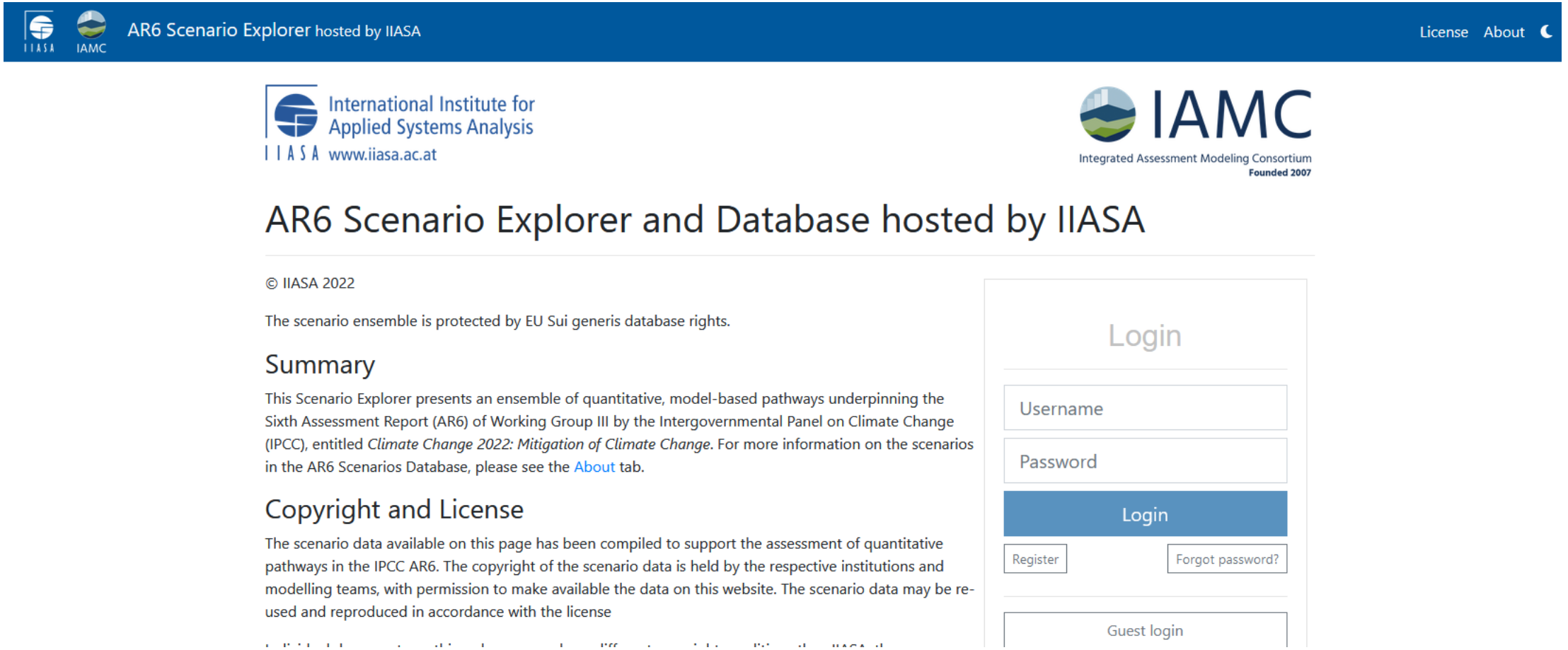
For serious number crunchers…..



https://data.ece.iiasa.ac.at/ar6