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Systematic scenario process to support analysis of long-term emissions scenarios and transformation pathways for the IPCC WG3 6th Assessment Report

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The assessment of long-term greenhouse gas emissions scenarios and societal transformation pathways is a key component of the IPCC Working Group 3 (WG3) on the Mitigation of Climate Change. A large scientific community, typically using integrated assessment models and econometric frameworks, supports this assessment in understanding both near-term actions and long-term policy responses and goals related to mitigating global warming. WG3 must systematically assess hundreds of scenarios from the literature to gain an in-depth understanding of long-term emissions pathways, across all sectors, leading to various levels of global warming. Systematic assessment and understanding the climate outcomes of each emissions scenario, requires coordinated processes which have developed over consecutive IPCC assessments. Here, we give an overview of the processes involved in the systematic assessment of long-term mitigation pathways as used in recent IPCC Assessments[1] and being further developed for the IPCC 6th Assessment Report (AR6). The presentation will explain how modelling teams can submit scenarios to AR6 and invite feedback to the process.

Following discussions amongst IPCC Lead Authors to define the scope of scenarios desired and variables requested, a call for scenarios to support AR6 was launched in September 2019. Modelling teams have registered and submitted scenarios through Autumn 2019 using a new and secure online submission portal, from which authorised Lead Authors can interrogate the scenarios interactively.

This analysis is underpinned by the open-source software pyam, a Python package specifically designed for analysis and visualisation of integrated assessment scenarios[2]. Submitted scenarios are automatically checked for errors and processed using a new climate assessment pipeline. The

climate assessment involves infilling and harmonization[3] of emissions data, then the scenarios are processed through Simple Climate Models, using the OpenSCM framework[4], to give probabilistic climate implications for each scenario – atmospheric concentrations, radiative forcing and global mean temperature. The climate assessment accounts for updated climate sensitivity estimates from CMIP6 and WG1,s scenarios are categorized according to climate outcomes and distinguish between timing and levels of net-negative emissions, emissions peak and temperature overshoot. Scenarios are also categorized by other indicators, for consistent use across WG3 chapters, such as: population and GDP; Primary and Final energy use; and shares of renewables, bioenergy and fossil fuels.

The automated framework also facilitates bolt-on analyses, such as estimating the population impacted by biophysical climate impacts[5], and estimates of avoided damages with the social cost of carbon[6].

Upon publication of the WG3 AR6 report, all scenario data used in the WG3 Assessment will be publicly available on a Scenario Explorer, an online tool for interrogating and visualizing the data that supports the report. In combination, this framework brings new levels of consistency, transparency and reproducibility to the assessment of scenarios in IPCC WG3 and will be a key resource for the climate community in understanding the main drivers of different transformation pathways.