GCAM-USA Scenarios for GODEEEP

This dataset contains a set of twelve future (2020-2050) scenarios modeled by GCAM-USA for the GODEEEP project for the purpose of studying the effects of climate, socioeconomic change, technology change, current decarbonization incentives, and longer-term decarbonization policies on the U.S. energy-economy, the electricity grid, human well-being, and the environment.

GCAM-USA is a version of the Global Change Analysis Model (GCAM) with state-level detail in the United States. GCAM-USA simulates the supply/demand dynamics and interactions of four systems (energy, water, agriculture and land use, and the economy) in 32 geopolitical regions in the world, including the 50 states and the District of Columbia within the U.S. It can be configured to include climate impacts on energy demands, water availability, and crop yields. The GCAM-USA scenarios for GODEEEP include business-as-usual (BAU) as well as net-zero (NZ) greenhouse gas emissions by 2050 policy scenarios. All the NZ policy scenarios include a carbon-free electricity system by 2035, also referred to as a "clean grid." Net-zero greenhouse gas emissions by 2050 requires a combination of solutions including carbon sequestration, new fuels, long- and short-term energy storage, and new technologies such as direct air capture that have not previously been included in GCAM-USA. The GCAM-USA scenarios for GODEEEP represent alternative combinations of assumptions for climate impacts, decarbonization policies, decarbonization incentives, and carbon capture and sequestration technology availability.

GCAM-USA outputs are provided as XML databases, which can be read by the GCAM Model Interface or packages such as gcamreader for Python or gcamextractor for R.

Summaries of each scenario are provided below. For additional discourse on the scenarios, see Ou et al 2023 and other upcoming papers to be announced on the GODEEEP website.

Abbreviations used in scenario names and descriptions

- **BAU**: Business-As-Usual. These scenarios represent the continuation of policies from the recent past and include major state-level clean energy policies but do not include any federal policies or incentives for a clean grid or a net-zero economy.
- **NZ**: Net-Zero. These scenarios represent a U.S. decarbonization goal that requires a carbon-free electricity grid by 2035 and a net-zero greenhouse gas emissions economy by 2050.
- **IRA**: Inflation Reduction Act. These scenarios include the IRA incentives for energy

efficiency as well as clean energy, transportation, and fuels between 2025 and 2035.

- **CCS**: Carbon Capture and Sequestration. These scenarios assume that electricity generators equipped with CCS technology are available, whereas the other scenarios assume CCS technology is unavailable.
- **Climate**. These scenarios include the dynamic effects of a climate pathway (RCP8.5) on heating and cooling degree days (HDD/CDD) in the period 2020-2050. Note that in scenarios without "climate" in their name, HDD/CDD are left static at their 2020 levels.
- **SSP2**: Shared Socioeconomic Pathway 2. A "middle of the road" socioeconomic pathway where population and economic growth trends follow historical patterns.

Scenario Descriptions

#	Name	Description
1	bau	• This scenario does not include any long-term federal policies requiring decarbonization. • It does not include the IRA incentives. • It assumes that CCS technologies are unavailable. • The socioeconomic change assumptions are consistent with SSP2. • No climate impacts are considered.
2	bau_climate	• This scenario does not include any long-term federal policies requiring decarbonization. • It does not include the IRA incentives. • It assumes that CCS technologies are unavailable. • The socioeconomic change assumptions are consistent with SSP2. • This scenario includes future climate impacts on heating and cooling degree days based on an RCP8.5 pathway.
3	bau_ccs	• This scenario does not include any long-term federal policies requiring decarbonization. • It does not include the IRA incentives. • It assumes that CCS technologies are available. • The socioeconomic change assumptions are consistent with SSP2. • No climate impacts are considered.

4	bau_ccs_climate	• This scenario does not include any long-term federal policies requiring decarbonization. • It does not include the IRA incentives. • It assumes that CCS technologies are available. • The socioeconomic change assumptions are consistent with SSP2. • This scenario includes future climate impacts on heating and cooling degree days based on an RCP8.5 pathway.
5	bau_ira_ccs	• This scenario does not include any long-term federal policies requiring decarbonization. • It does include the IRA incentives. • It assumes that CCS technologies are available. • The socioeconomic change assumptions are consistent with SSP2. • No climate impacts are considered.
6	bau_ira_ccs_climate	• This scenario does not include any long-term federal policies requiring decarbonization. • It does include the IRA incentives. • It assumes that CCS technologies are available. • The socioeconomic change assumptions are consistent with SSP2. • This scenario includes future climate impacts on heating and cooling degree days based on an RCP8.5 pathway.
7	nz	• This scenario includes a clean electricity grid in the U.S. by 2035 and a net-zero economy by 2050. • It does not include the IRA incentives. • It assumes that CCS technologies are unavailable. • The socioeconomic change assumptions are consistent with SSP2. • No climate impacts are considered.
		• This scenario includes a clean electricity grid in the U.S. by 2035 and a net-zero economy by 2050. • It does not include the IRA incentives. • It assumes that CCS technologies are unavailable.

8	nz_climate	• The socioeconomic change assumptions are consistent with SSP2. • This scenario includes future climate impacts on heating and cooling degree days based on an RCP8.5 pathway.
9	nz_ccs	• This scenario includes a clean electricity grid in the U.S. by 2035 and a net-zero economy by 2050. • It does not include the IRA incentives. • It assumes that CCS technologies are available. • The socioeconomic change assumptions are consistent with SSP2. • No climate impacts are considered.
10	nz_ccs_climate	• This scenario includes a clean electricity grid in the U.S. by 2035 and a net-zero economy by 2050. • It does not include the IRA incentives. • It assumes that CCS technologies are available. • The socioeconomic change assumptions are consistent with SSP2. • This scenario includes future climate impacts on heating and cooling degree days based on an RCP8.5 pathway.
11	nz_ira_ccs	• This scenario includes a clean electricity grid in the U.S. by 2035 and a net-zero economy by 2050. • It does include the IRA incentives. • It assumes that CCS technologies are available. • The socioeconomic change assumptions are consistent with SSP2. • No climate impacts are considered.
12	nz_ira_ccs_climate	• This scenario includes a clean electricity grid in the U.S. by 2035 and a net-zero economy by 2050. • It does include the IRA incentives. • It assumes that CCS technologies are available. • The socioeconomic change assumptions are consistent with SSP2. • This scenario includes future climate impacts on heating and cooling degree days based on an RCP8.5

		pathway.

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