



# Uncertainty in future global societies and evaluating projections options

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# Evaluating potential future societies

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- What are the possible societies exposed and responding to future climate change?
- What are the possible transitions from today, especially locally?



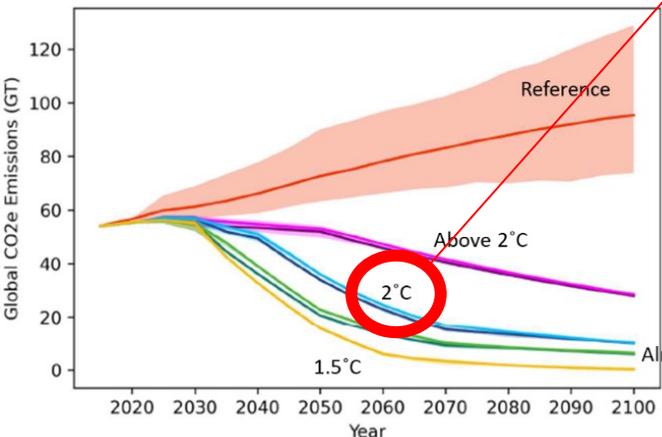
# EPRI-MIT's evaluation of potential future societies

- Global probabilistic economic structural modeling
- Evaluating potential global and sub-global low-carbon transitions, and thus populations and economies that could be exposed to future climate change, in particular regional/national societies
- Considering three categories of uncertainty:
  1. **Economic development factors:** e.g., population, productivity, resources, technologies
  2. **Global climate ambition:** global emissions pathways for Above 2°C, 2°C, Almost 1.5°C, and 1.5°C
  3. **Decarbonization policy design:**
    - “Optimistic” – global cooperation, global land carbon incentives, bioenergy with CCS
    - “More pessimistic” – without all three of the above
    - “More pessimistic with bioCCS” – “More pessimistic” with bioenergy with CCS (bioCCS)

# EPRI-MIT's evaluation of potential future societies

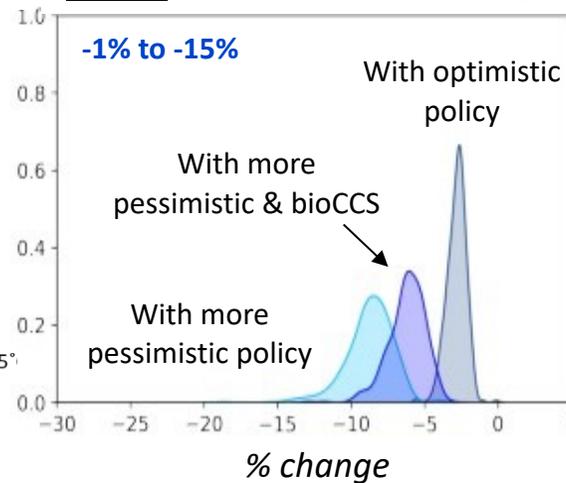
- Finding significant uncertainty without climate policy (“Reference”)
- Finding significant uncertainty in the size and structure of global and national economies consistent with a 2°C global emissions pathway
- These uncertainties are important in economic impacts estimation AND discounting

**Global GHG emissions  
(reference and global policies)**

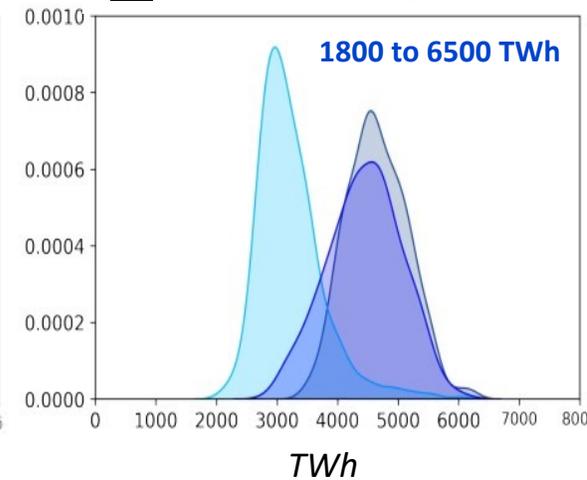


**Distributions of economic conditions consistent with the 2°C pathway**

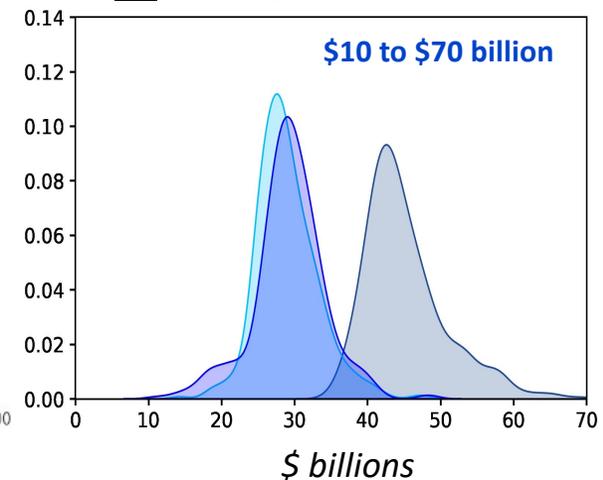
**Global 2050 GDP/capita change**



**EU 2050 electricity generation**

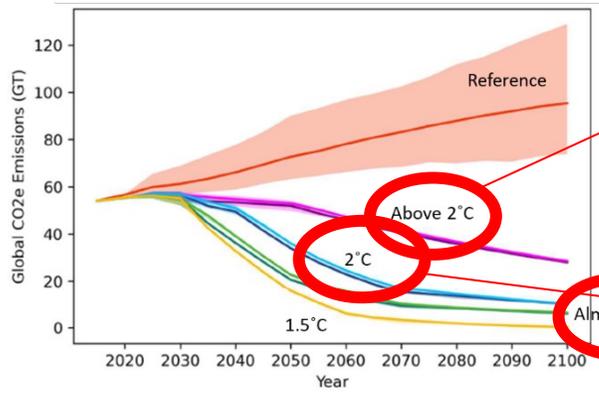


**US 2050 agricultural output**



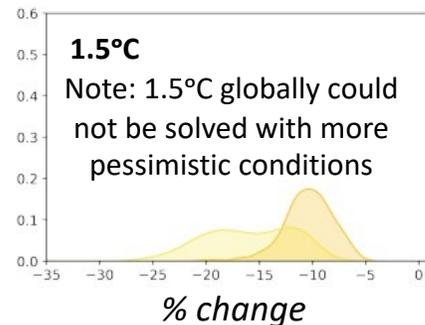
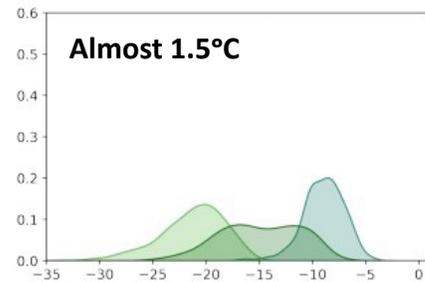
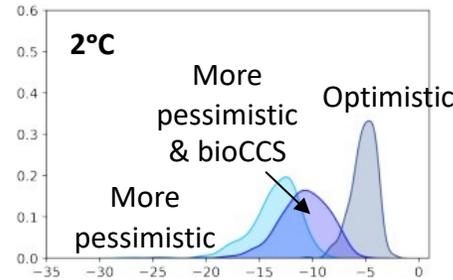
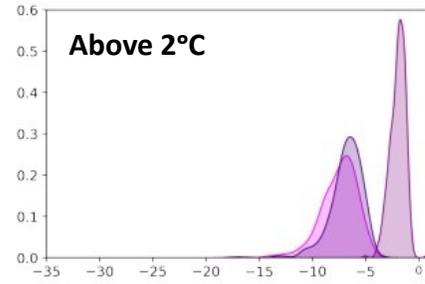
EPRI-MIT (forthcoming)

## Global GHG emissions (reference and global policies)

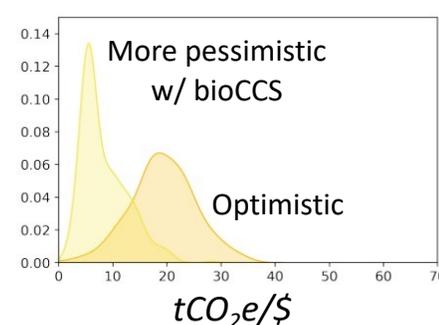
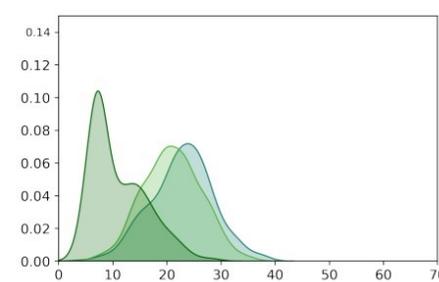
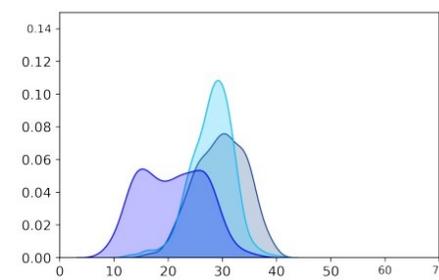
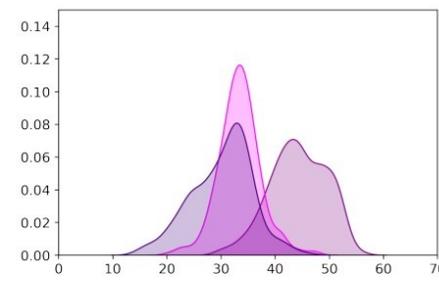


- For any global ambition, uncertainty in the size and structure of national economies significant
- However, the uncertainty shifts with global ambition
- Regional economic cost risk increases with ambition, as does implausibility

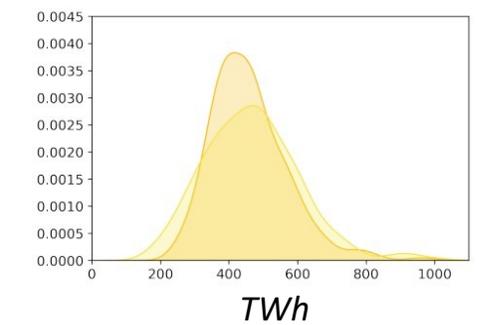
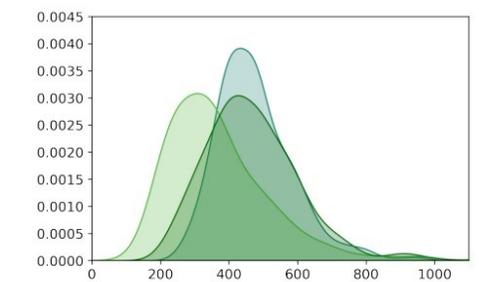
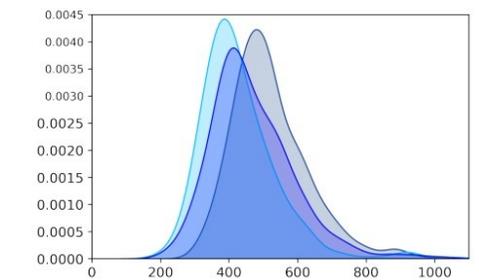
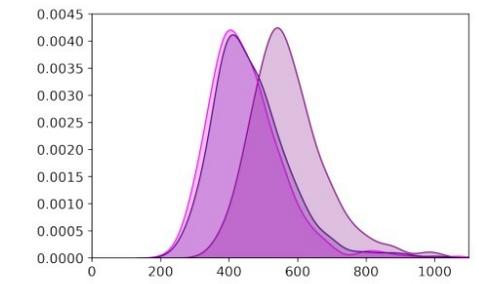
## Mexico 2050 consumption/capita change



## Mexico 2050 emissions/output



## Mexico 2050 electricity generation





# Assessing the options for projecting future global economies?

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## Options

1. [Shared Socioeconomic Pathways \(SSPs\)](#) – structural projections with SSP-RCP design
2. [“IPCC” projections](#) (IAMC hosted by IIASA) – large collection of projections
3. [Multi-model comparison studies](#)
4. [Individual model analysis and sensitivities](#)
5. [RFF/EPA](#) (Rennert et al, 2022) – statistical projections and expert elicitation
6. [EPRI-MIT](#) – probabilistic structural modeling projections

## Technical requirements

1. [Drive the climate](#) – project the different forcings of climate change (GHGs, etc.)
2. [Project future societies](#) – project societies exposed and responsive to climate change
3. [Internal consistency and coherency](#) – defined and plausible relationships
4. [Account for uncertainty](#)
5. [Project beyond 2100](#) (for some applications)

# Characterizing the options (in terms of requirements)

Option	Drive the climate			Project future societies				Internal consistency & coherency	Account for uncertainty				Project beyond 2100
	Kyoto GHGs	Non-Kyoto	Land albedo	Populations		Economies			Alternative climate forcer sets	Alternative future societies		Likelihoods & distributions	
				Size	Structure	Size	Structure			Global	Structure		
SSPs	Y	Y	Mixed	Regional	Mixed	Regional	Regions, sectors, interactions, (adaptive capacity, options, & dynamics possible)	Y	Limited, truncated	Limited, truncated	Limited, truncated	N	Stylized extensions
IPCC	Mixed	Mixed	Mixed	Regional	N	Regional	Regions, sectors, interactions, (adaptive capacity, options, & dynamics possible)	Y	Limited, truncated, arbitrary	Limited, truncated, arbitrary	Limited, truncated, arbitrary	N	N
Multi-model study	Mixed	Mixed	Mixed	Regional	N	Regional	Regions, sectors, interactions, (adaptive capacity, options, & dynamics possible)	Y	Limited, truncated	Limited, truncated	Limited, truncated	N	N
Individual model study	Mixed	Mixed	Mixed	Regional	N	Regional	Regions, sectors, interactions, (adaptive capacity, options, & dynamics possible)	Y	Limited, truncated	Limited, truncated	Limited, truncated	Mixed	Mixed
RFF/EPA	Partial	N	N	Regional	N	Regional	N	N	Limited	Limited	N	Statistical & expert elicitation	Aggregate
EPRI-MIT	Y	Y	Y	Regional	N	Regional	Regions, sectors, interactions, (adaptive capacity, options, & dynamics possible)	Y	Limited	Limited	Limited	Sub-global for plausible alternative global pathways	Not to date

# Concluding remarks

- Future economic structural uncertainty—global and sub-global—is significant for a single global emissions pathway, but not currently considered by applications
- Wide ranges of global and sub-global economies (and populations) are potentially exposed to, and at risk, from future climate change
  - With economic size, structure, and relationships a function of uncertain non-policy, policy ambition, and policy design conditions
  - And linked, consistent, and coherent shifts in economies occurring with alternative conditions
- Plausibility is also important – we frequently find implausible futures being assumed
- There are alternatives for projecting future global societies
  - No option currently satisfies all the technical requirements, but they differ notably in what they provide
    - The greatest differences are in representing climate drivers and economic structure, internal consistency and coherency, characterizing likelihoods and distributions, and projecting beyond 2100
  - There are trade-offs, biases, and potential errors to consider, evaluate, and justify when choosing one



# Thank you!

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