Climate Policy as Risk Management

Geoffrey Blanford

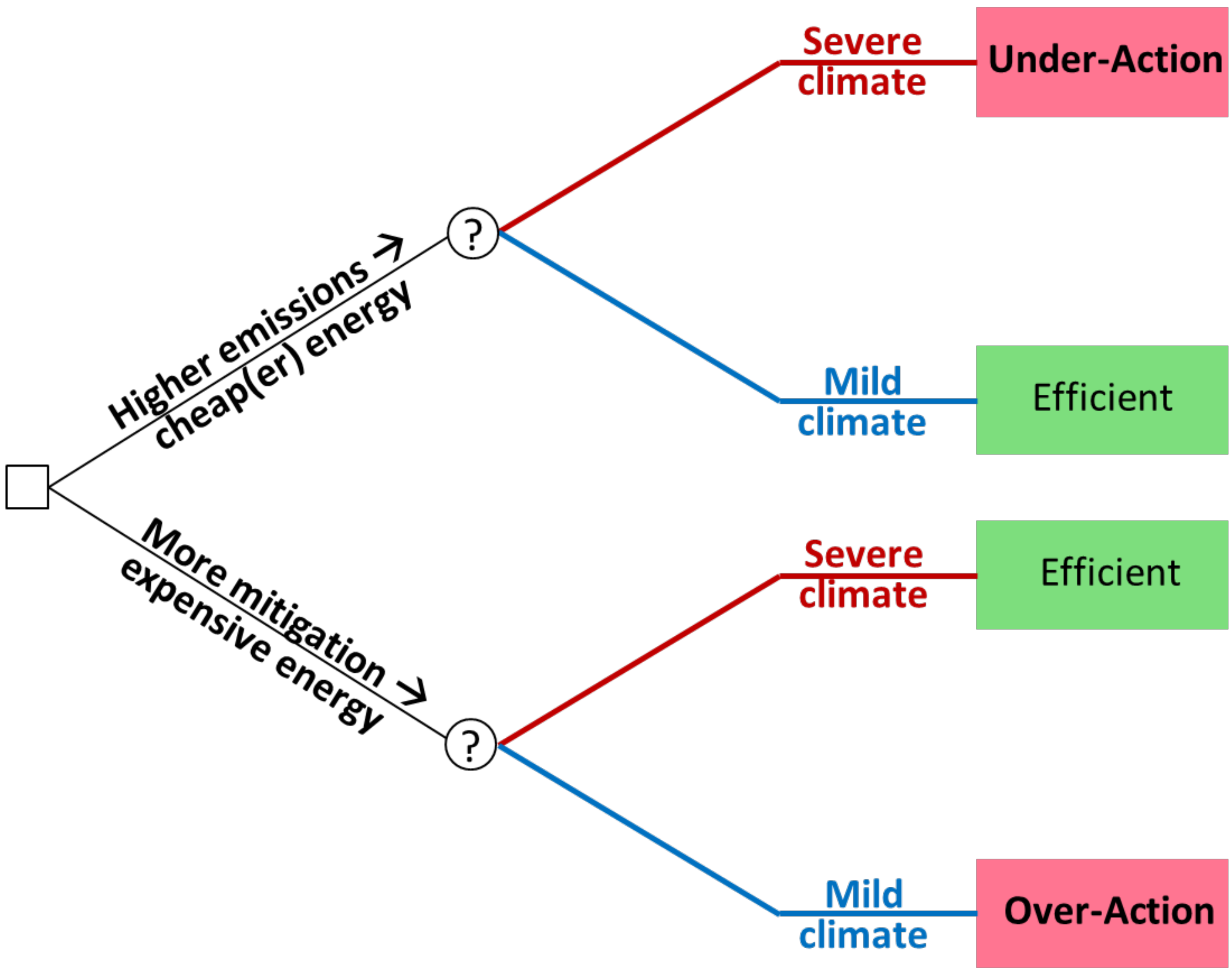
Delavane Diaz, Richard Richels, Steven Rose, Thomas Rutherford

IAMC Annual Meeting

Potsdam, Germany

November 16, 2015

Climate policy is fundamentally about risk



Perceptions of climate risk drive GHG regulations… yet little analysis informs risk trade-offs

- Instead, climate policy has been oriented around long-term targets:
  - 550, then 450 (now 350) ppm CO_2, then 2°C (now 1.5°C)
- Nearly all mitigation analysis has focused on evaluating the costs of meeting targets – with perfect foresight
  - Fixed targets ignore marginal trade-offs, imply infinite damages above threshold
  - Uncertainty handled with scenarios – no probabilities, no decision-making under uncertainty
- A better framework → Risk Management analysis
  - Efficient mitigation strategy can be described as a hedging path before uncertainty is resolved

In this presentation

- Illustrate risk management analysis with MERGE model
  - Model and scenario set-up
  - Characterization of uncertainty in damages and climate sensitivity
  - Optimal policy with *known* damages/climate
  - Optimal policy with *uncertain* damages/climate (based on expected utility)

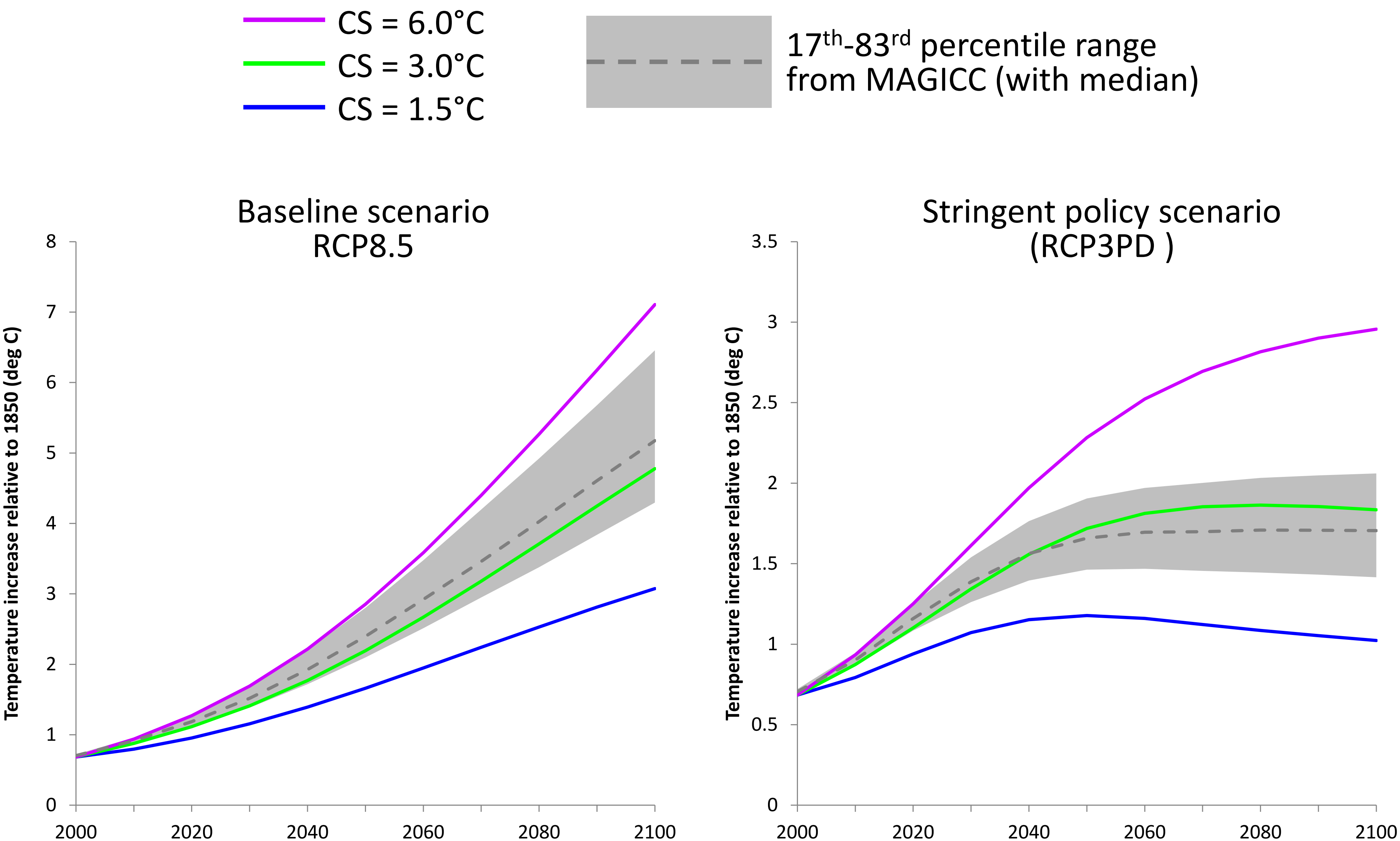
- Next steps, what's missing

- Results are ***illustrative***, intended to demonstrate the potential of this framework to better frame policy objectives

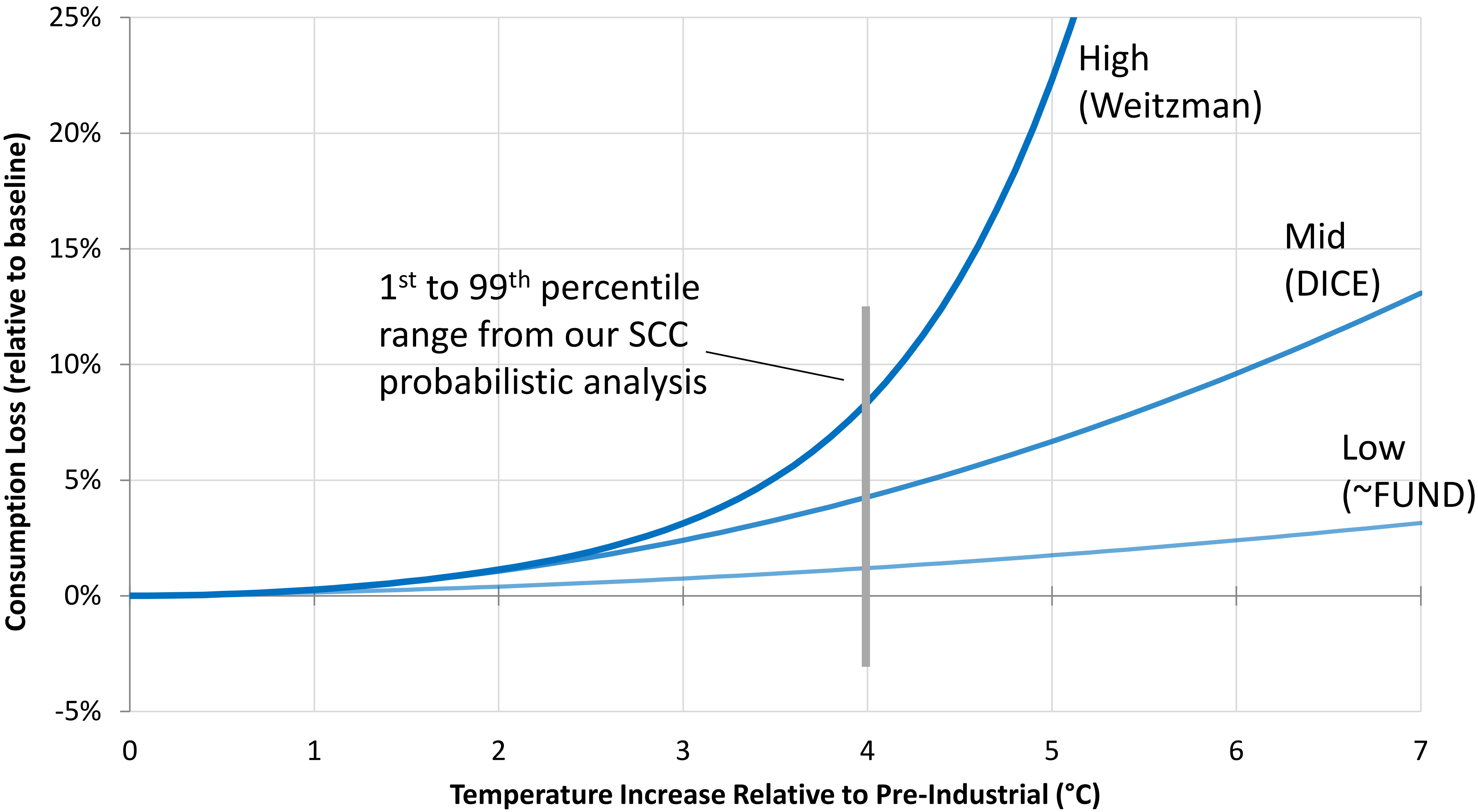
MERGE model set-up

- Single world region – necessary for computation of uncertainty
- Compared to SCC models, MERGE has more detail in energy, economy, and climate system
  - Electric sector technologies capture (more) realistic abatement decisions
  - Investment decisions & capital dynamics are critical for hedging
- Introduce damage functions and uncertainty states
- Focus on 2 leading uncertain parameters – main topics raised in public comments on SCC and government response
  - Climate sensitivity
  - Damage functions

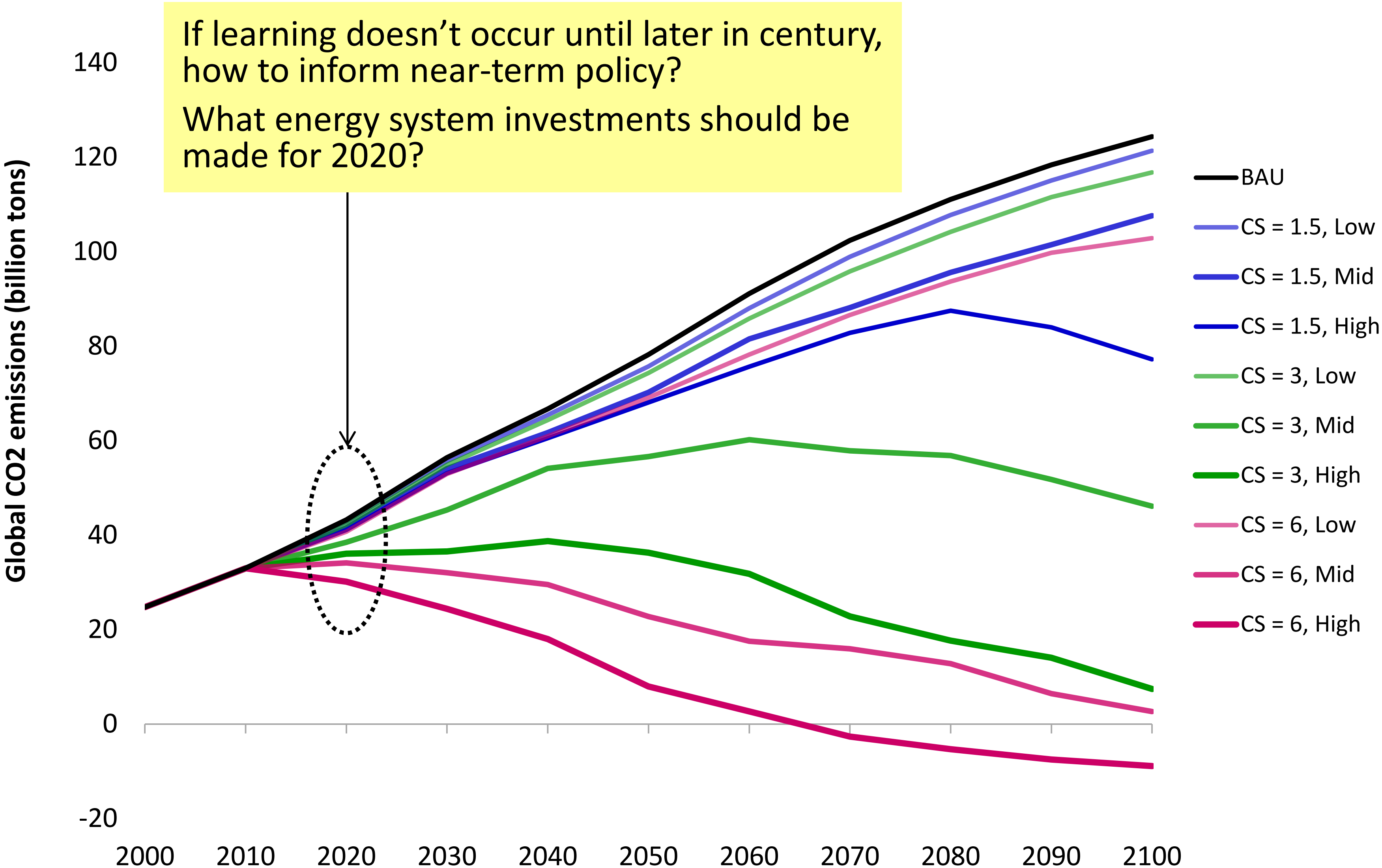
Input Assumptions: 3 Alternative Climate Sensitivities



Input Assumptions: 3 Illustrative Damage Functions

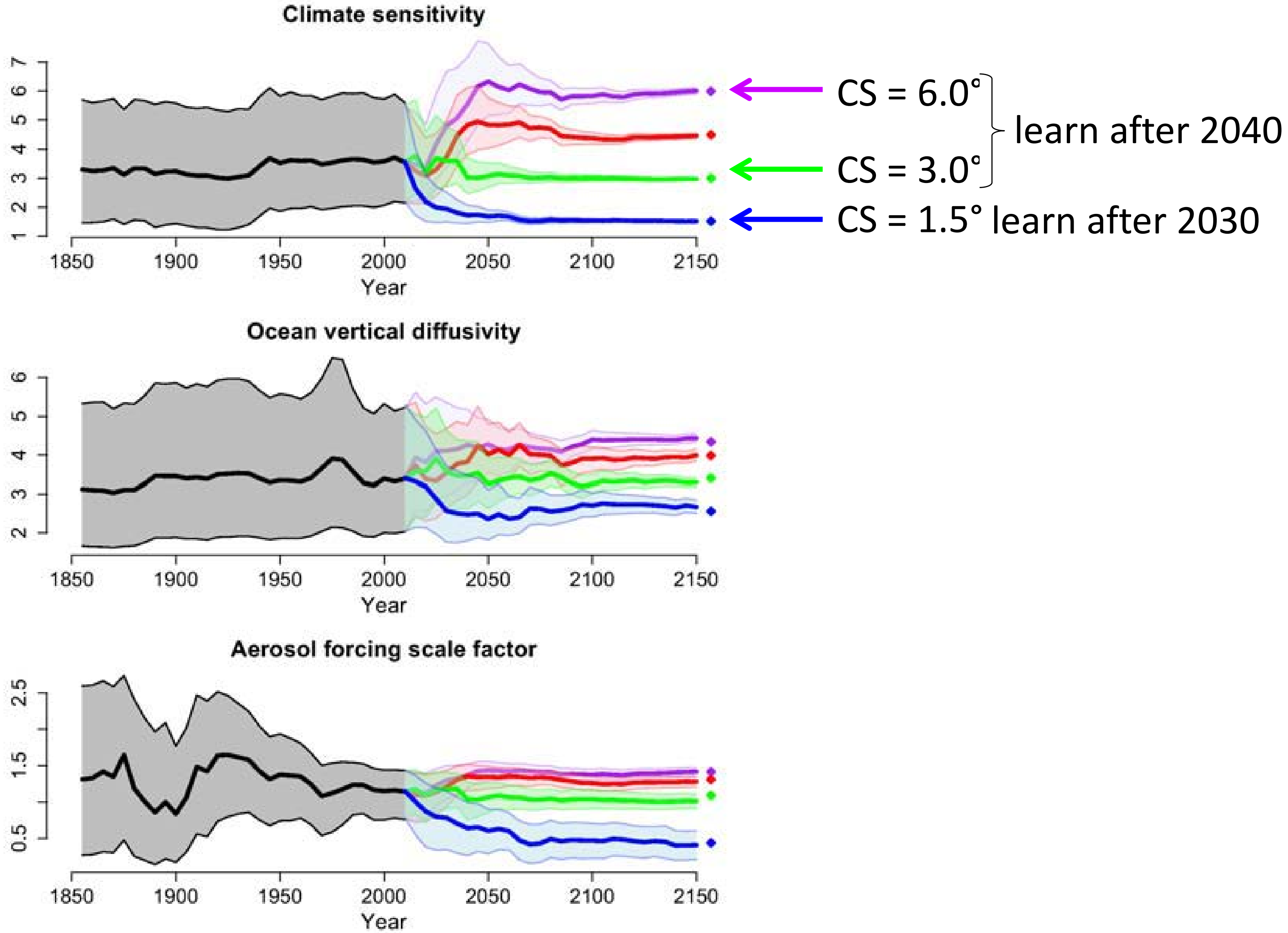


"Learn then Act" emissions paths efficiently balance mitigation costs if impacts are *known*



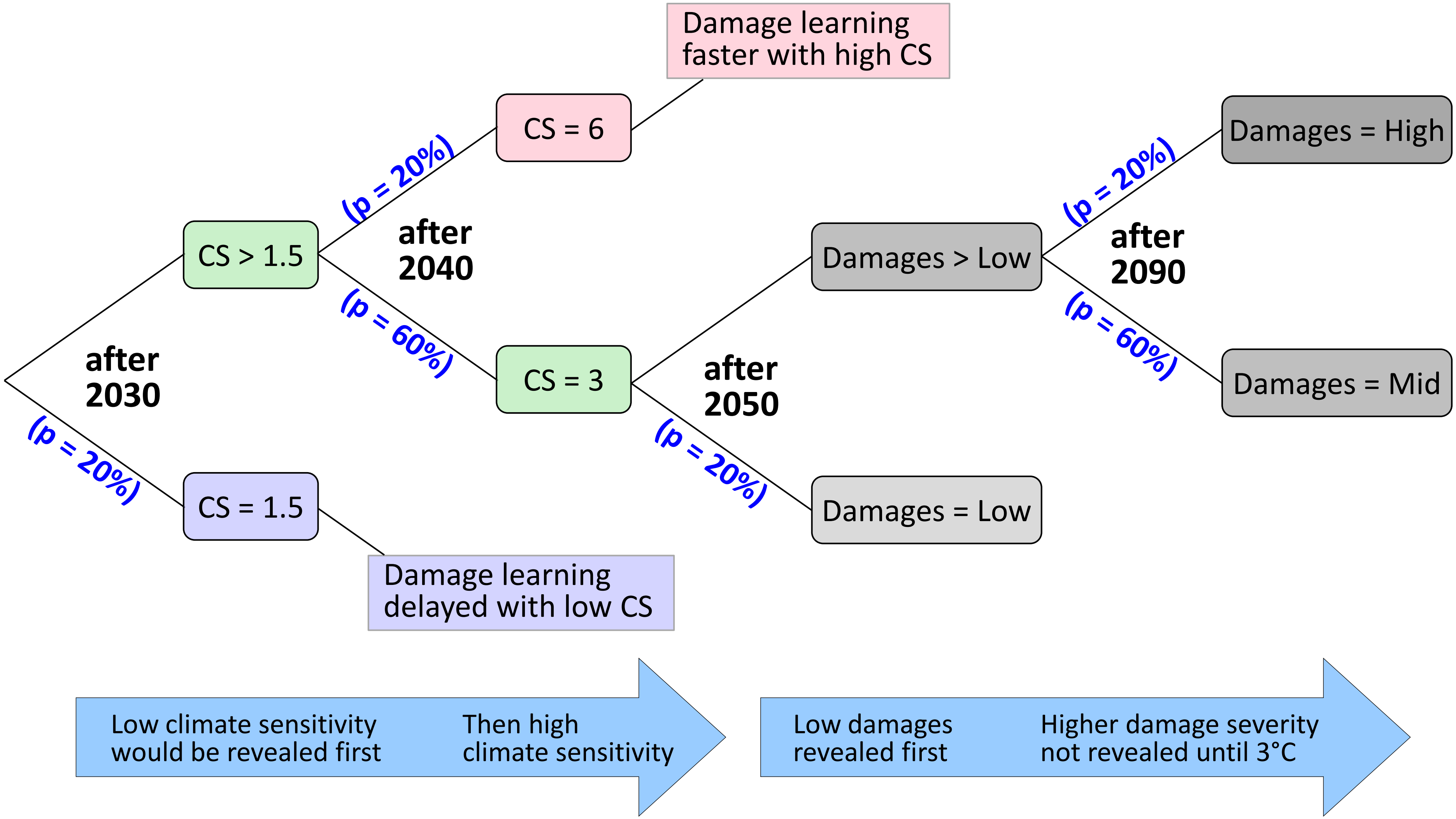
EPRI ELECTRIC POWER RESEARCH INSTITUTE

Future learning about climate sensitivity (from observations)



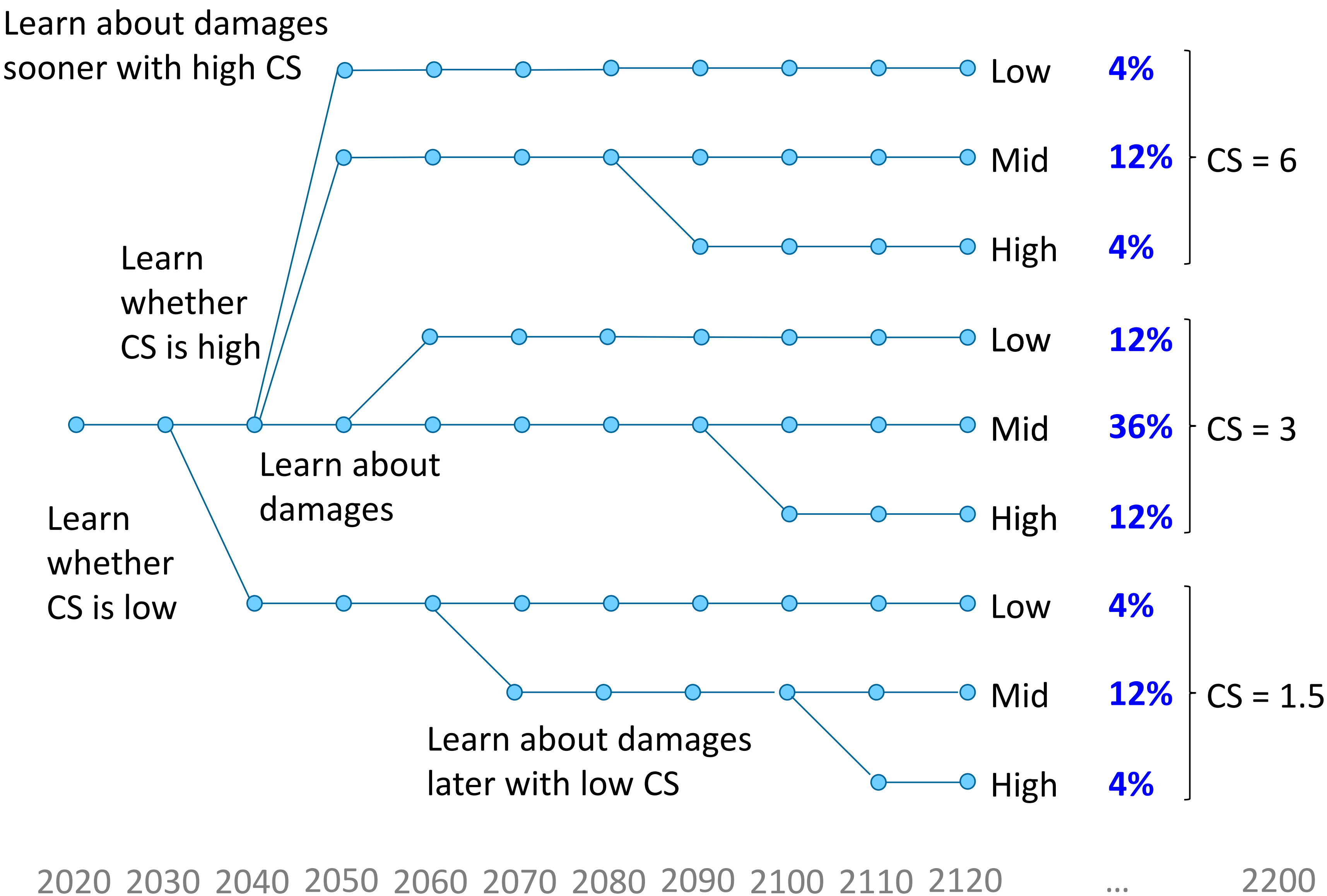
Urban et al (2014). "Historical and future learning about climate sensitivity," *Geophysical Research Letters* **41**(7), pp 2543-2552.

Suppose we "learn" over time but have to "act" now?

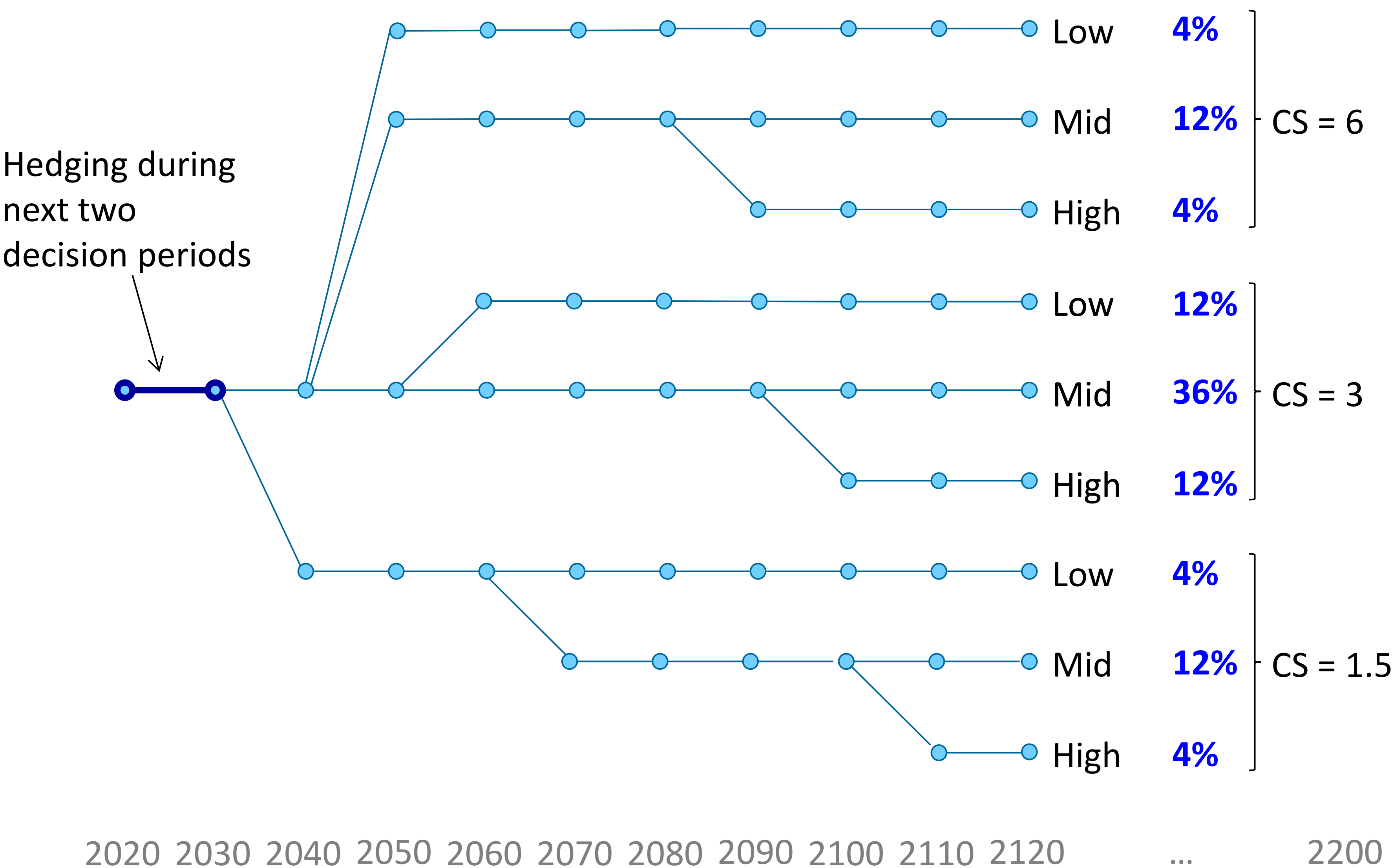


(Illustrative Probabilities)

Combined State Space

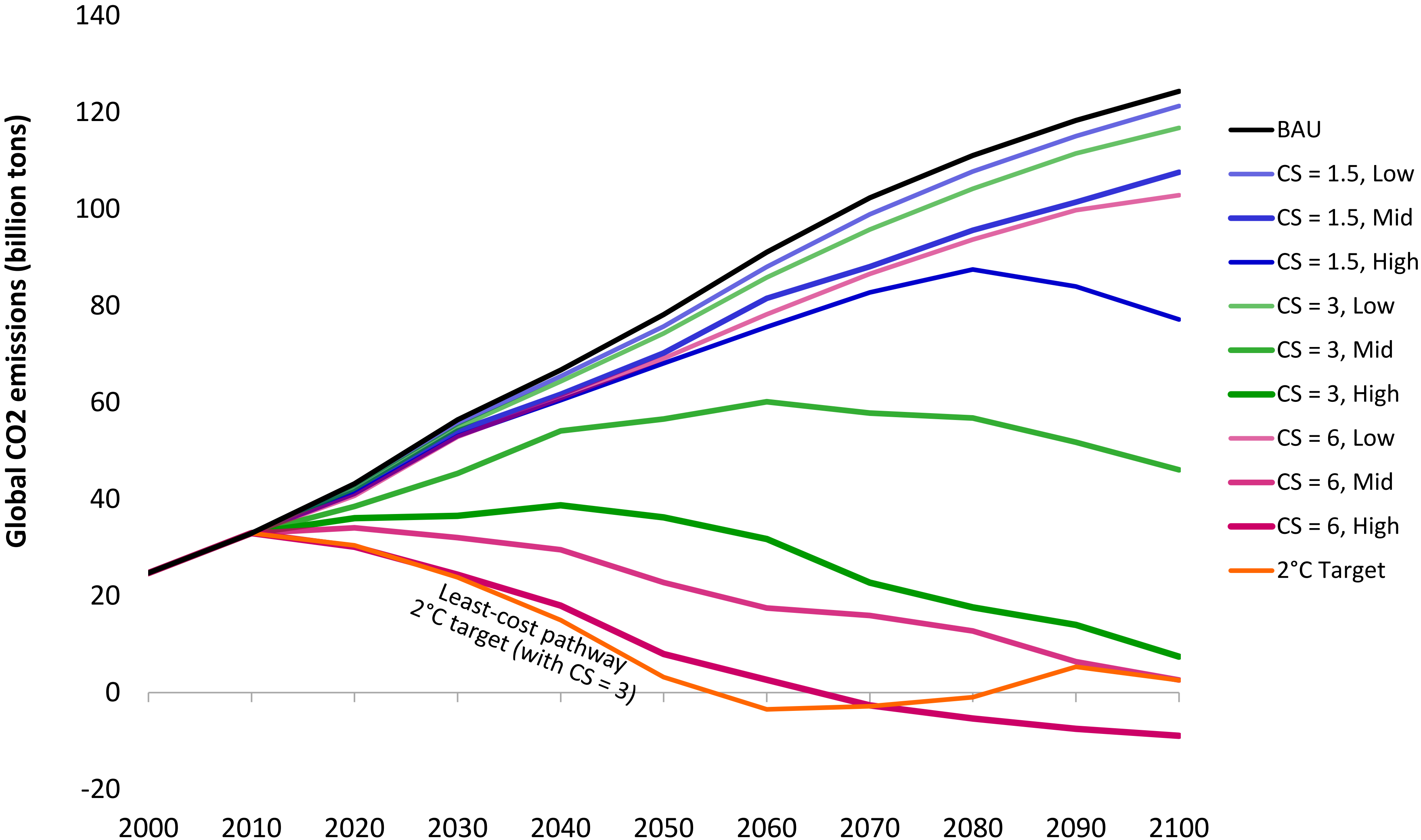


Primarily interested in 2020 and 2030



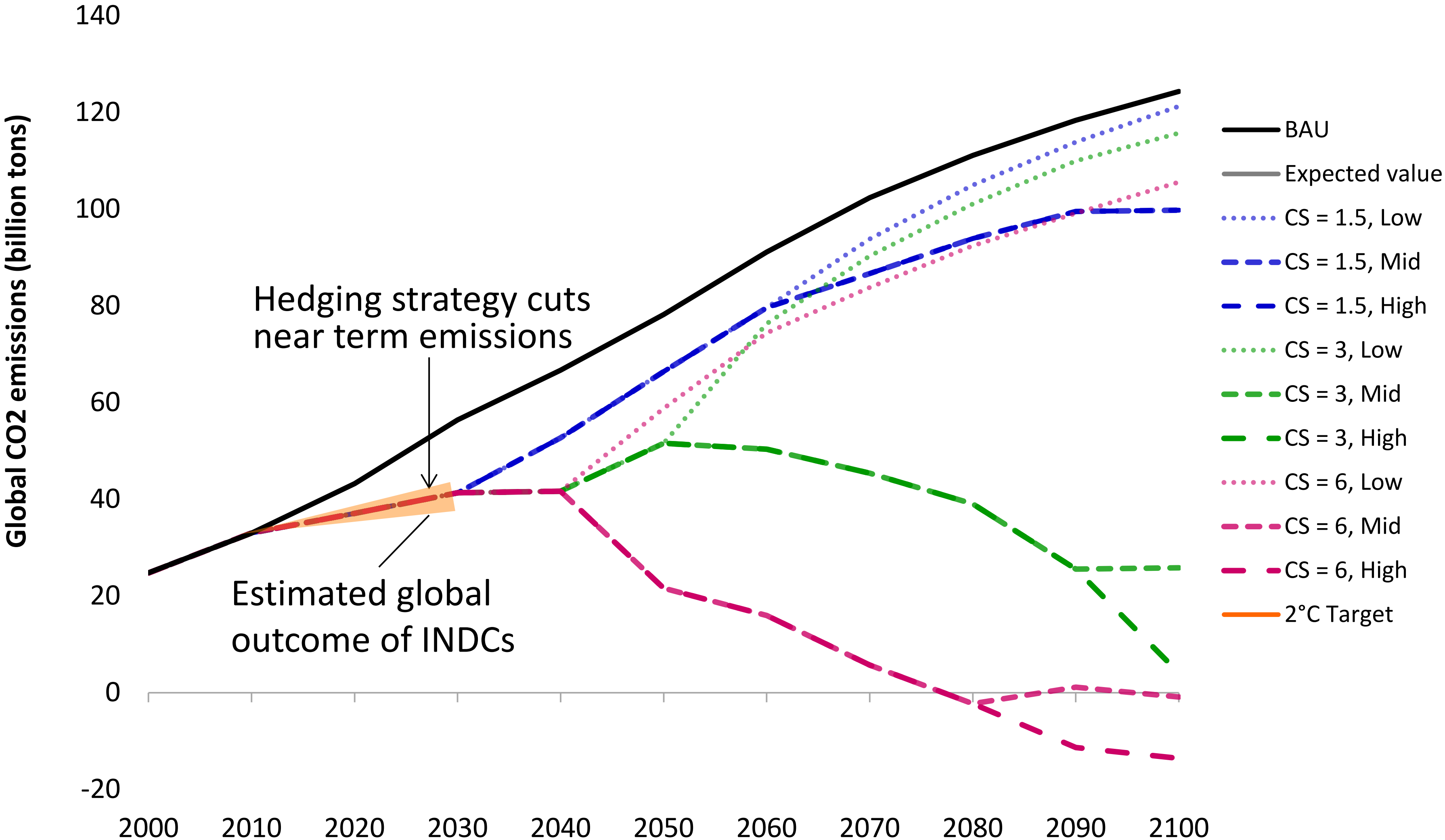
EPRI ELECTRIC POWER RESEARCH INSTITUTE

"Learn then Act" – Efficient emissions for *known* impacts

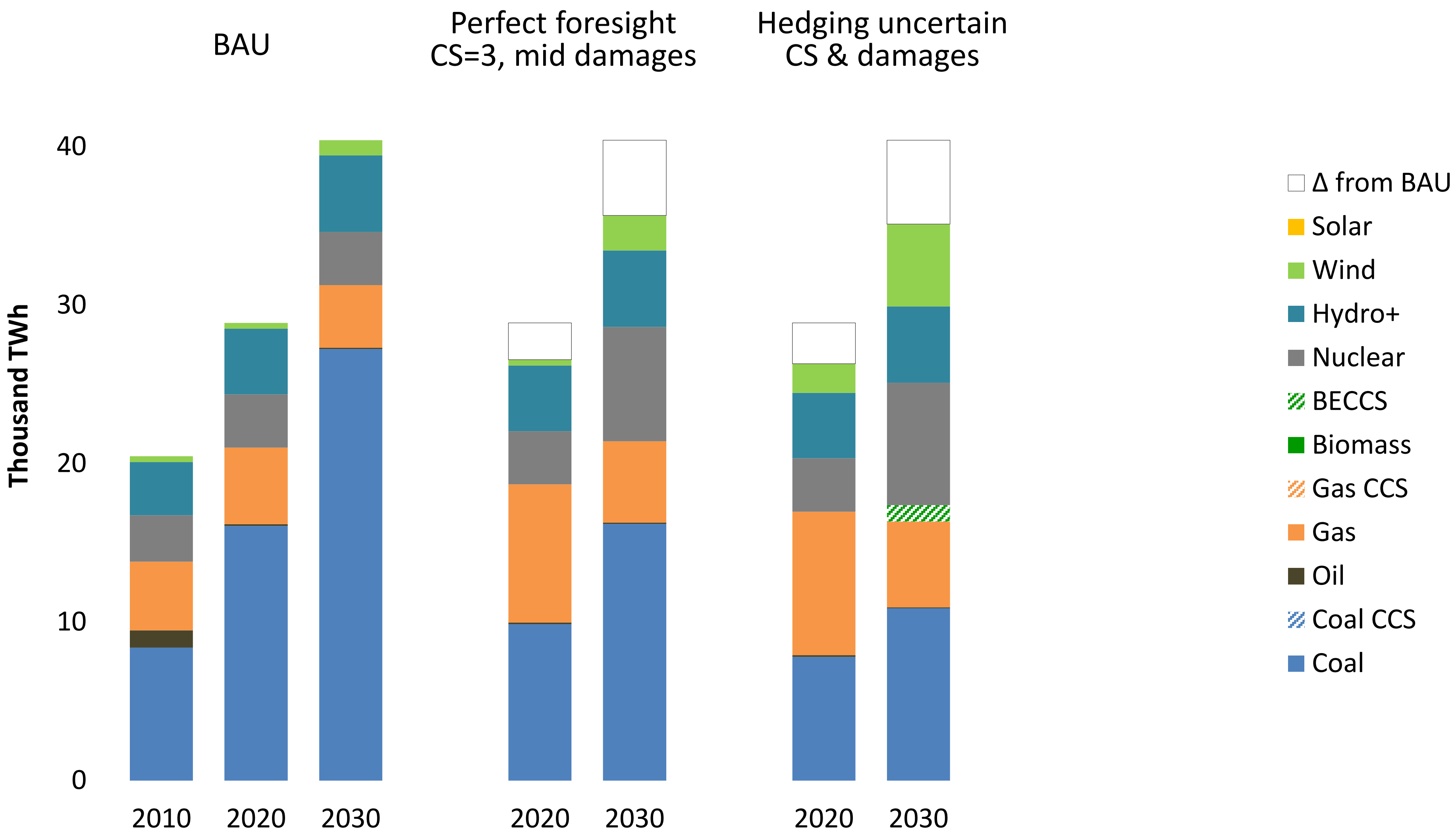


EPRI ELECTRIC POWER RESEARCH INSTITUTE

“Act then Learn” – Efficient emissions for uncertain climate and damages



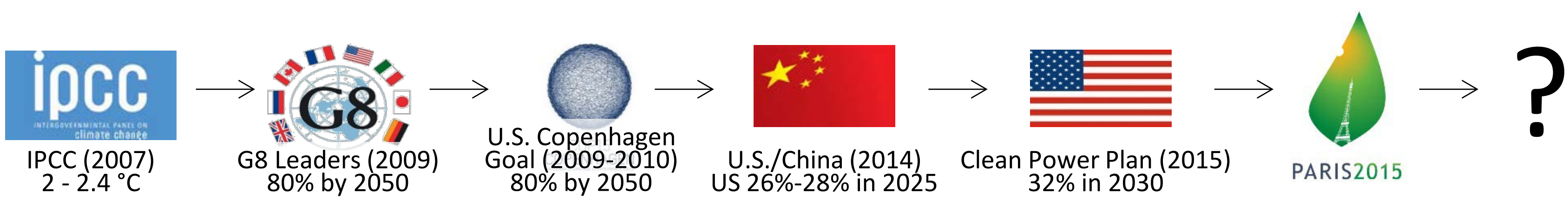
Near-term efficient generation mix varies depending on risk management framework



ELECTRIC POWER RESEARCH INSTITUTE

Key insights

- "Perfect foresight" near-term strategies vary widely with climate sensitivity and damage assumptions
  - Unclear how to interpret for policy – **similar to wide range of SCC estimates**
  - Risk management suggests an alternative, more analytically sound approach
- Mitigation cost and assumptions about climate/damage uncertainties (among others, as well as preferences) drive results
  - In this example, deep cuts occur only after worst-case state is confirmed
- Policy measures will evolve over time



- Risk Management Analysis can inform this evolution

Next steps: Many opportunities

- MERGE is well suited to implement a decision-making under uncertainty framework
- Further research needs to strengthen analysis:
  - More comprehensive assessment of damages literature
    - Explicit representation of possible catastrophic events
    - Treatment of adaptation
  - Adding regional detail and interactions
    - Incomplete participation, differentiated damages, etc.
    - Potential links to “Road to Paris” analysis of pledges / targets
  - Additional uncertainties around other input assumptions
    - Baseline growth, technology costs, etc.
  - Co-benefits, e.g. air pollution
  - Alternative attitudes toward risk, discounting
  - Growth-related impacts (of both mitigation and damages)

Together…Shaping the Future of Electricity