



Climate Policy and Business Decisions: How Can Generators and Utilities Manage Risks?



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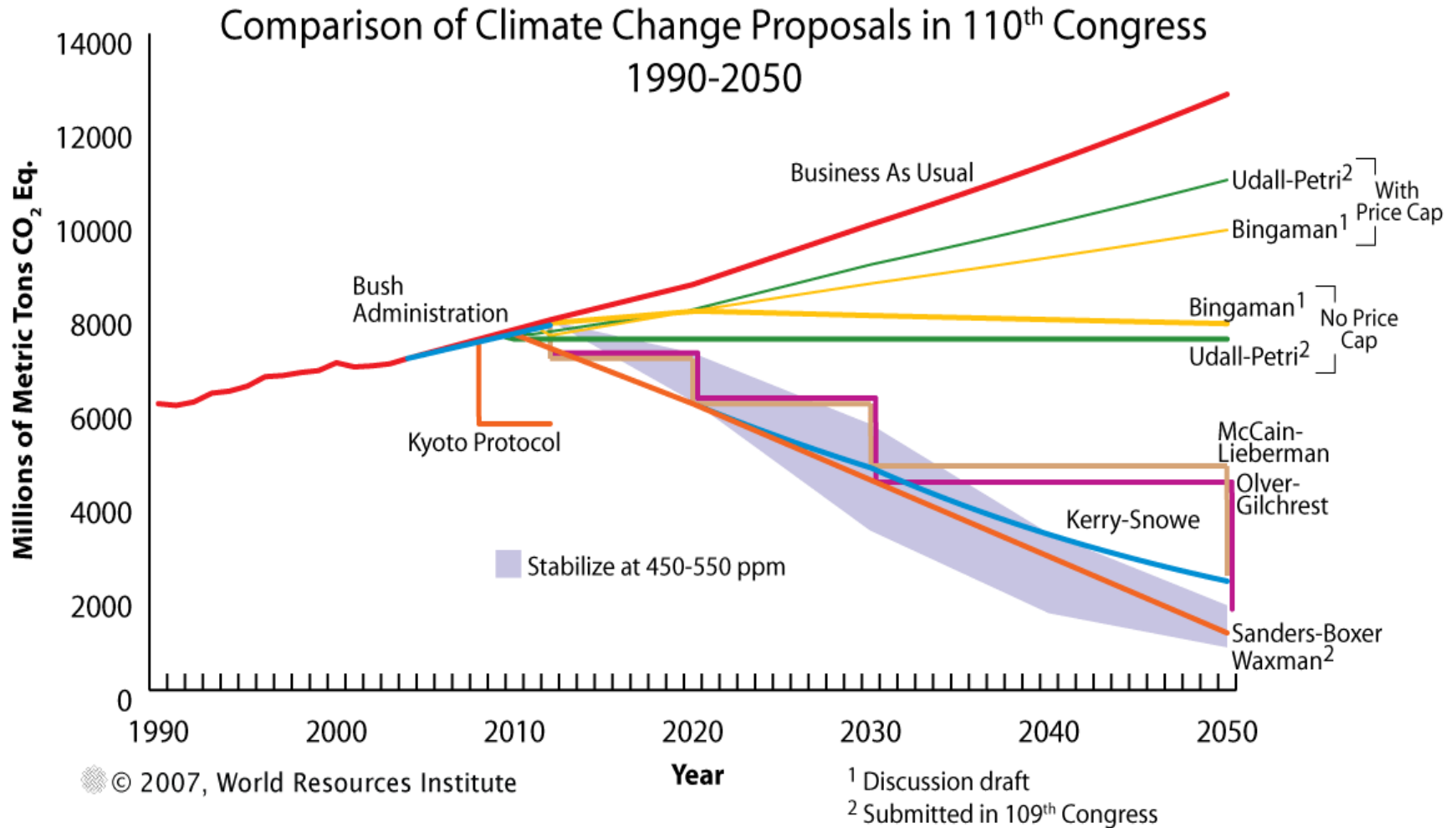
Anne E. Smith, Ph.D.

**Harvard Electricity Policy Group
October 4, 2007**

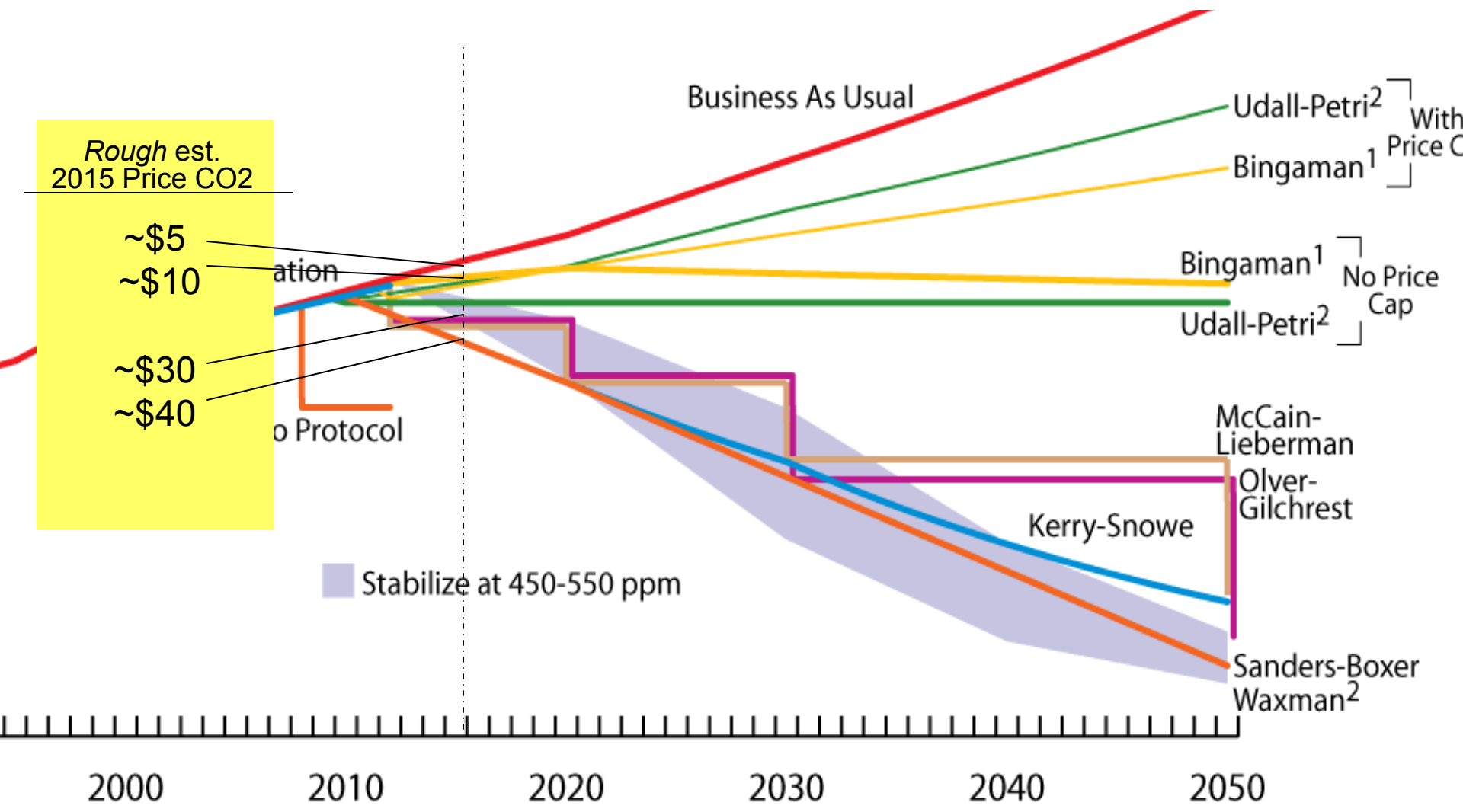
Climate Policy Creates A New Dimension of Investment Risk for Utilities and Generators

- **Proposals before Congress span immense range of approaches and potential carbon prices**
- **Investments that look good under one carbon policy outlook look terrible under another**
- **This adds up to much more difficult investment decisions than the power industry has faced for many years**
 - **What to build or acquire** – natural gas, coal, take a chance on nuclear or carbon capture and sequestration?
 - **What to invest in existing units** – retrofit environmental controls, perform unexpected maintenance?
 - **What businesses to be in or out of** – will utility regulation protect against cost risks or magnify them?
- **Companies need more robust decision processes taking into account market and policy uncertainties and options for reducing risk**

Huge Variation in What Is Being Discussed Now -- and Their Business Impacts Also Differ Dramatically



Comparison of Climate Change Proposals in 110th Congress 1990-2050



Rough est.
2015 Price CO2

- ~\$5
- ~\$10
- ~\$30
- ~\$40

¹ Discussion draft

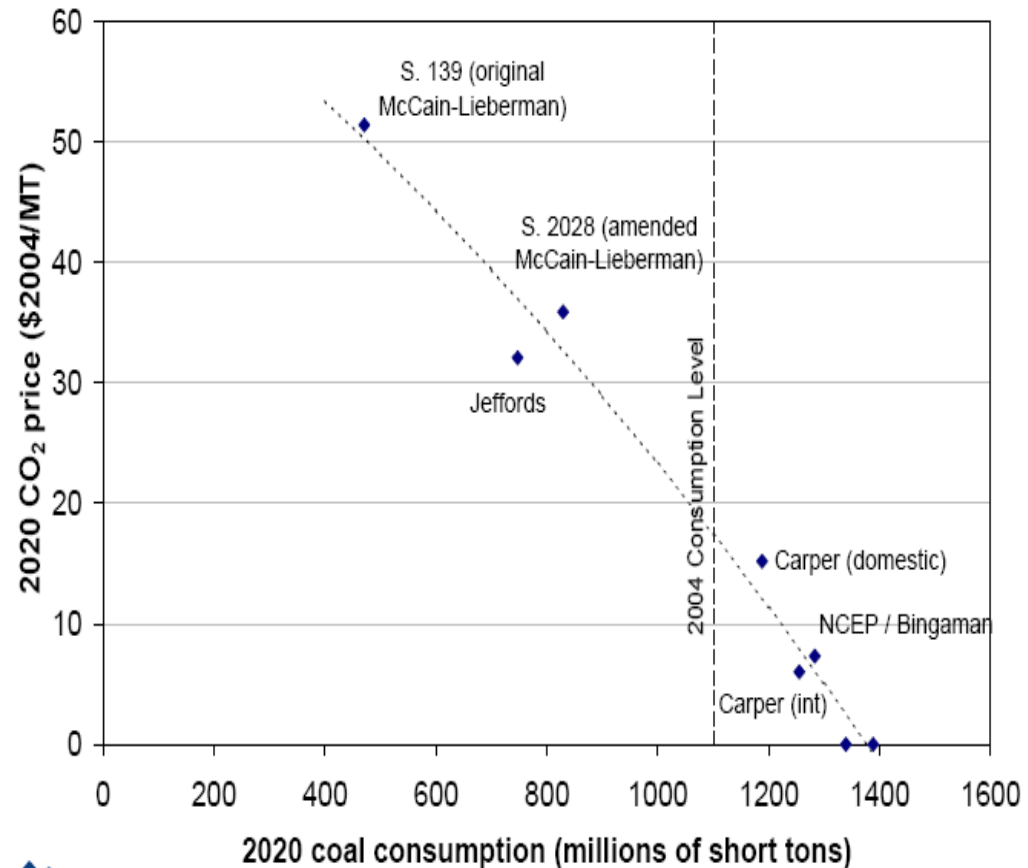
² Submitted in 109th Congress

High CO₂ Prices Are Game Changing

- **With ~\$10/T CO₂ (rising in real terms)**
 - Some new coal-fired generation can be profitable *for a while*
 - Existing coal-fired generation can survive, some retrofits still make sense
- **With ~\$30/T CO₂ (rising in real terms)**
 - No new investment in coal-fired generation without CCS
 - Most existing coal-fired generation units are at risk
 - Investments in environmental retrofits on some existing coal units may be unwise

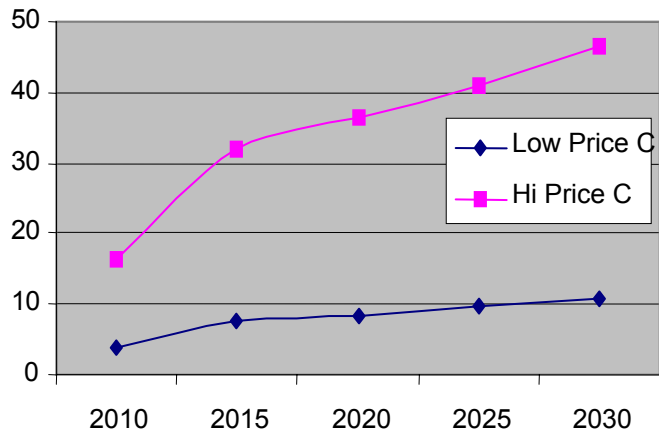
2020 Coal Consumption versus CO₂ Price

(select EIA analyses)

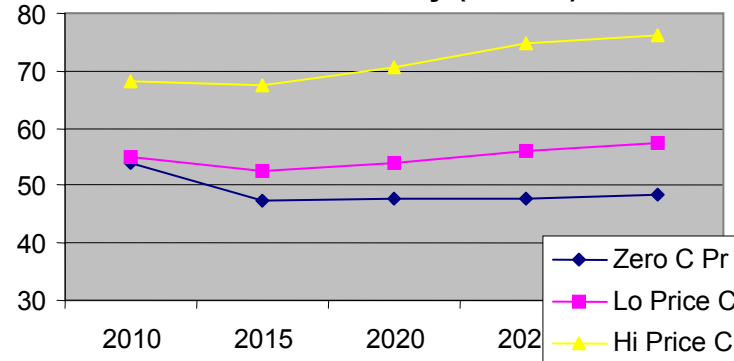


CO₂ Prices Are Integrated with Everything Else that Matters to Generation Planners

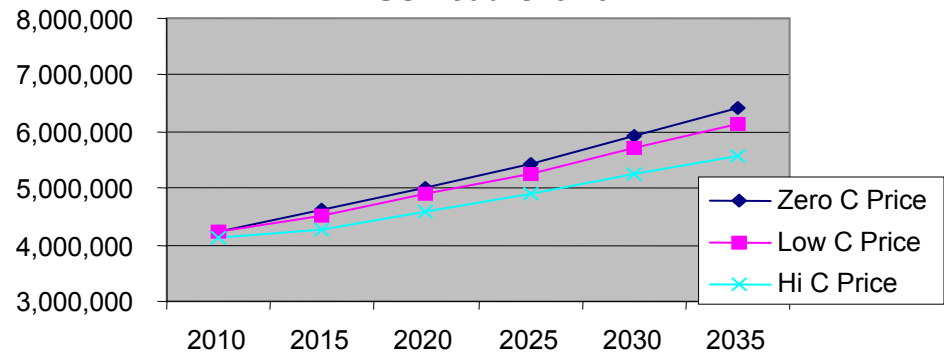
Price of CO₂ (\$/short ton)



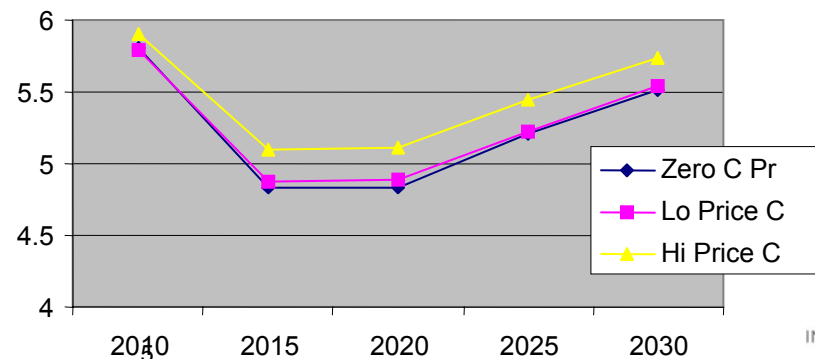
Price Electricity (\$/MWh)





















US Load Growth



Natural Gas Prices (\$/mmBtu constant 2003\$)

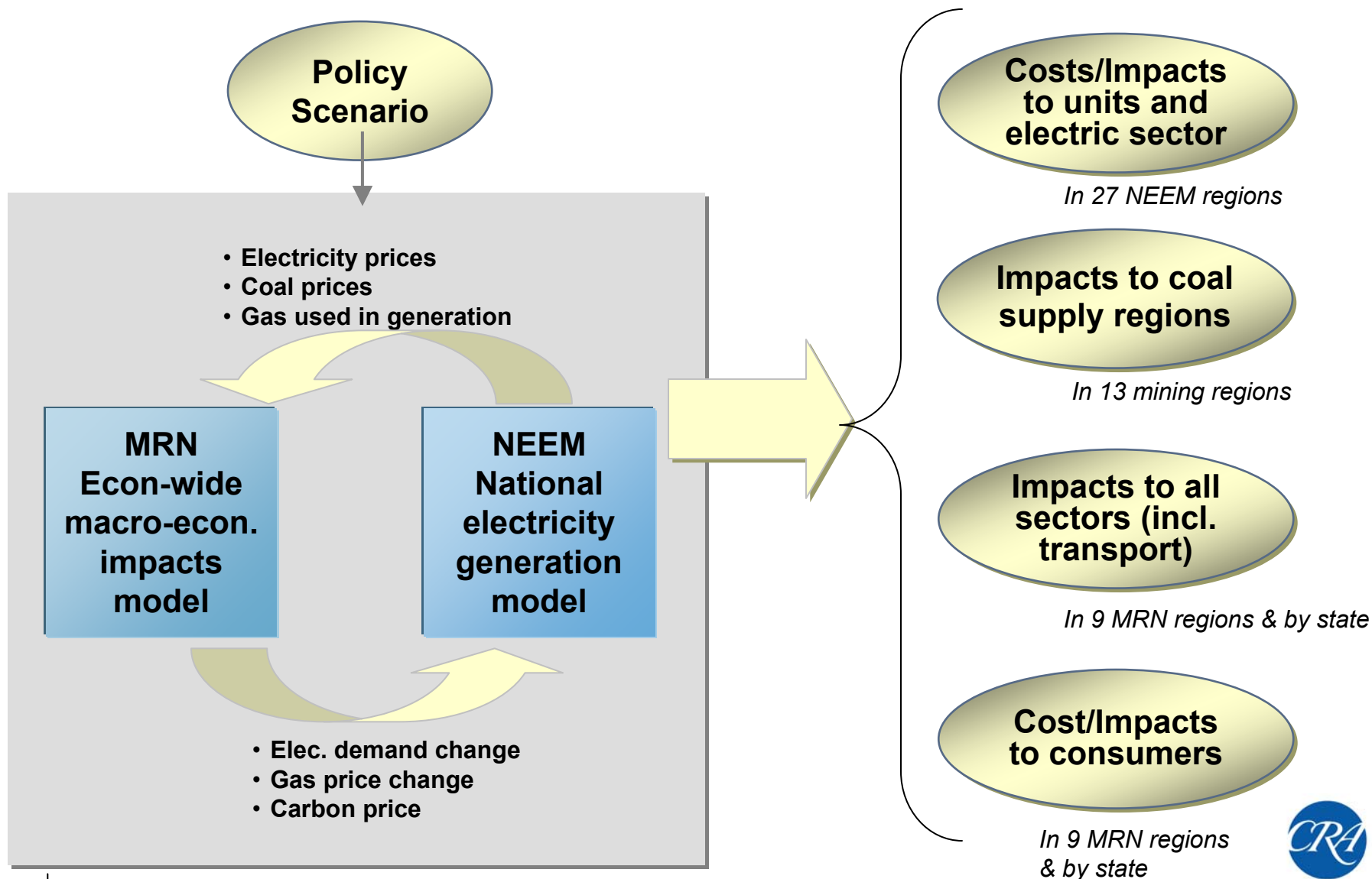


CO₂ Prices: The Tail that Wags the Dog in Energy Markets

	Lower CO2 Price	Higher CO2 Price	V. High CO2 Price
– Natural gas demand			
– Natural gas prices			
– Energy demand			
– Energy prices			
– Coal costs			
– Emission allowance prices			

Investment decisions need to be based on projections of commodity and allowance prices that are mutually and internally consistent (“integrated”)

CRA Developed its MRN-NEEM Model Specifically to Provide for Integrated Energy-Environmental Analysis



Key Needs for Business Planning in this Situation

1. Scenario analysis
2. Combined with integrated modeling of energy-economy

Analysis Using Integrated Scenarios May Not Be Sufficient: Best Alternative Usually Varies by Scenario

Gas Supply	Preferred Decision by Carbon Policy Scenario						
	Scn0	Scn1	Scn2	Scn3	Scn4	Scn5	Scn6
Tight	Build Coal	Build Coal	Build Coal	Build Coal	Build Coal	Build Gas	Build Gas
Plentiful	Build Coal	Build Coal	Build Gas	Build Gas	Build Gas	Build Gas	Build Gas



When best decision is highly dependent on scenario outcome, probabilistic decision analysis can be performed

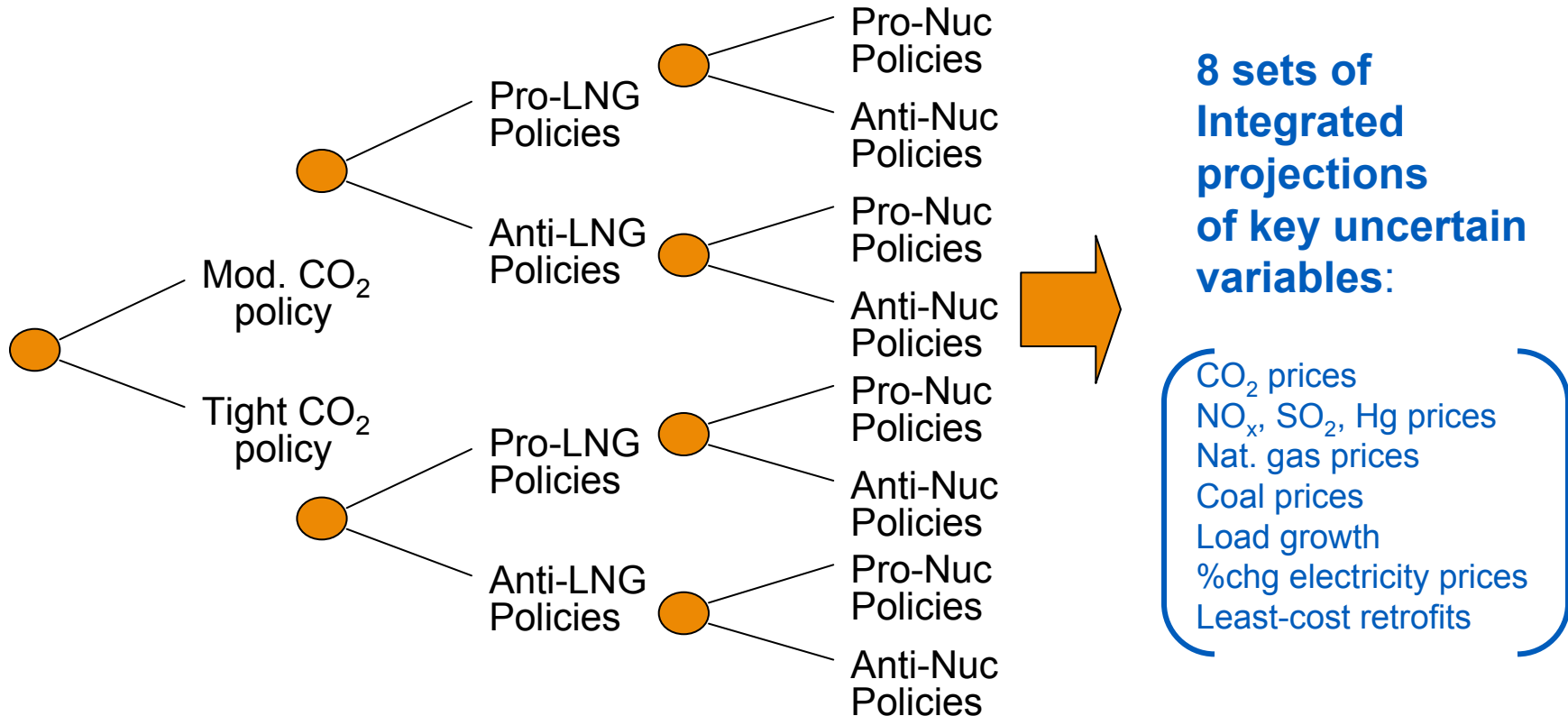
Key Needs for Business Planning in this Situation

1. **Scenario analysis**
2. **Combined with integrated modeling of energy-economy**
3. **Probabilistic analysis and decision analysis**
 - Scenarios alone are likely to only highlight riskiness of choices
 - Decision analysis tools necessary to choose among risky propositions
 - Decision analysis can help account for risk-reduction from sequencing decisions and preservation of options

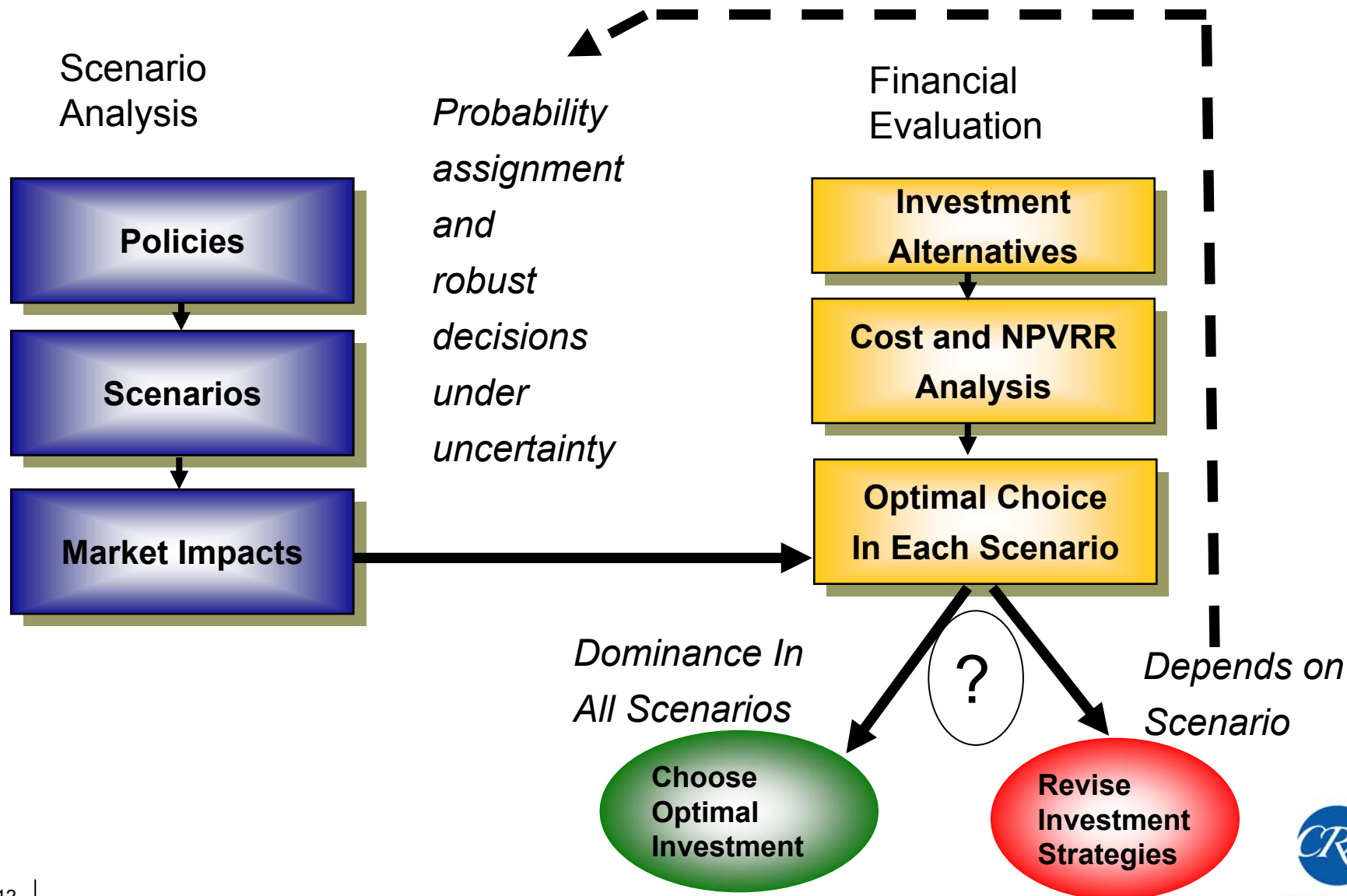
“Monte Carlo” uncertainty analysis cannot do this job



Step 1 for a Probabilistic Analysis with Integrated Uncertainties: Create Probability Tree Defining Range of Integrated Planning Scenarios



CRA Provides a Systematic Process for Developing Investment Strategy With Climate Policy Uncertainty



Closing Observations

- **What regulators will accept as a cost is the most important fact of life for regulated utilities**
 - Some first movers to newer technologies are regulated utilities with low load growth and ability to pass risk/cost onto consumers
- **Unregulated generators may gain or lose depending on their generation mix and how wholesale prices increase as a result of carbon policy**
- **Investment choices are highly dependent on the carbon scenario envisioned, but uncertainties about natural gas prices, construction costs, and technology also matter**
- **Greatly increased uncertainty requires**
 - Integrated analysis of all the relevant market developments
 - Assignment of probabilities to different scenarios
 - New processes within companies to reach robust decisions



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