Carbon Dioxide Emissions Costs and Electricity Resource Planning

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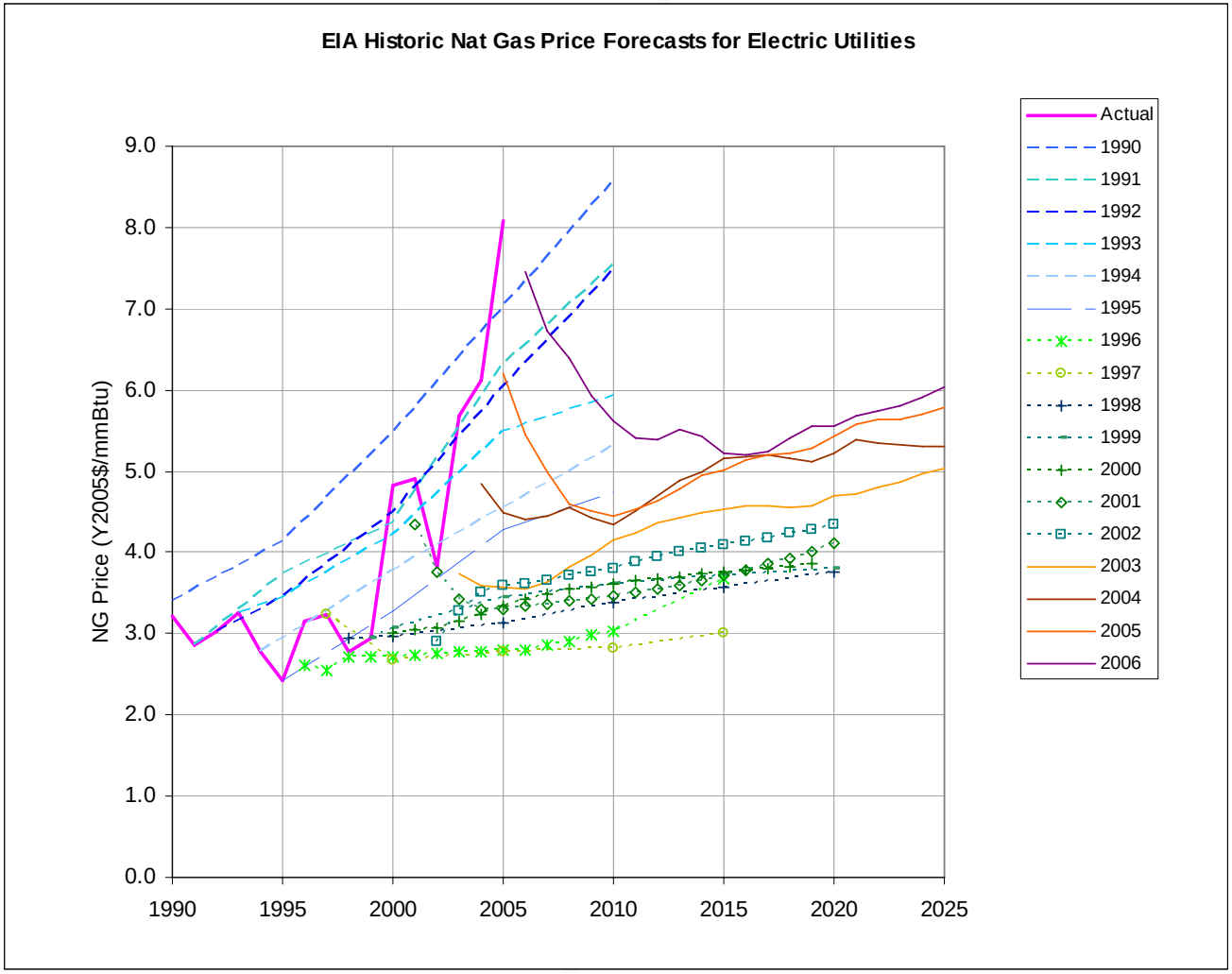
Background

- There is increasing acknowledgement of climate change from industry and government and that emissions from fossil fired power plants are a major contributor.
- Federal regulation of CO_2 emissions is now a question of when, not if.
- Significant reductions will be required.
- Imprudent for a utility to evaluate future resource options without fully considering carbon risks.

Uncertainty in Many Resource Planning Assumptions Example: Natural Gas Prices



How to Make CO_2 Costs *Not* Count In Resource Planning

1. Too uncertain! – assume that CO_2 costs will be zero throughout 40-60 year operating lives of proposed generating facilities.
2. Assume CO_2 costs only as sensitivity analyses – not in base case studies.
3. Assume only a single CO_2 price trajectory, not a range of possible CO_2 prices.
4. At best, only a few non-carbon emitting resources are made available for model to select.
5. Avoided costs for energy efficiency don't reflect the cost of CO_2 regulations.
6. Assume CO_2 prices do not reflect any increases, over time, of the stringency of regulation.
7. Assume delayed adoption or implementation of CO_2 regulations, e.g., not starting until 2015.
8. Focus on decreasing carbon intensity (lbs per MWh) instead of reducing overall CO_2 emissions.
9. Assume that new units will be grandfathered.

Current Synapse CO_2 Price Forecast

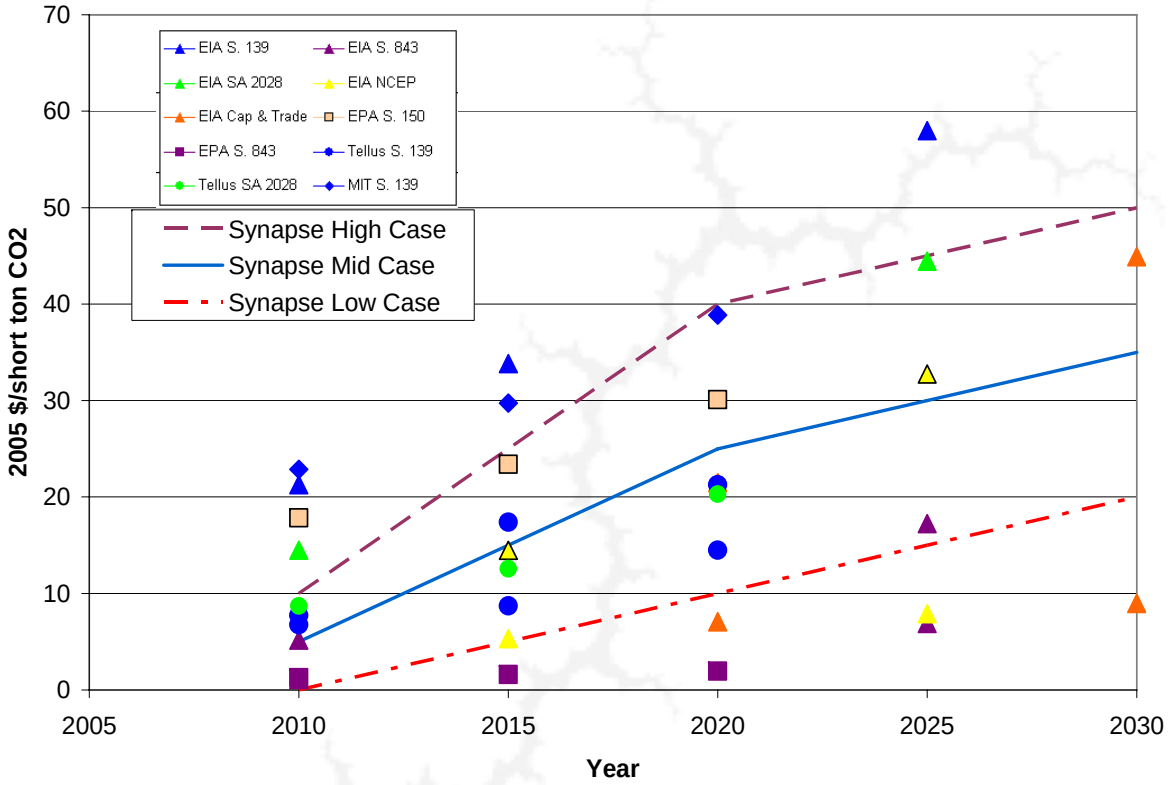
- Developed in the Winter and Spring of 2006.
- Based on several factors including analyses of four bills proposed in Congress prior to 2006 and a proposal from the National Commission on Energy Policy.

Policy proposal	Analysis
McCain Lieberman – S. 139	EIA 2003, MIT 2003, Tellus 2003
McCain Lieberman – SA 2028	EIA 2004, MIT 2003, Tellus 2004
Greenhouse Gas Intensity Targets	EIA 2005, EIA 2006
Jeffords – S. 150	EPA 2005
Carper 4-P – S. 843	EIA 2003, EPA 2005

Factors that Affect Future Carbon Emissions Policy Costs

- "Base case" emissions forecast
- Complimentary policies
- Policy implementation timeline
- Reduction targets
- Program flexibility
- Technological progress
- Emissions co-benefits

The Current Synapse CO_2 Price Forecast



Synapse's Levelized Carbon Price Forecast (2005$/ton)

Low Case	Mid Case	High Case
$7.80	$19.10	$30.50

Examples of the Impact of Current Synapse CO_2 Price Forecast on Costs of Fossil Supply Options

For a new plant online in 2011			
	Supercritical PC	**Combined Cycle**	**IGCC**
Size (MW)	600	600	535
CO_2 (lb/MMBtu)	208	110	200
Heat Rate (Btu/KWh)	9,369	7,400	9,612
CO_2 Low Price (2005$/ton)	7.8	7.8	7.8
CO_2 Mid Price (2005$/ton)	19.1	19.1	19.1
CO_2 High Price (2005$/ton)	30.5	30.5	30.5
CO_2 Low Cost per MWh	$7.60	$3.17	$7.50
CO_2 Mid Cost per MWh	$18.61	$7.77	$18.36
CO_2 High Cost per MWh	$29.72	$12.41	$29.32

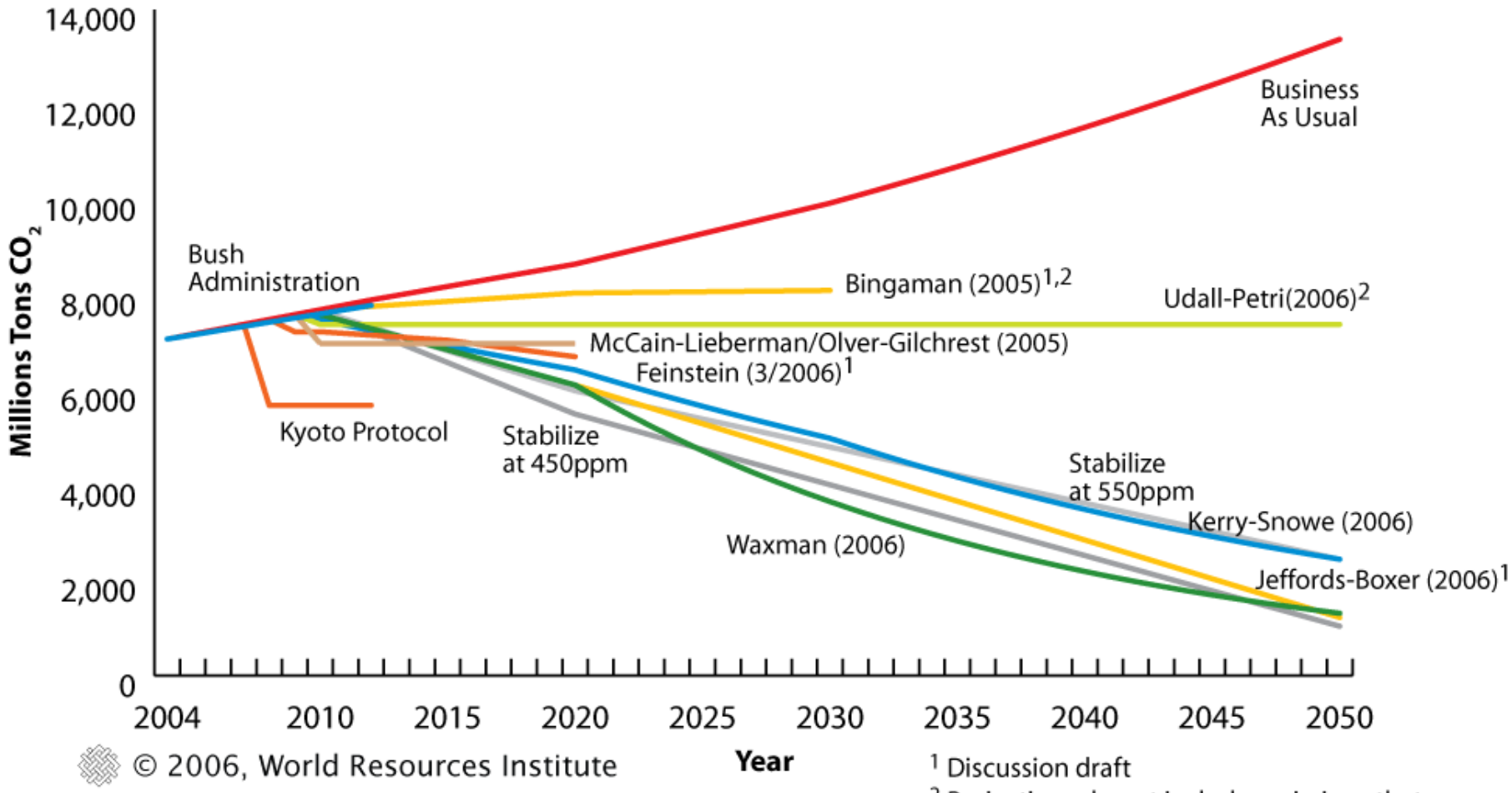
Proposed Big Stone II Coal-Fired Generating Unit – 600 MW at an average 88% annual capacity factor

- Low Synapse CO_2 Price Forecast - 4,856,000 MWh · $7.74/MWh = $37,585,440 per year
- Mid Synapse CO_2 Price Forecast - 4,856,000 MWh · $19.60/MWh = $95,177,600 per year
- High Synapse CO_2 Price Forecast - 4,856,000 MWh · $30.39/MWh = $147,573,840 per year

Factors that suggest Current Synapse CO_2 Price Forecast is too low

- Proposals in Congress have become much more aggressive since early 2006 - would require greater CO_2 emissions reductions.
- Estimates of the CO_2 allowance prices at which carbon capture and sequestration technologies would become cost-effective.
- State initiatives create pressure for stringent federal regulation – e.g. California.

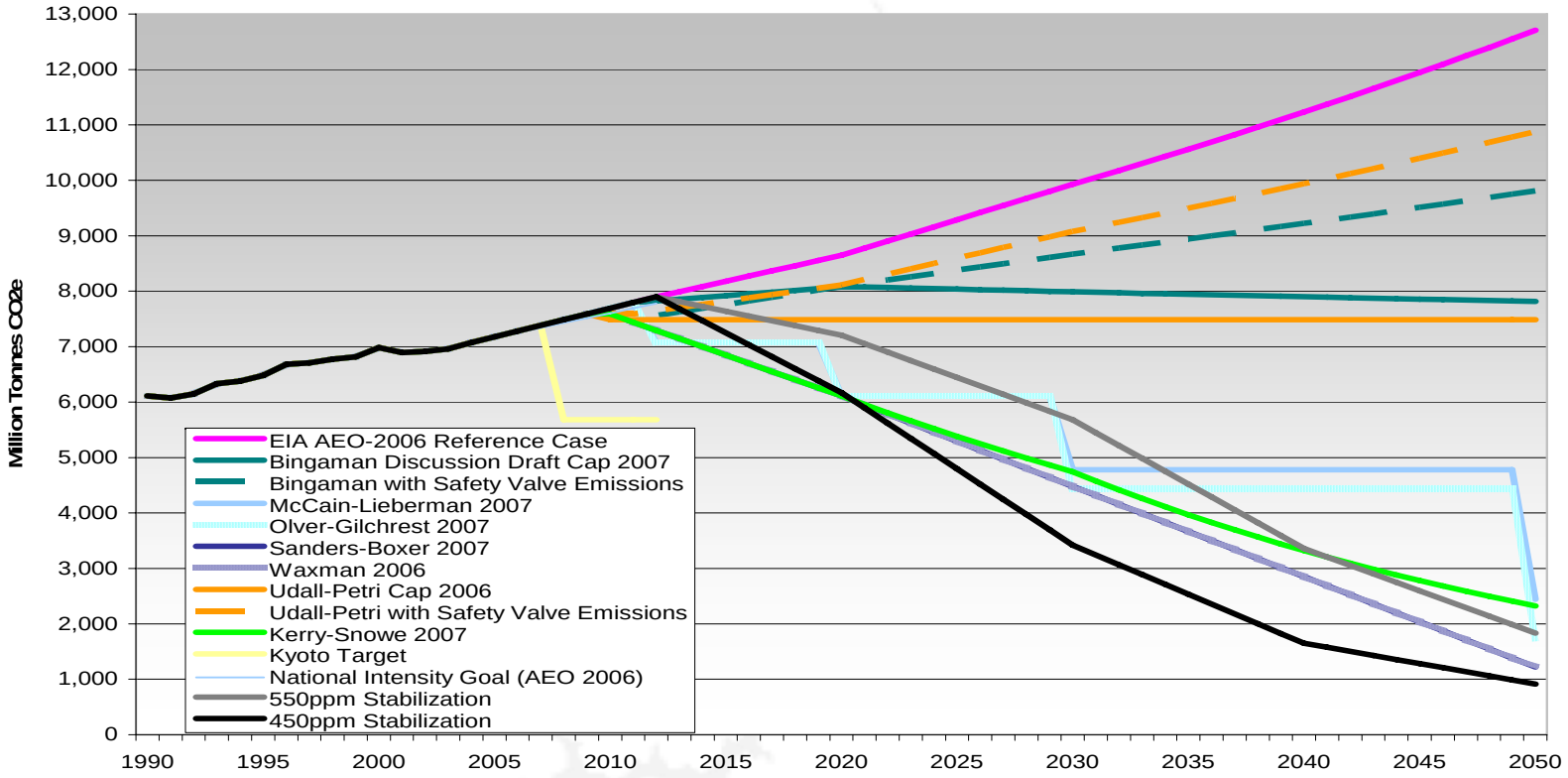
Bills in the 109th Congress



[1] Discussion draft

[2] Projections do not include emissions that may exceed the cap due to a price "safety valve."

Bills in 110th Congress are more aggressive than the bills used to develop Synapse CO_2 price forecast



Source: World Resources Institute

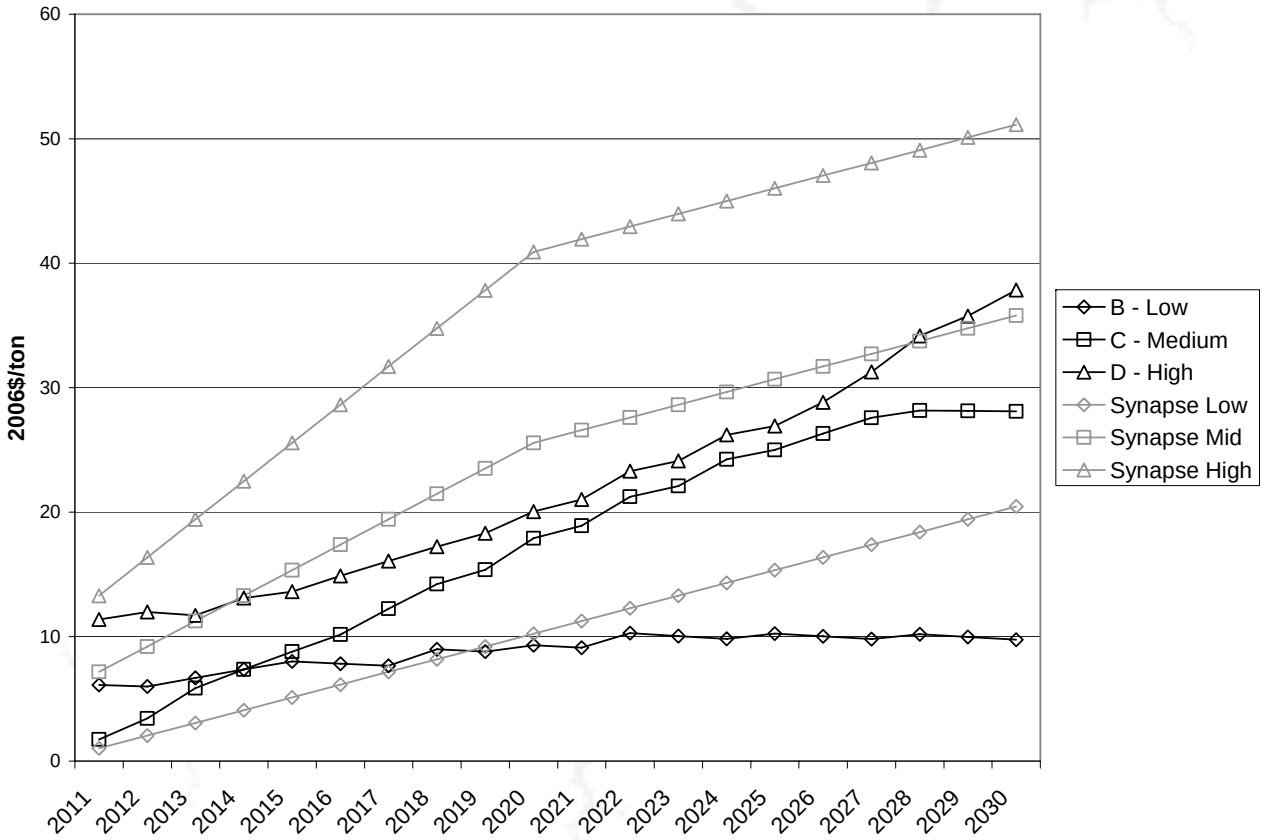
- Most aggressive proposal prior to May 2006 was capping emissions at 1990 levels. Most proposals now are looking at reductions of 60-80 percent below 1990 levels.

Utility CO_2 price forecasts do not reflect current bills being discussed in Congress

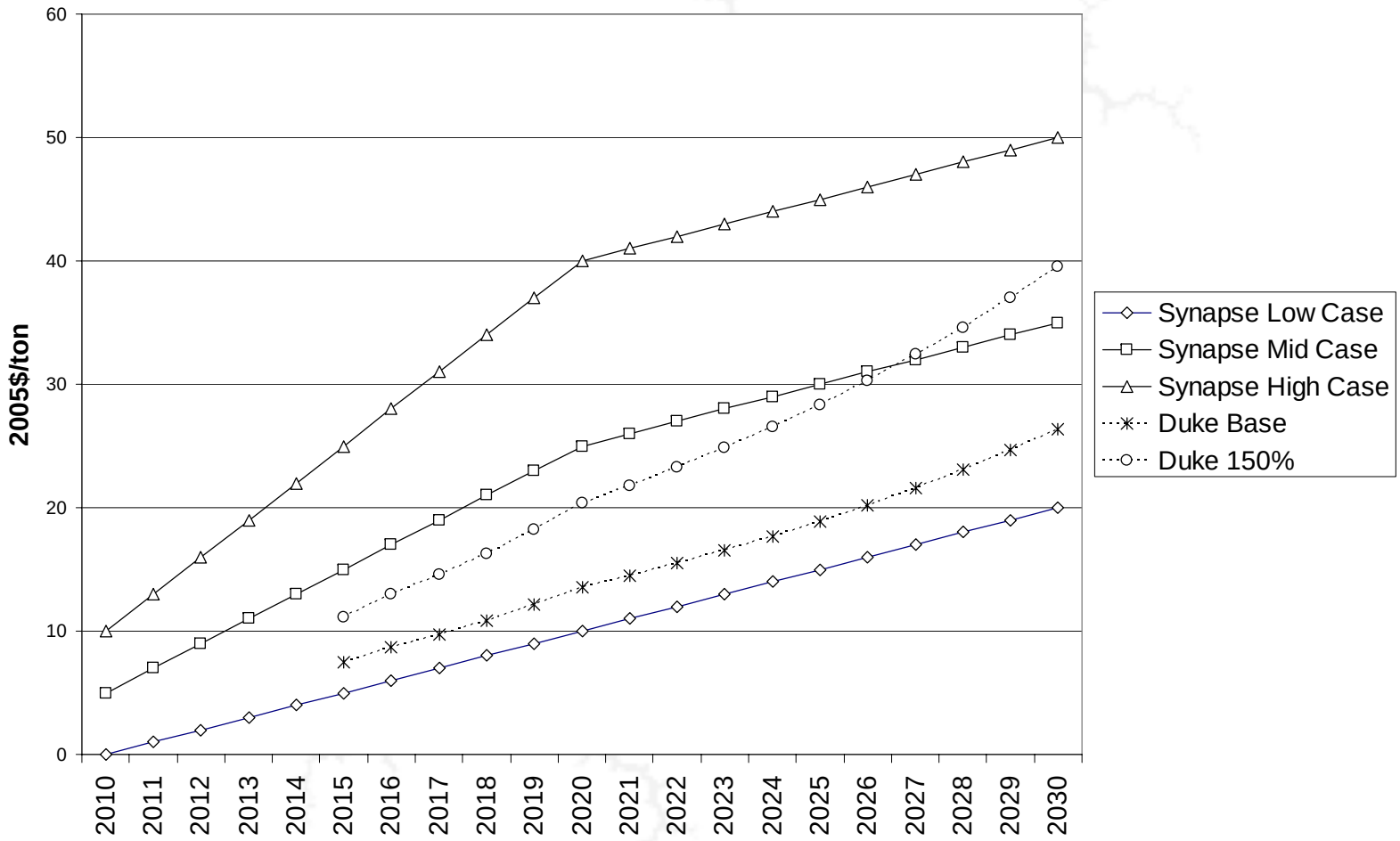
- FPL
  - Bingaman's 2006 Discussion Draft
  - Carper 2006 (S.2724)
  - Feinstein 2006 Draft
  - McCain-Lieberman 2005
- Duke
  - Bingaman 2006 Draft
- AEP
  - Carper 2003 (S.843)
  - McCain-Lieberman 2003 (S. 139)
- As a result, utility CO_2 price forecasts are too low and do not adequately reflect real risks of CO_2 regulation.

2007 FPL CO_2 price forecast

Comparison of FPL CO_2 Forecast to Synapse Forecast



Duke January 2007 CO_2 price forecast



Estimates of the CO_2 Prices at which CCS technologies would become cost-effective

- $30/ton – 2007 MIT Study, “The Future of Coal – Options for a Carbon-Constrained World”
- $15-$75/ton CO_2 net captured – Intergovernmental Panel on Climate Change, “Carbon Dioxide Capture and Storage”
- $45/ton – Global Energy Technology Strategy Program, “Carbon Dioxide Capture and Geologic Storage

States also are mandating aggressive reductions in CO_2 emissions

STATE	GHG REDUCTION GOALS & TIMELINES
AZ	2000 levels by 2020; 50 percent below 2000 levels by 2040
CA	2000 levels by 2010; 10 percent below by 2020; 80 percent below by 2050
CT	1990 levels by 2010; 10 percent below by 2020; 75 percent below by 2050
MA	1990 levels by 2010; 10 percent below by 2020; 75 percent below by 2050
ME	1990 levels by 2010; 10 percent below by 2020; 75 percent below by 2050
NJ	5 percent below 1990 by 2005
NM	2000 by 2012; 10 percent below by 2020; 75 percent below 2050
NY	5 percent below 1990 by 2010
OR	1990 by 2010; 10 percent below by 2020; 75 percent by 2100
RI	1990 by 2010; 10 percent below by 2020; 75 percent by 2050
VT	25 percent below 1990 levels by 2012; 50 percent below 2028; 75 below by 2050
WA (Puget Sound)	1990 by 2010; 10 percent below by 2020; 75 percent by 2100

Source: December 2006 New Mexico Climate Change Advisory Group Report

