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DOCKET NO. UE-111048/UG-111049
2011 PSE GENERAL RATE CASE
WITNESS: EZRA D. HAUSMAN

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY, INC.,** **Respondent.**	**Docket No. UE-111048** **Docket No. UG-111049**

THIRD EXHIBIT TO THE DIRECT TESTIMONY OF EZRA D. HAUSMAN, PH.D. ON BEHALF OF THE SIERRA CLUB

DECEMBER 7, 2011

Synapse
Energy Economics, Inc.

2011 Carbon Dioxide Price Forecast

February 11, 2011

(Amended August 10, 2011)

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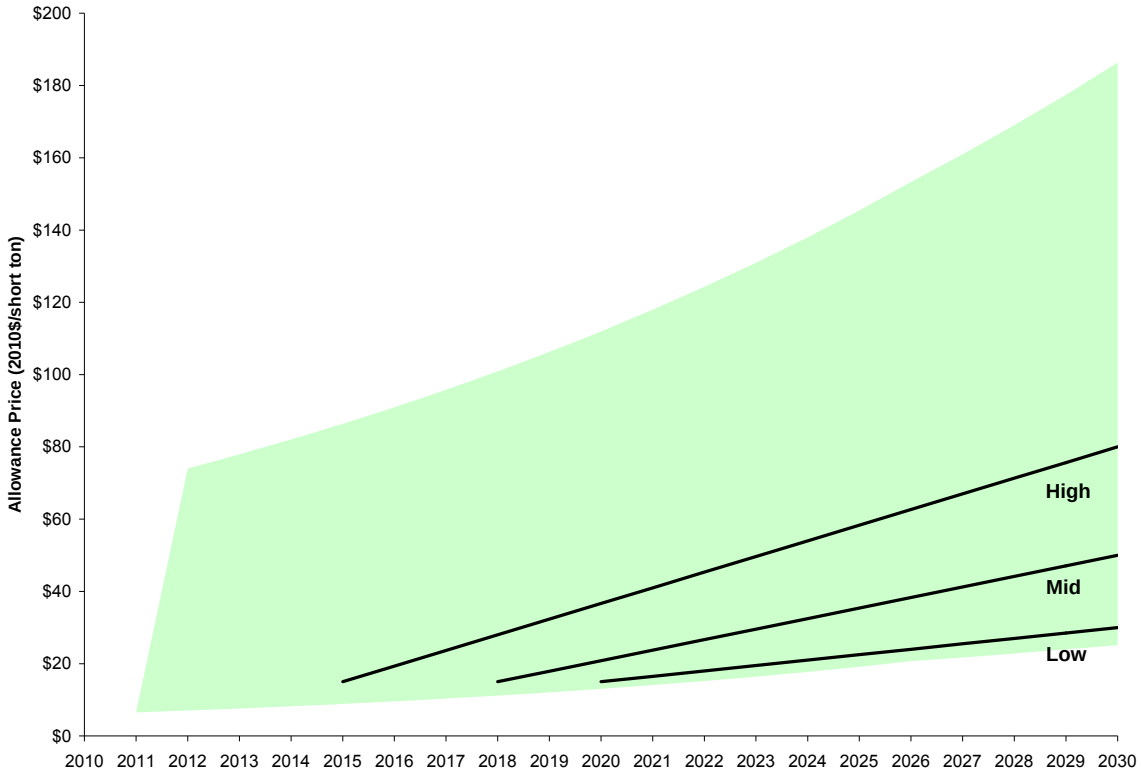
1. Executive Summary

Synapse has prepared 2011 CO_2 price projections for use in Integrated Resource Planning (IRP) and other electricity resource planning analyses. Our projections of prices associated with carbon dioxide emissions reflect a reasonable range of expectations regarding the likelihood and the magnitude of costs for greenhouse gas emissions. Our high bound on our CO_2 Price Forecast starts at $15/ton in 2015, and rises to approximately $80/ton in 2030. This High Forecast represents a $43/ton levelized price over the period 2015-2030. The low boundary on the Synapse CO_2 price forecast starts at $15/ton in 2020, and increases to approximately $30/ton in 2030. This represents a $13/ton levelized price over the period 2020-2030. Synapse also has prepared a Mid CO_2 Price Forecast that starts a bit more slowly, but close to the low case, at $15/ton in 2018, but then climbs to $50/ton by 2030. The levelized cost of this mid CO_2 price forecast is $26/ton. All annual allowance price and levelized values are given in 2010 dollars per short ton of carbon dioxide.[1] Our forecast is presented below, in Figure ES-1. The shaded region shows a range of allowance prices forecasted by various analyses of legislative cap-and-trade proposals. Further details on these proposals are shown in later Figures.

Figure ES-1: Synapse price forecast



[1] All values in the Synapse Forecast are presented in 2010 dollars. Results from EIA and EPA modeling analyses were converted to 2010 dollars using price deflators taken from the US Bureau of Economic Analysis, and available at: http://www.bea.gov/national/nipaweb/SelectTable.asp Because data were not available for 2010 in its entirety, values used for conversion were taken from Q3 of each year. Consistent with EIA and EPA modeling analyses, a 5% real discount rate was used in all levelization calculations.

The future of climate change policy is unclear. While climate legislation was considered in the last Congress, and passed the House, it did not pass the Senate; currently, there are a range of actions that could be taken by federal entities in the legislative, executive and judicial branches of government, as well as by states individually and in regional organizations that will affect the competitiveness of resources with greenhouse gas emissions (these are described in more detail in the body of this report). The lack of clarity regarding the future of climate change policy in the United States presents a challenge, but is not justification for assuming there will be no cost associated with greenhouse gases, no effect on the competitiveness of resources based on their greenhouse gas emissions. Though we cannot predict specific policies that will develop between now and 2030, the end of our forecast period, we believe that current and emerging state, regional, and federal policies are all indications that greenhouse gas emissions will not be without cost impact on the emitter over the course of any investment in long-term resources. Indeed, it would be imprudent to make resource decisions today based upon an assumption that carbon emissions will be unregulated, or priced at zero, in the future.

The Synapse projections represent a range of possible future costs, recommended price trajectories, that are useful for testing range-sensitivity of various investment possibilities in resource planning in the electric sector. The projection does not represent a prediction of specific future price trajectories; there will be variability and volatility in prices following supply and demand dynamics, as there is with other cost drivers. We intend and anticipate that the CO_2 price projections presented here will be useful for planning in the face of uncertainty.

While reasonable people may argue about the ultimate timing and details of any policy, about the likelihood of various forms of federal policy, and about the costs of specific technologies, we believe our forecast represents a valuable tool for use in resource planning and selection and in investment decisions in the electric sector.

2. Introduction

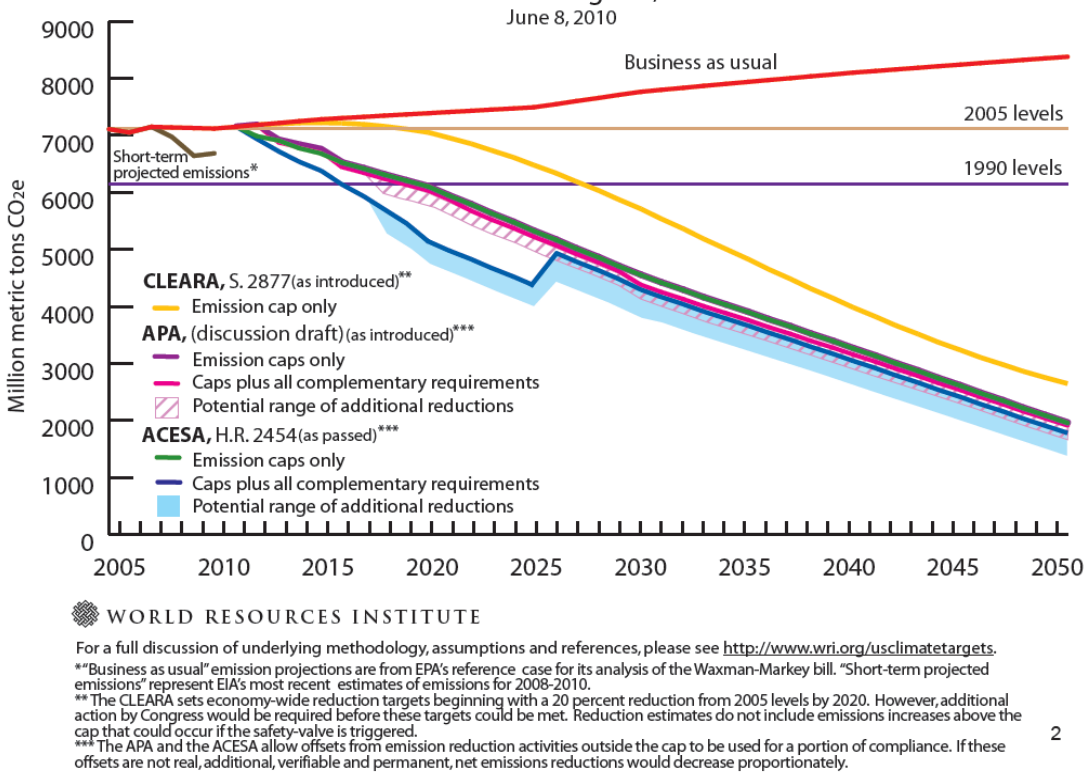
Over the next several years the economics of power generation will change in a manner that makes sources with high greenhouse gas emissions less competitive relative to those with lower greenhouse gas emissions. This change in the competitiveness of resources will result from interactions among a variety of factors (including state policy actions, federal agency regulations, federal court decisions, federal legislative initiatives, technological innovation, and presidential administrations) not due to any single factor.

3. Policy Context

In the past few years, Congress has been a major focus for climate policy. Congress has considered enacting legislation that would reduce greenhouse gas emissions through a federal cap on greenhouse gas emissions and trading emissions allowances, or through other means. Legislative proposals and the President Obama's initiatives aim to reduce greenhouse gas emissions by approximately 80% from current levels by 2050.

Figure 1, below, shows the emissions reductions trajectories from recent legislative proposals (Waxman-Markey HR 2454, Kerry-Lieberman APA 2010, and Cantwell-Collins S. 2877).

Figure 1. Net Estimates of Emissions Reductions Under Pollution Reduction Proposals in the 111th U.S. Congress, 2005-2050



For a full discussion of underlying methodology, assumptions and references, please see http://www.wri.org/usclimatetargets.
*"Business as usual" emission projections are from EPA's reference case for its analysis of the Waxman-Markey bill. "Short-term projected emissions" represent EIA's most recent estimates of emissions for 2008-2010.
** The CLEARA sets economy-wide reduction targets beginning with a 20 percent reduction from 2005 levels by 2020. However, additional action by Congress would be required before these targets could be met. Reduction estimates do not include emissions increases above the cap that could occur if the safety-valve is triggered.
*** The APA and the ACESA allow offsets from emission reduction activities outside the cap to be used for a portion of compliance. If these offsets are not real, additional, verifiable and permanent, net emissions reductions would decrease proportionately.

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Despite passage of comprehensive climate legislation in the House in the 111th Congress, the Senate ultimately did not take up climate legislation in that session. On the other hand, the Senate did consider -- but did not pass – legislation that would have restricted the Environmental Protection Agency's ability to regulate greenhouse gases.

As the 112th Congress opens, prospects for legislation establishing an economy-wide emissions cap seem dim, and legislators seem instead likely to focus on policies that would foster technology innovation, and a possible multi-regulation approach to energy issues. The 112th Congress is opening with simultaneous promises to use Congressional authority to prevent or delay EPA's ability to issue regulations concerning greenhouse gas emissions, and increasing interest in developing renewable energy standards or clean energy standards. Congress is unlikely to take up an economy-wide cap and trade program in its new session; instead, legislators are likely to focus on policies that promote technological innovation.

In fact, Congressional action is only one avenue in an increasingly dynamic and complex web of activities that could result in internalizing a portion of the costs associated with emissions of greenhouse gases from the electric sector. As Congress wrestles with the issue, the states, the federal courts, and federal agencies also grapple with the complex issues associated with climate change. Many efforts are proceeding simultaneously.

The U.S. Environmental Protection Agency (EPA) intends to mandate emissions reductions following the Supreme Court's determination that the harms associated with climate change are serious and well-recognized, that greenhouse gases fit within the Clean Air Act's definition of "air

pollutant", and that the EPA has the authority to regulate greenhouse gases.[2] As a first step, the EPA issued a finding that greenhouse gases endanger public health and welfare. The EPA has also developed regulations to limit any greenhouse gas emission permitting requirements to the largest industrial sources, as well as regulations that boost automobile and truck fuel efficiency and contain the first-ever greenhouse gas tailpipe standards for vehicles. On August 12, 2010, EPA proposed two rules to ensure that businesses planning to build new, large facilities or make major expansions to existing ones obtain New Source Review Prevention of Significant Deterioration (PSD) permits that address greenhouse gases (GHG). These rules became effective in early January 2011. EPA announced December 23, 2010 that it will issue greenhouse gas performance standards for new and modified electric generating units under section 111(b) of the Clean Air Act, and for existing electric generating units under section 111(d) with final regulations promulgated in May 2012 and December 2012, respectively.[3]

The states – individually and coordinating within regions - are leading the nation's policies to respond to the threat of climate change. In fact, several states, unwilling to postpone and wait for federal action, are pursuing policies specifically because of the lack of federal legislation.

States continue to be the innovative laboratories for climate policy, and they are pursuing a wide variety of policies across the country.

- Forty-three states have a greenhouse gas inventory,
- Forty-one states have a greenhouse gas registry,
- Thirty-six states have completed a climate action plan or have one in progress,
- Twenty-two states have greenhouse gas emissions targets,
- Eleven states have an electric sector cap and allowance trading,
- Five states have emissions performance standards.
- Twenty-one states are participating in the operation or development of regional emissions cap and allowance trading programs, with an additional nine states as official observers in those processes.
- Only Nebraska, North Dakota, and the District of Columbia appear not to be taking specific climate-related policy initiatives at this time.
- In general, states are also where the nitty-gritty decisions will be made about investments in new or existing power plants.

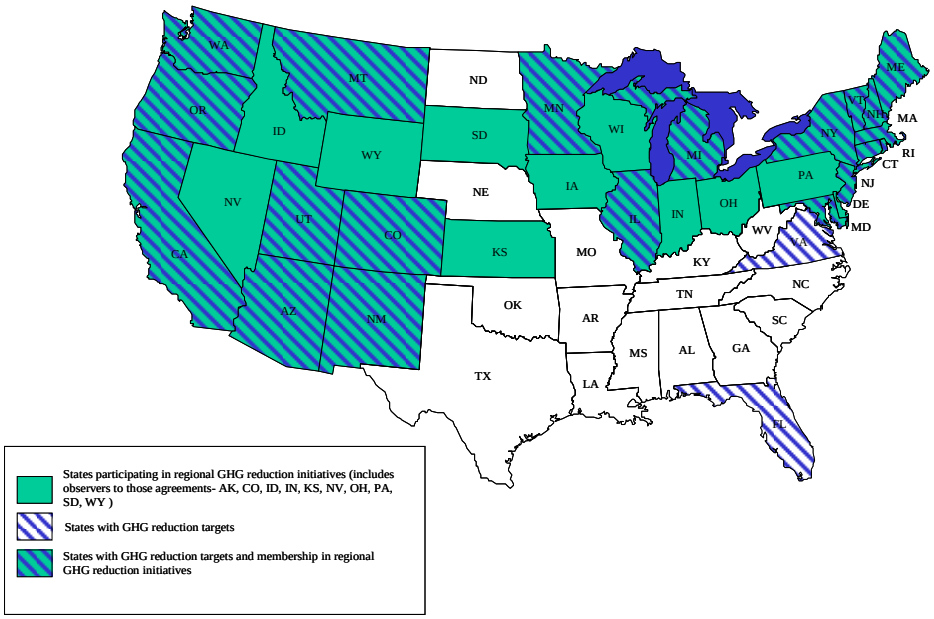
The map below shows states with emission targets and those participating in, or observing, regional climate initiatives as of January 2011. States that have adopted emissions targets and/or that are participating actively in regional climate initiatives comprise 44.4% of US electrical generation, 48.3% of retail electricity sales, and 58.1% of U.S. population. The observer states add

[2] Information on EPA's plans and regulations available from EPA website on climate change regulatory initiatives at http://www.epa.gov/climatechange/initiatives/index.html

[3] U.S. EPA, EPA to Set Modest Pace for Greenhouse Gas Standards, Press Release December 23, 2010. And U.S. EPA, Settlement Agreements to Address Greenhouse Gas Emissions from Electric Generating Units and Refineries - Fact Sheet, December 23, 2010. Available at http://www.epa.gov/airquality/pdfs/settlementfactsheet.pdf

an additional 17.3% of electrical generation, 16.1 % of retail electricity sales, and 14.5% of the U.S. population.

Figure 2: States in regional climate initiatives and/or with greenhouse gas targets



Source: Pew Center on Global Climate Change

Three regions in the country have developed, or are developing greenhouse gas caps and allowance trading:

Regional Greenhouse Gas Initiative: The Regional Greenhouse Gas Initiative (RGGI) is an effort of ten Northeast and Mid-Atlantic states to limit greenhouse gas emissions and is the first market-based CO_2 emissions reduction program in the United States. Participating states have agreed to a mandatory cap on CO_2 emissions from the power sector with the goal of achieving a ten percent reduction in these emissions from levels at the start of the program by 2018.[4] This is the first mandatory carbon trading program in the nation.

Western Climate Initiative: In 2007, Governors of five western states signed an agreement establishing the Western Climate Initiative (WCI), a joint effort to reduce greenhouse gas (GHG) emissions and address climate change.[5] Subsequently, two more states and four Canadian Provinces also joined the effort.[6] Fourteen states and provinces also are official observers of the process.[7] WCI members signed a Memorandum of Understanding agreeing to jointly set a regional emissions target and establish a market-based system—such as a cap-and-trade program covering

[4] The ten states are: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. Information on the RGGI program, including history, important documents, and auction results is available on the RGGI Inc website at www.rggi.org
[5] The five states are Arizona, California, New Mexico, Oregon and Washington.
[6] Utah, Montana, British Columbia, Manitoba, Ontario and Quebec.
[7] Alaska, Colorado, Idaho, Kansas, Nevada, and Wyoming, as well as the provinces of Nova Scotia and Saskatchewan and the Mexican states of Baja California, Chihuahua, Coahuila, Nuevo Leon, Sonora, and Tamaulipas.

multiple economic sectors—to aid in meeting this target. The WCI regional, economy-wide greenhouse gas emissions target is 15 percent below 2005 levels by 2020, or approximately 33 percent below business-as-usual levels. The WCI Partners released the Design for the WCI Regional Program in 2010.[8]

Midwest Greenhouse Gas Reduction Accord: In 2007, six states and one Canadian province established the Midwest Greenhouse Gas Reduction Accord (MGGRA).[9] Three additional states are official observers.[10] The members agree to establish regional greenhouse gas reduction targets, including a long-term target of 60 to 80 percent below current emissions levels, and develop a multi-sector cap-and-trade system to help meet the targets. The MGGRA Advisory Group presented final recommendations in May 2010.[11]

The Federal Courts have allowed common law nuisance actions to go forward against some of the nation's largest owners and operators of fossil fueled facilities. In those actions, plaintiffs successfully stated a cause of action for harm suffered as a result of defendants' carbon intensive activities that contributed to climate change. The Supreme Court is due to take up legality of "nuisance" lawsuits over greenhouse gas emissions in 2012. If nuisance lawsuits are allowed to go forward, the threat of climate change lawsuits could spur congressional action.

It is not likely that all of these initiatives will move forward and result in a cost to emitting greenhouse gases. It is also not likely that none of these initiatives or similar initiatives will move forward. Any of these will happen in the context of implementing other policies that, while not focusing directly on greenhouse gas emissions (e.g. renewable standards, efficiency standards, investment in new technologies etc.) will reduce greenhouse gas emissions.

In the absence of a comprehensive federal policy, efforts to address the climate issues will persist, albeit in a variety of forums. The multiple threats of EPA regulation, litigation (nuisance and plant by plant), and diverse state policies could very well create a strong demand for coordinated federal legislation. However, it is clear that the absence of federal legislation has not brought efforts to formulate policies addressing greenhouse gas emissions to a halt, and it is equally clear that these policies will affect the costs of operating resources with high levels of greenhouse gas emissions. Regulation of greenhouse gases will increase the cost of producing electricity from power sources that emit greenhouse gases, reflecting either the direct cost of reducing emissions or the cost of purchasing emissions allowances. Though it is certain that emission-related costs will increase, the nature, magnitude and timing of the cost increases are uncertain and thus introduce financial risk into decisions to invest in long-lived capital-intensive resources that use carbon-based fuels.

Meanwhile, negotiations for international coordination on initiatives to mitigate and adapt to climate change are on-going. Most recently, the 2009 Copenhagen Accord called on developed nations to submit quantified greenhouse gas emission reduction targets for 2020, and for developing nations to submit "nationally appropriate mitigation actions." The United States has said it will reduce

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[8] This summary is based on information available from Pew Center on Global Climate Change, www.pewclimate.org; and also from the WCI website, www.westernclimateinitiative.org.
[9] The states are Illinois, Iowa, Kansas, Michigan, Minnesota, and Wisconsin, as well as the Premier of the Canadian Province of Manitoba.
[10] Observers are Indiana, Ohio, and South Dakota.
[11] This summary is based on information available from Pew Center on Global Climate Change, www.pewclimate.org; and also from the MGGRA website, www.midwesternaccord.org

greenhouse gas emissions in the range of 17% below 2005 levels by 2020, which is a target consistent with anticipated climate and energy legislation.[12]

4. Elements in a price projection

A. Difficulty of price projection under uncertainty

Though the need for a comprehensive effort to reduce greenhouse gas emissions seems clear, the particular set of policies that will be adopted to bring about a low carbon economy are unknown. It is also likely that some policies will focus on adaptation rather than emissions reduction. Nevertheless, while state and federal policy-makers continue to struggle with the details and political challenges of such an effort, the need for a reliable and cost-effective electric sector does not diminish. Regardless of what the policy or policies ultimately look like, it is certain that any policy requiring, or leading to, greenhouse gas emission reductions will mean that there is a cost associated with emitting greenhouse gases over at least some portion of the life of a long-lived resource. Despite policy uncertainty, it is important to incorporate some reasonable consideration of a range of potential costs into long-term investment planning in the electric sector.

There are several types of information that are useful to consult in developing a reasonable forecast of the cost of carbon emissions for decision-making in the electric sector. Though none of this information can predict future costs, it is useful as a point of reference in developing a reasonable forecast. Information includes analyses of compliance costs under various federal cap and trade proposals, costs of low carbon technologies, projections of compliance costs under mandatory emission reduction programs other than cap and trade. For this forecast, we have focused primarily on analyses of federal cap and trade proposals since they present a well analyzed and comprehensive exploration of the possible costs associated with carbon dioxide emissions. But we have also taken into account other sources of information.

A large number of modeling analyses have been undertaken to evaluate the CO_2 allowance prices that would result from the major climate change bills introduced in Congress over the past several years. Though it is not certain that a federal cap and allowance trading program will ultimately be what is adopted, analyses of the various proposals to date are one of the sources of the most comprehensive estimates of costs associated with greenhouse gas emissions under a variety of regulatory scenarios. These estimates can be useful sources of information. It is not possible to compare the results of all of these analyses directly because the specific models and the key assumptions vary. Further, it is not certain that a federal cap and trade program will be the form that climate policy in the U.S. takes. While consistent federal rules would be the most efficient mechanism for climate policy, the costs are associated with emissions limits and other policy details, not with the source of the rules. Accordingly, the results of these analyses provide important insights into the ranges of possible future CO_2 allowance prices under a range of potential scenarios.

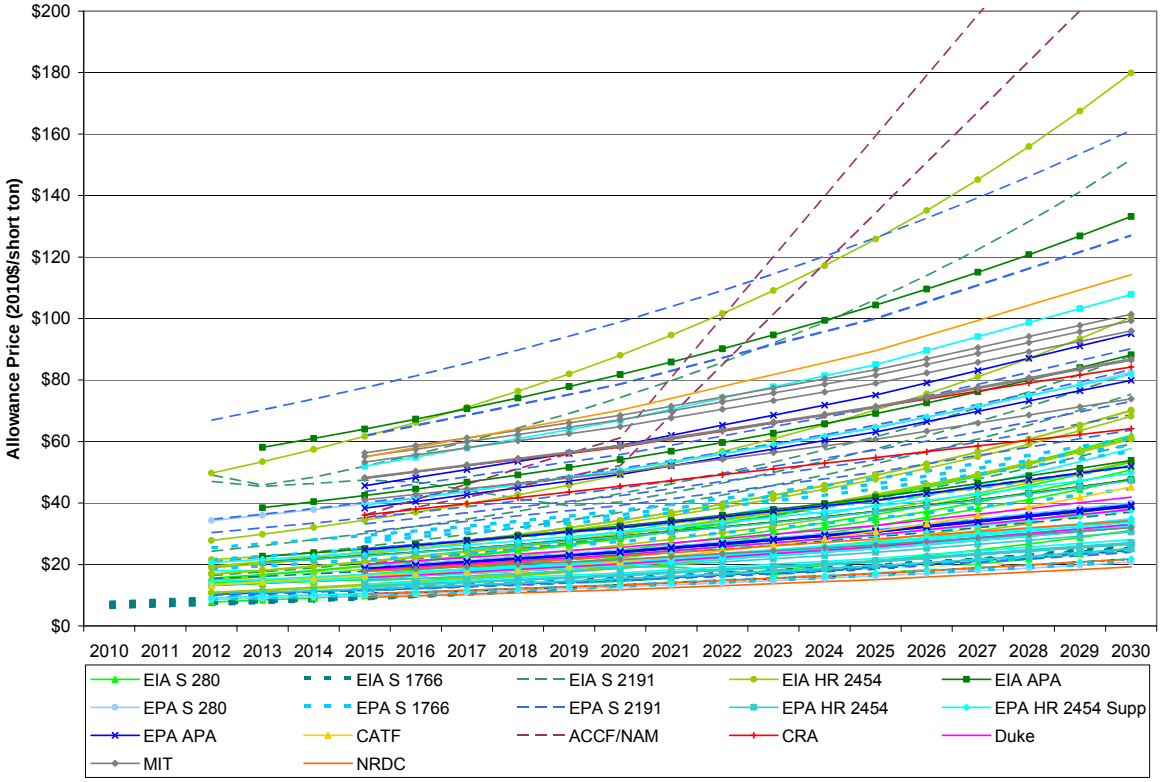
[12] Information is available at http://www.pewclime.org/copenhagen-accord

B. Analyses of compliance costs- and conclusions on effects of factors

The results of the dozens of analyses over the past several years show that there are a number of factors that affect projections of allowance prices under federal greenhouse gas regulation. Some of these derive from the details of policy design, some of them pertain to the outlook for the context in which a policy would be implemented. These include: the base case emissions forecast; the reduction targets in each proposal; whether complementary policies such as aggressive investments in energy efficiency and renewable energy are implemented, independent of the emissions allowance market; the policy implementation timeline; program flexibility regarding emissions offsets (perhaps international) and allowance banking; assumptions about technological progress; the presence or absence of a "safety valve" price; and emissions co-benefits.

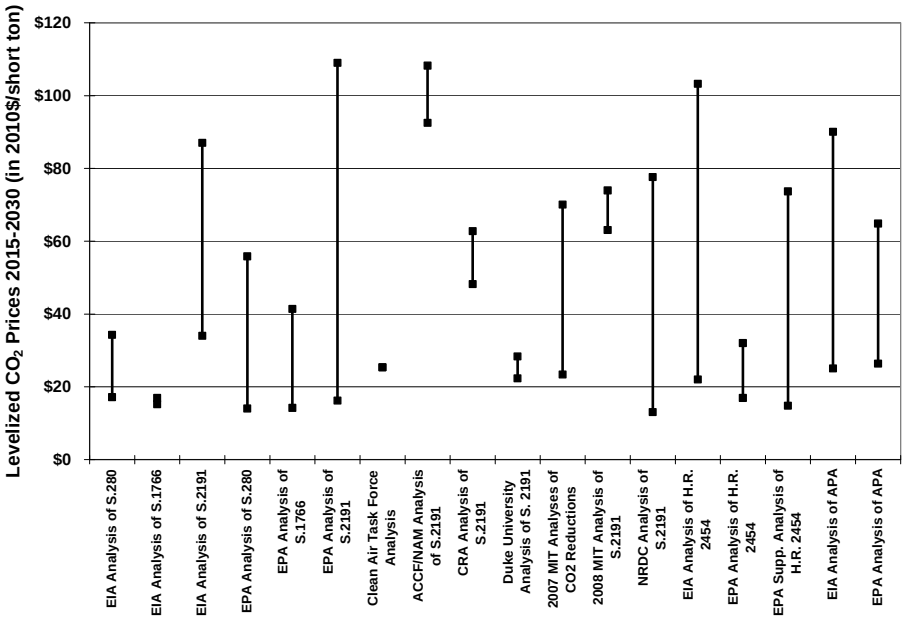
The graph below shows the results of all the scenarios from multiple analyses in the past several years. The studies that are incorporated into this graph are identified in Appendix A.

Figure 3: Greenhouse gas allowance price projections based on analyses of federal legislative proposals



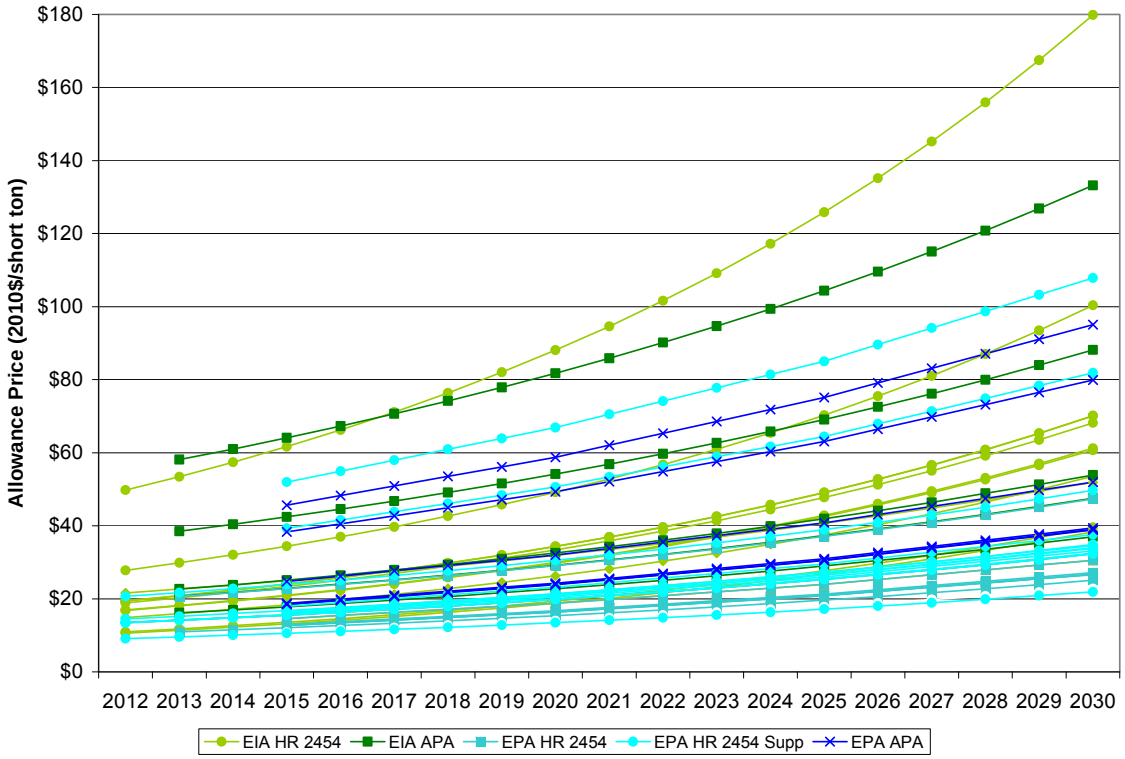
The results of these same analyses are represented in Figure 4, below, as ranges of levelized costs.

Figure 4: Greenhouse gas allowance price projections based on analyses of federal legislative proposals - levelized



We have looked in more detail at the EIA and EPA analyses of the three major legislative proposals in the 111th Congress. The results of these analyses span a similar range to earlier studies. The chart below shows the forecasted allowance prices in all of the scenarios of those analyses.

Figure 5: Greenhouse gas allowance price projections for HR 2454 and APA 2010



These values are shown as levelized prices for the time period 2015 to 2030 in Figure 6 below.

Figure 6: Greenhouse gas allowance price projections for HR 2454 and APA 2010- levelized 2015-2030

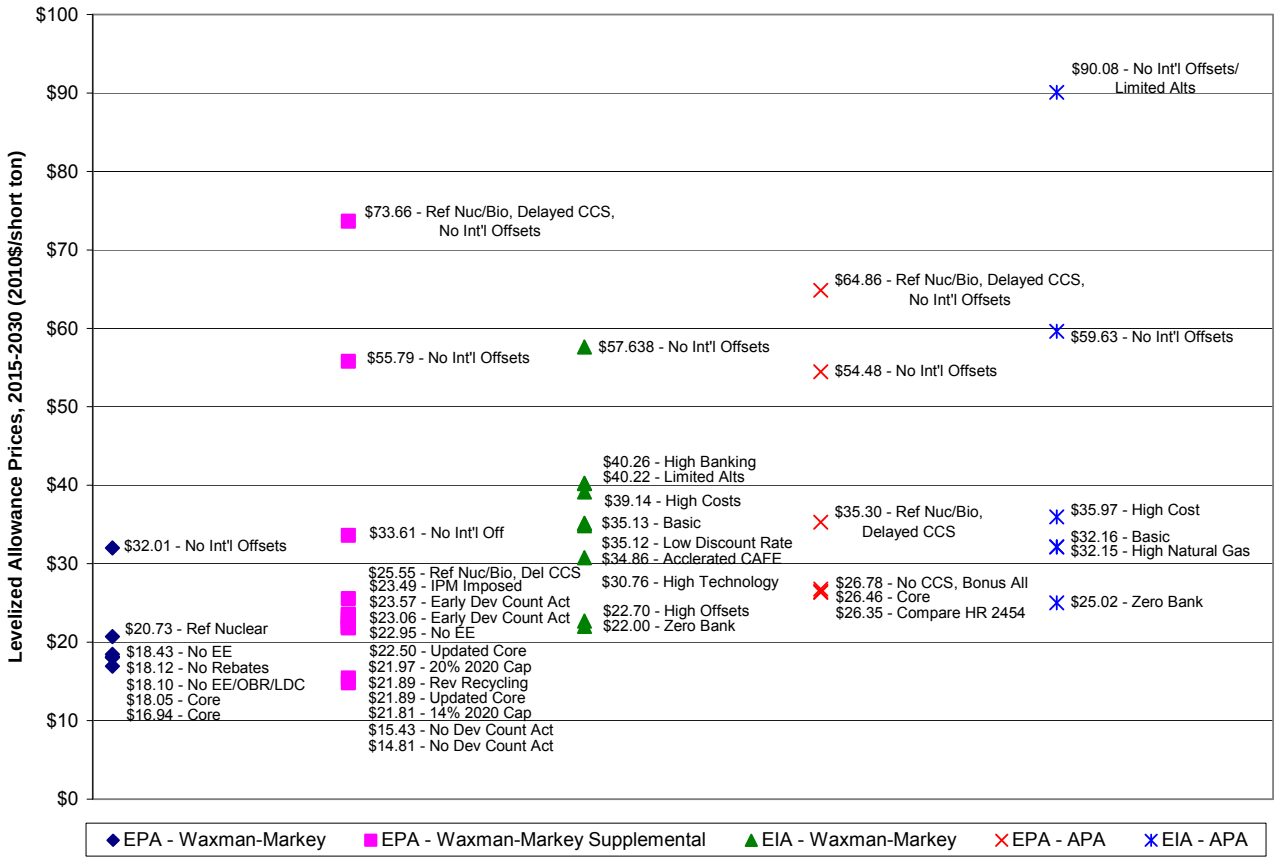
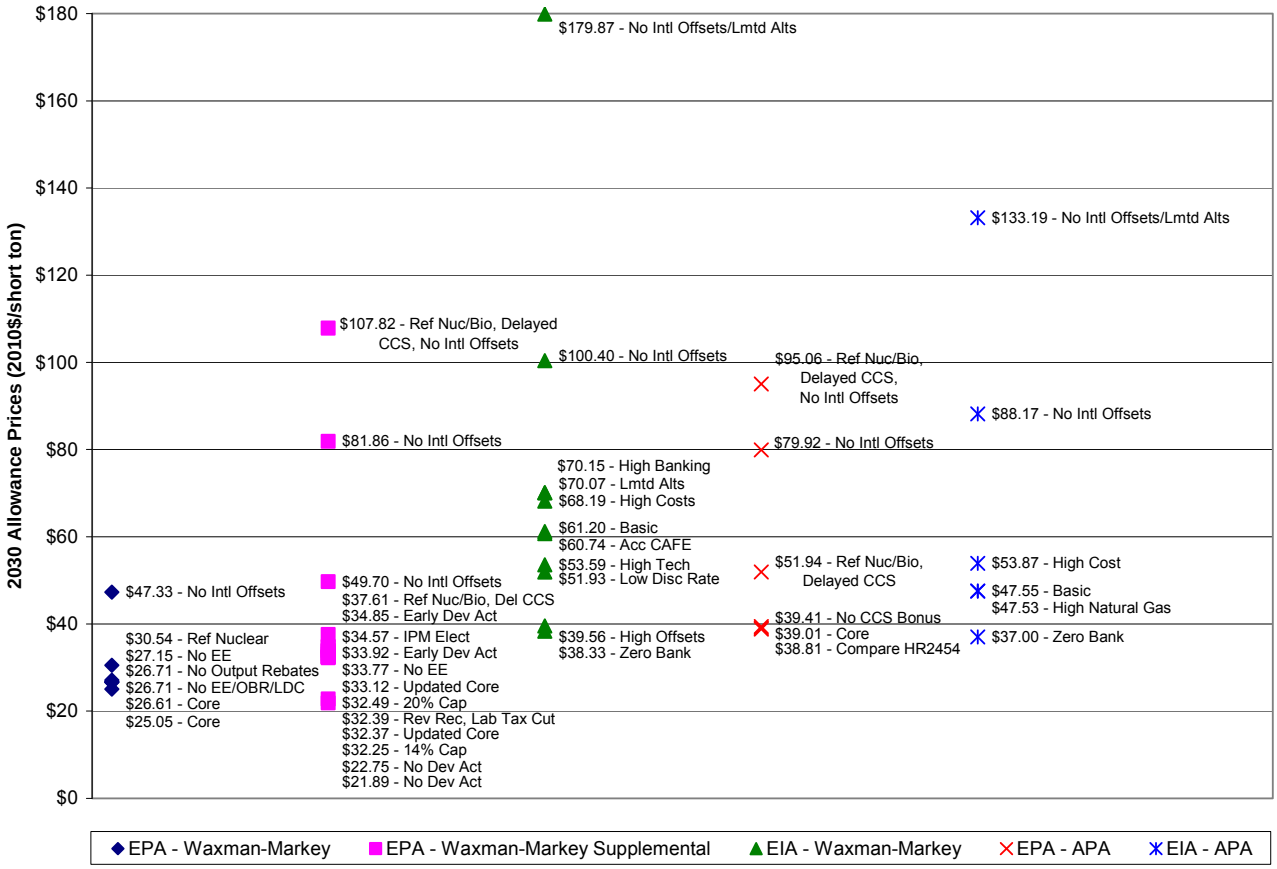


Figure 7: 2030 Greenhouse gas allowance price projections for HR 2454 and APA 2010



Our review of the more than 75 scenarios examined in the modeling analyses represented in Figure 7, above, as well as a closer examination of the most recent analyses of legislation considered in the 111th Congress indicates that:

1. Other things being equal, more aggressive emissions reductions will lead to higher allowance prices than less aggressive emissions reductions.

2. Greater program flexibility decreases the expected allowance prices, while less flexibility increases prices. This flexibility can be achieved through increasing the percentage of emissions that can be offset, by allowing banking of allowances or by allowing international trading.

3. The rate of improvement in emissions mitigation technology is a crucial assumption in predicting future emissions costs. For CO_2, looming questions include the future feasibility and cost of carbon capture and sequestration, and cost improvements in integrating carbon-free generation technologies. Improvements in the efficiency of coal burning technologies and in the costs of nuclear power plants could also be a factor. In general, those scenarios in the modeling analyses with lesser availability of low-carbon alternatives have the higher CO_2 allowance prices. When low carbon technologies are widely available, CO_2 allowance prices tend to be lower.

4. Complementary energy policies, such as direct investments in energy efficiency or policies that foster renewable energy resources are a very effective way to reduce the demand for emissions allowances and thereby lower their market prices. A policy scenario which includes aggressive energy efficiency and/or renewable resource development along with carbon emissions limits will result in lower allowance prices than one in which these resources are not directly addressed.

5. Most technologies which reduce carbon emissions also reduce emissions of other criteria pollutants, such as NO_x and SO_2, and mercury. Models which include these co-benefits will predict a lower overall cost impact from carbon regulations, as the cost of reducing carbon emissions will be offset by savings in these other areas. Adopting carbon reduction technology results not only in cost savings to the generators who no longer need criteria pollutant permits, but also in broader economic benefits in the form of reduced permit costs and consequently lower priced electricity. In addition, there are a number of co-benefits such as improved public health, reduced premature mortality, and cleaner air associated with overall reductions in power plant emissions which have a high economic value to society.

6. Projected emissions under a business-as-usual scenario (in the absence of greenhouse gas emission restrictions) have a significant bearing on projected allowance costs. The higher the projected emissions, the higher the projected cost of allowance to achieve a given reduction target.

C. Other forecasts

A number of electric companies include projections of costs associated with greenhouse gas emissions in their resource planning procedures. Table 2, below, summarizes the values used by utilities in their resource plans in the past two years.

Table 2: Values for carbon dioxide used by utilities in resource planning

Utility	Date of IRP (or equivalent)	Model Run	Description
Avista	2009	Base-case	Allowance cost is $46.14 (nominal) and $33.37 (2009 dollars), beginning in 2012. Reaches its high value in 2029.
Idaho Power	2009		$43/ton starting in 2012
LADWP	2010	Base Case	Base case assumes that GHG pricing starts at $20/short ton in 2012 and escalates to $40/short ton in 2020, then escalating at 2.6% annually through 2030. (nominal dollars)
		Low Case	The low case assumes that pricing starts at $15/short ton in 2012 and escalates to $30/short ton in 2020, then escalating at 2.6% annually through 2030. (nominal dollars)
		High Case	The high case assumes that pricing starts at $25/short ton in 2012 and escalates to $50/short ton by 2020 with continued escalation of 2.6% through 2030. (nominal dollars)
Minnesota Power	2010	Base Forecast	$22.11/short ton starting in 2015 and $47.03/short ton in 2024
		Low Forecast	No carbon costs
		High Forecast	$25.66/short ton starting in 2012 and $138.04/short ton in 2024
Nevada Power	2009	Low	Begins at about $10 in 2013 and rises to about $32 in 2039. (2009$/short ton)
		Mid	Begins at about $20 in 2013 and rises to about $70 in 2039. (2009$/short ton)
		High	Begins at about $39 in 2013 and rises to about $138 in 2039. (2009$/short ton)
NorthWestern	2009		Base Case assumes that regs begin in 2013 at $9.55/ton and rises to $80.41/ton in 2030 (2006$). Also cases for earlier and later action.
PacifiCorp	2011	Low	Starting at $12/ton (2015$) in 2015, with 5% annual escalation.
		Medium	Starting at $19/ton (2015$) in 2015, with 5% annual escalation.
		High	Starting at $25/ton (2015$) in 2015, with 7% annual escalation.
		Medium-High	Starting at $19/ton (2009$) in 2015, with 5% annual escalation through 2020; in 2020, escalating at 12% per year. Price reaches $75/ton by 2030.
PGE	2009	Base	Levelized cost of $30/short ton. (2009$)
		Sensitivity	Levelized costs of $12/short ton. (2009$)
		Sensitivity	Levelized costs of $20/short ton. (2009$)
		Sensitivity	Levelized costs of $45/short ton. (2009$)
		Sensitivity	Levelized costs of $65/short ton. (2009$)
PSCo	2010	Base	$20/ton starting in 2014 and escalating at 7% per year
		Sensitivity	$0/ton for all year
		Sensitivity	$40/ton starting in 2014 and escalating at 7% per year
PSE	2009	2007 Trends/2009 Trends	Assumes a CO2 charge of $37/ton starting in 2012, increasing to $130/ton by 2029.
		Green Worlds	CO2 emissiosn cost rise from $55/ton in 2012 to $150/ton in 2029.
		2007 BAU/2009 BAU	$1.60/ton for 20% of the CO2 emitted by plants producing greater than 250 MW. This equates to $0.32/ton, i.e. nearly zero.
Seattle City Light	2010	Basic	In 2007$ per ton. Begins at $20/ton in 2012 and increases to $64.80 in 2030.
		Low	In 2007$ per ton. Begins at $15/ton in 2012 and increases to $41.90 in 2030.
		High	In 2007$ per ton. Begins at $30/ton in 2012 and increases to $106.40 in 2030.
Sierra Pacific	2010		2009$/short ton. Low case begins at about $9 in 2014 and rises to about $31 in 2040. Mid case begins at about $19 in 2014 and rises to about $64 in 2040. High case begins at about $38 in 2014 and rises to about $132 in 2040.
Tri-State	2007	Low	$10/ton (2007$) starting in 2007, escalating at 3% per year
		Mid	$25/ton (2007$) starting in 2007, escalating at 3% per year
		High	$35/ton (2007$) starting in 2007, escalating at 3% per year
SPS (Xcel)	2009		Modeled at $8, $20, and $40 per metric ton, escalated at 2.5%/year consistent with New Mexico PUC Order.
Northern States Power Company (Xcel)	2010		A planning value of $17 per ton CO2 starting in 2012 and escalating at 1.9% per annum. MN Commission high and low externality values are incorporated as sensitivities.

5. Synapse's Recommended February 2011 CO_2 Price Forecast

Our forecast of prices associated with carbon dioxide emissions reflects a reasonable range of expectations regarding the `timing and magnitude of costs for greenhouse gas emissions. We considered what policy developments (e.g. regulation, regional coordination, federal legislation) would lead to costs in the near-term. Our forecast of the range for the mid-term is dominated by projections of legislative compliance costs since those are readily available, rigorous analyses of potential costs under a variety of reduction targets. These are informative even with current uncertainty about federal legislation since they represent the most comprehensive analysis of costs of achieving certain levels of reductions. In the long-term, beyond 2030, we anticipate that costs of emissions will be governed by the costs of marginal abatement technologies. However, our current forecast does not extend beyond 2030. All annual allowance price and levelized values are given in 2010 dollars per short ton of carbon dioxide.[13]

The Synapse February 2011 CO_2 price forecast begins in 2015. This assumption reflects the fact that Congress has lagged behind the states and executive branch in developing a policy response to the science of climate change. The earliest possible action that will affect power generation in all states will likely be regulations from EPA. EPA has agreed to issue final regulations by 2012. Implementation of the regulations, resulting in costs to generators, is likely to be in 2013-2015. That time frame is also consistent with the development of regional emissions cap and allowance trading programs in the West and the Midwest that will affect 13 states beyond the 10 that are already participating actively in the functioning Regional Greenhouse Gas Initiative in the Northeast.

The high bound on our CO_2 Price Forecast starts at $15/ton in 2015, and rises to approximately $80/ton in 2030. Taken as a single trajectory, this High Forecast represents a $43/ton levelized price over the period 2015-2030. This High CO_2 Price Forecast is consistent with the occurrence of one or more of the factors identified above that have the effect of raising prices. These factors include somewhat more aggressive emissions reduction targets, greater restrictions on the use of offsets, restricted availability or high cost of technology alternatives such as nuclear, biomass and carbon capture and sequestration, more aggressive international actions (thereby resulting in fewer inexpensive international offsets available for purchase by U.S. emitters), or higher baseline emissions.

The low boundary on the Synapse CO_2 price forecast starts at $15/ton in 2020, and increases to approximately $30/ton in 2030. Taken as a trajectory, this represents a $13/ton levelized price over the period 2015-2030. By the year 2020 there is likely to be a price on greenhouse gas emissions either related to achieving greenhouse gas reduction goals, or to adaptation initiatives. A price on carbon affecting power plants throughout the country could come as late as 2020 if legislators fail to act for the next three sessions of congress, and if the President in power is either unable or unwilling to drive federal climate policy. In our opinion, federal legislation is likely by the end of the session in 2018 (with implementation by 2020) spurred by one or more of the following factors:

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[13] All values in the Synapse Forecast are presented in 2010 dollars. Results from EIA and EPA modeling analyses were converted to 2010 dollars using price deflators taken from the US Bureau of Economic Analysis, and available at: http://www.bea.gov/national/nipaweb/SelectTable.asp Because data were not available for 2010 in its entirety, values used for conversion were taken from Q3 of each year. Consistent with EIA and EPA modeling analyses, a 5% real discount rate was used in all levelization calculations.

technological opportunity; a patchwork of state policies to achieve state emission targets for 2020 spurring industry demands for federal action; a Supreme Court decision to allow nuisance lawsuits to go ahead resulting in a financial threat to energy companies; and increasingly compelling evidence of climate change. Given the interest and initiatives on climate change policies in states throughout the nation, a lack of federal action will result in a hodge podge of state policies. This scenario is a nightmare for any company that seeks to make investments in existing, modified, or new power plants. Historically, just such a pattern of states and regions leading with initiatives that are eventually superseded at a national level is common for energy and environmental policy in the US. It seems likely that this will be the dynamic that ultimately leads to federal action on greenhouse gases, as well.

The low forecast boundary is consistent with the coincidence of one or more of the factors discussed above that have the effect of lowering prices. For example, this price boundary may represent a scenario in which Congress begins regulation of greenhouse gas emissions slowly by either:

1. including a very modest or loose cap, especially in the initial years,
2. including a safety valve price or
3. allowing for significant offset flexibility, including the use of substantial numbers of international offsets.

The factors could also include state actions to reduce emissions through aggressive energy efficiency and renewable actions, and/or a decision by Congress to adopt a set of aggressive complementary policies as part of a package to reduce CO_2 emissions. These complementary policies could include an aggressive federal Renewable Portfolio Standard, more stringent automobile CAFE mileage standards (in an economy-wide regulation scenario), and/or substantial energy efficiency investments. Such complementary policies would lead directly to a reduction in CO_2 emissions independent of federal cap-and-trade or carbon tax policies, and would thus lower the expected allowance prices associated with the achievement of any particular federally-mandated goal.

The range of prices we have shown is recommended for planning purposes, but it is certainly possible that the actual price will fall outside of this range. For example, there are some CO_2 price scenarios identified in recent analyses that are significantly higher than our Synapse High Price Forecast. These scenarios represent situations with limited availability of alternatives to carbon-emitting technologies and/or limited use of international and domestic offsets. We do not believe that the CO_2 prices characteristic of such scenarios are likely in the current political environment, given that there may be avenues available for meeting likely emissions goals that would mitigate costs to below these levels. However, the political context may change over time due to changes in technical, economic, and political circumstances, and/or developments in scientific evidence on the rate and impacts of a changing climate.

Synapse also has prepared a Mid or Expected CO_2 Price Forecast that starts a bit more slowly, but close to the low case, at $15/ton in 2018, but then climbs to $50/ton by 2030. The levelized cost of this mid CO_2 price forecast is $26/ton over the period 2015 to 2030.

The 2011 Synapse High, Mid and Low CO_2 Price Forecasts are shown in Figure 8 and Table 3 below:

Figure 8: 2011 Forecast Values

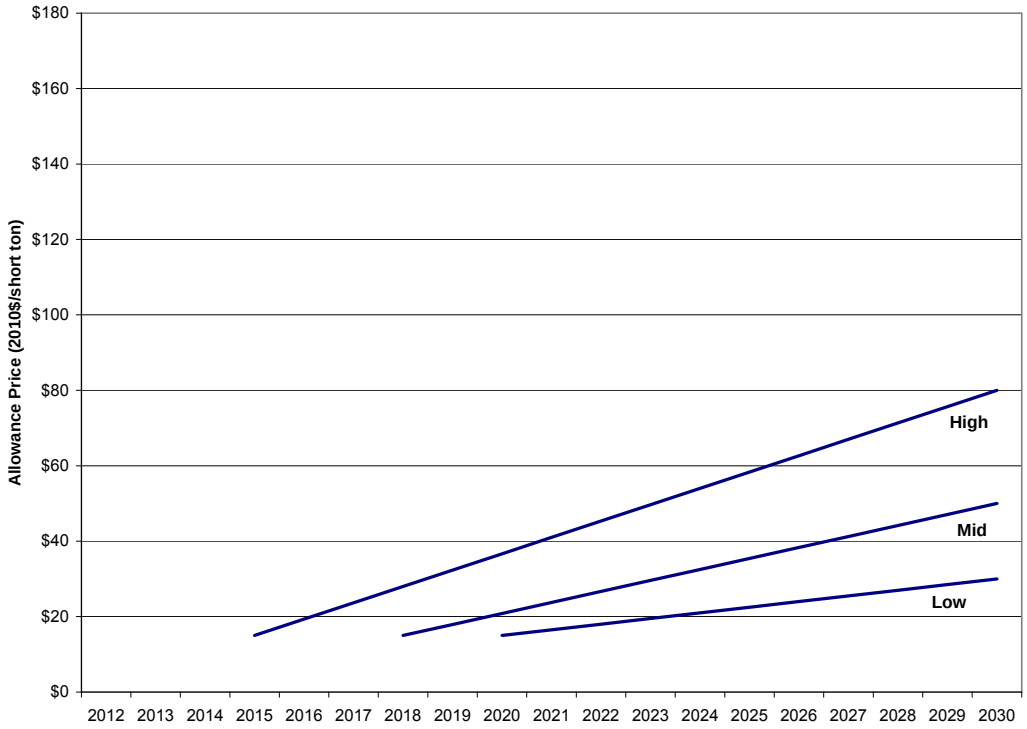


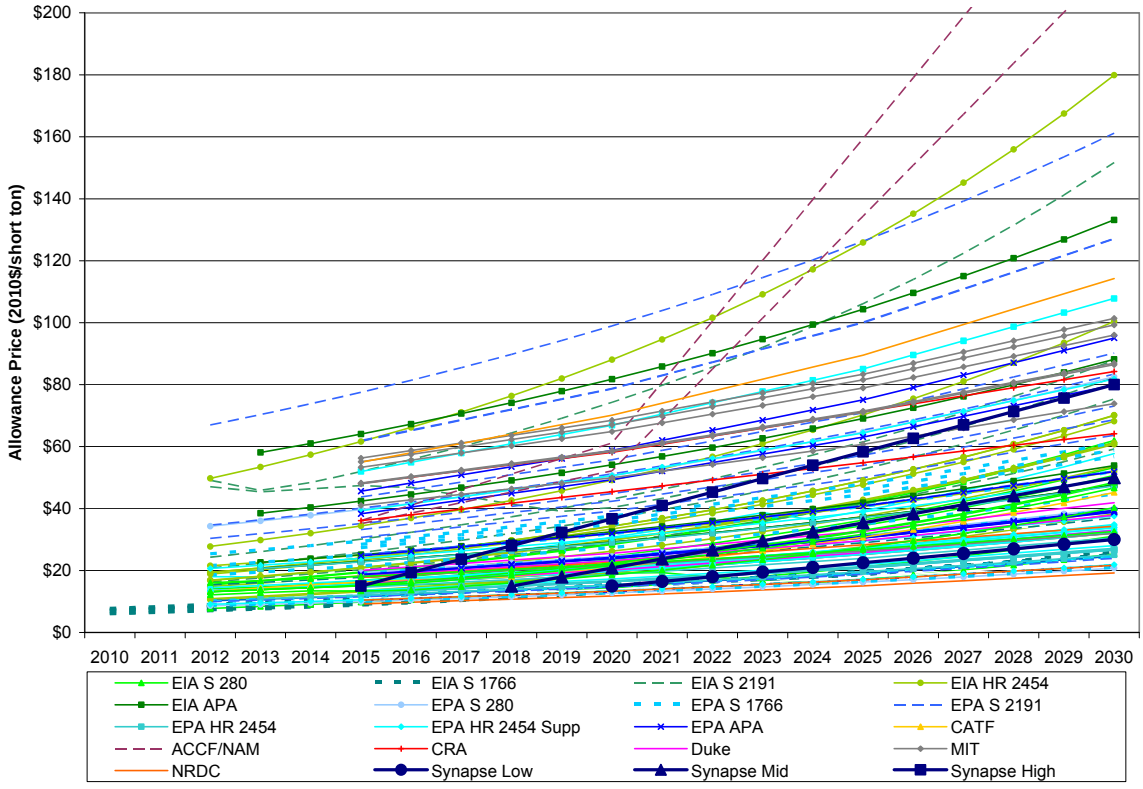
Table 3: 2011 Synapse Low, Mid, and High CO_2 Allowance Price Forecasts (2010$/short ton)

Year	Low Case	Mid Case	High Case
2015	N/A	N/A	$15.00
2016	N/A	N/A	$19.33
2017	N/A	N/A	$23.67
2018	N/A	$15.00	$28.00
2019	N/A	$17.92	$32.33
2020	$15.00	$20.83	$36.67
2021	$16.50	$23.75	$41.00
2022	$18.00	$26.67	$45.33
2023	$19.50	$29.58	$49.67
2024	$21.00	$32.50	$54.00
2025	$22.50	$35.42	$58.33
2026	$24.00	$38.33	$62.67
2027	$25.50	$41.25	$67.00
2028	$27.00	$44.17	$71.33
2029	$28.50	$47.08	$75.67
2030	$30.00	$50.00	$80.00

It is important to emphasize that these are price trajectories to use for planning purposes, so that a reasonable range of emissions costs can be incorporated to reflect likely costs of alternative resource plans, for example. We do not expect carbon prices to follow any single trajectory in our

forecast. Rather, our forecast can be read as the expectation that in 2015 the price will be between $0 and $15 in 2010 dollars, and in 2025 it will be between $23 and $58. It is entirely possible that the price will start out quite low, as Congress "tests the waters" on carbon policy, and rise closer to our high case as the need for greater emissions reductions becomes increasingly evident, more technological options become available, and the economy and the electorate adjust to paying for carbon emissions. Just such a scenario was recently applied by Pacificorp in their proposed Integrated Resource Plan.[14] Their "Low to Very High" trajectory begins at $12/ton in 2015 (2015 dollars) and grows at only 3%/year in real terms until 2020, and then at 18% real escalation thereafter. Converted into 2010 dollars, this scenario has a levelized cost almost exactly the same as Synapse' "Mid" case presented here. Figures 9 through 13, below, place the Synapse February 2011 forecast in context. They present the Synapse February 2011 forecast alongside projections of greenhouse gas allowance prices associated with federal legislative proposals discussed in previous sections of this report.

Figure 9: Synapse CO_2 trajectories and greenhouse gas allowance price projections based on analyses of federal legislative proposals



[14] Pacificorp, "Portfolio Development Cases for the 2011 Integrated Resource Plan", December 7, 2010.

Figure 10: Synapse CO_2 trajectories and greenhouse gas allowance price projections based on analyses of federal legislative proposals – levelized

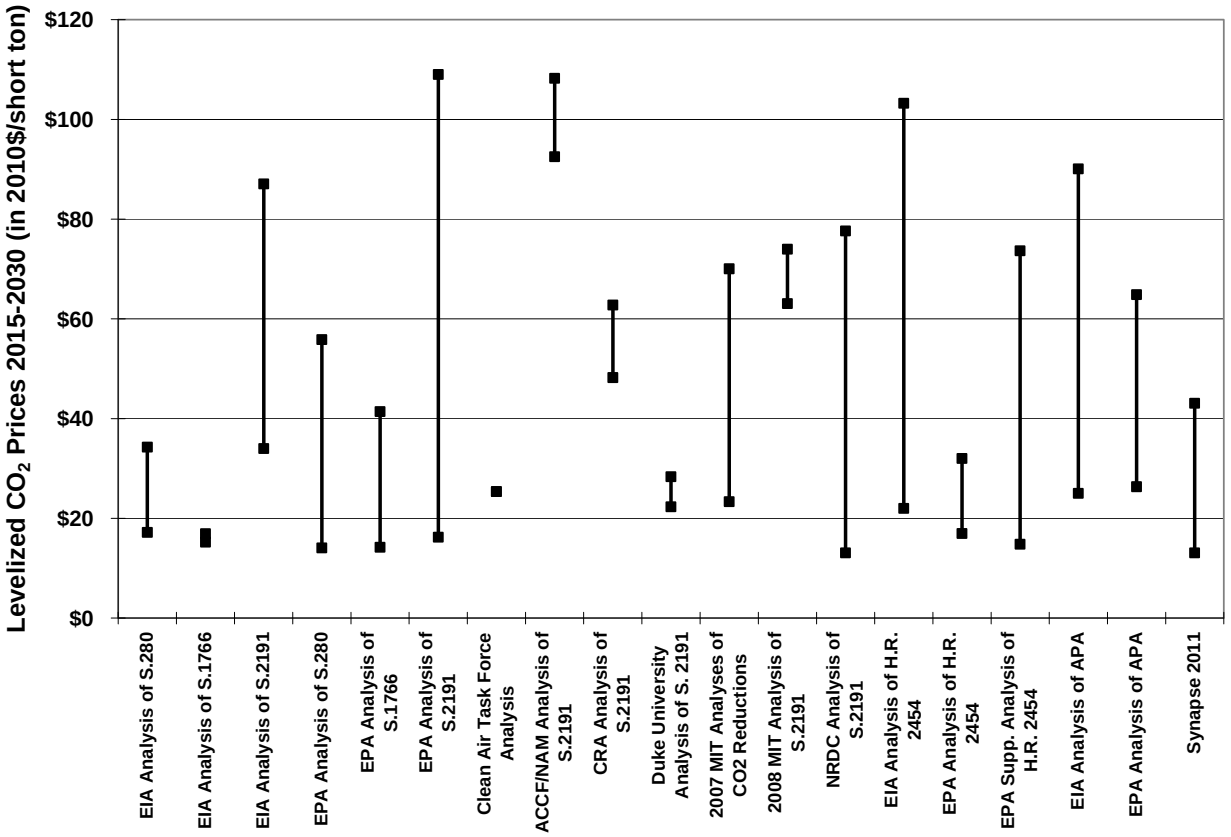


Figure 11: Synapse CO_2 trajectories and greenhouse gas allowance price projections for HR 2454 and APA 2010

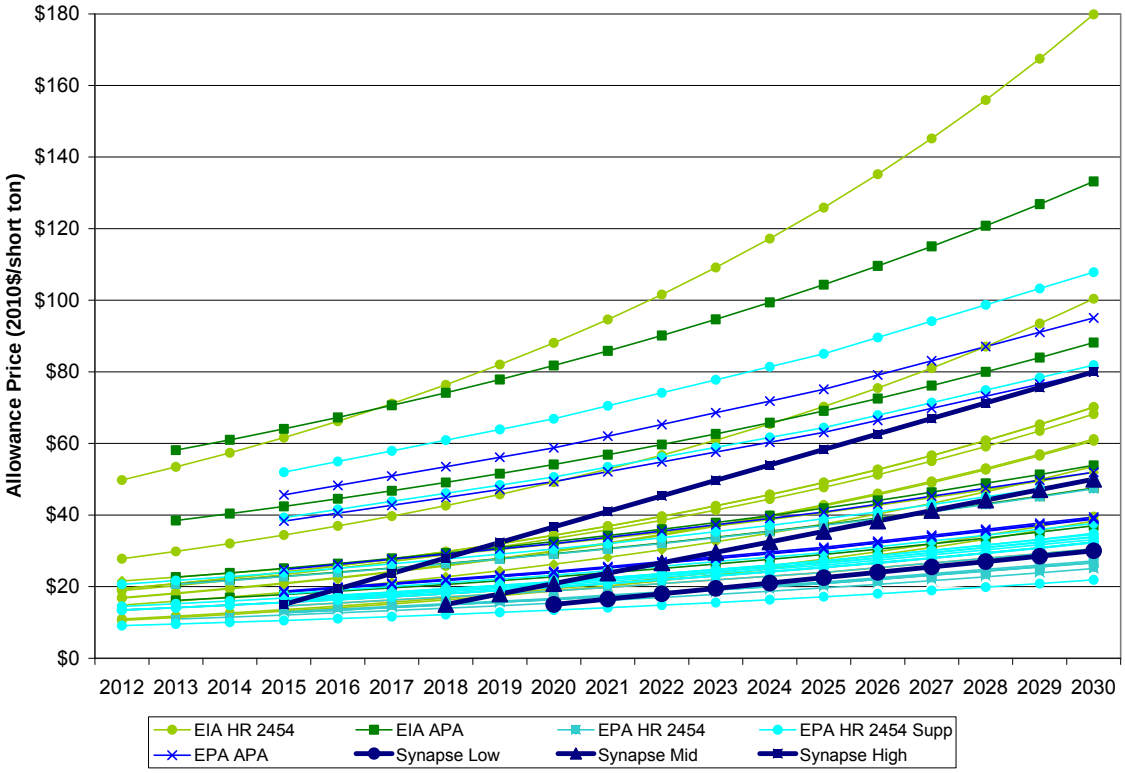


Figure 12: Synapse CO_2 trajectories and greenhouse gas allowance price projections for HR 2454 and APA 2010- levelized 2015-2030

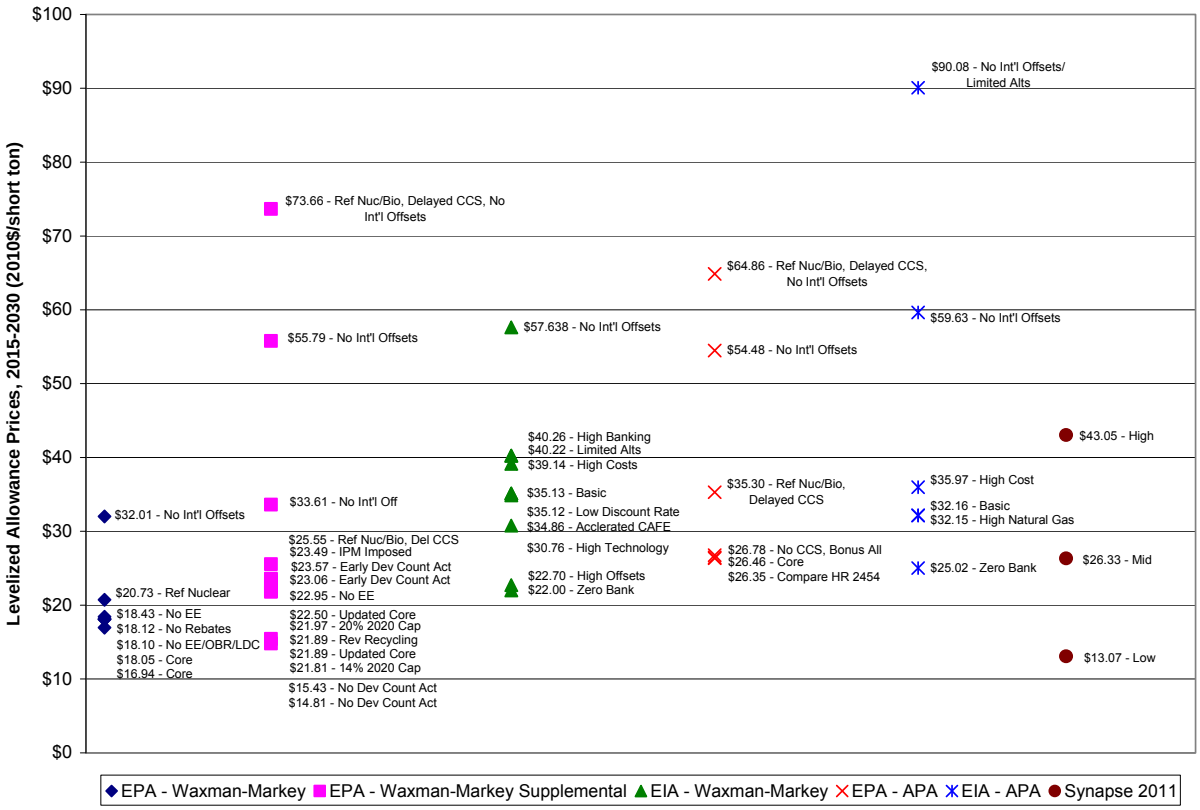
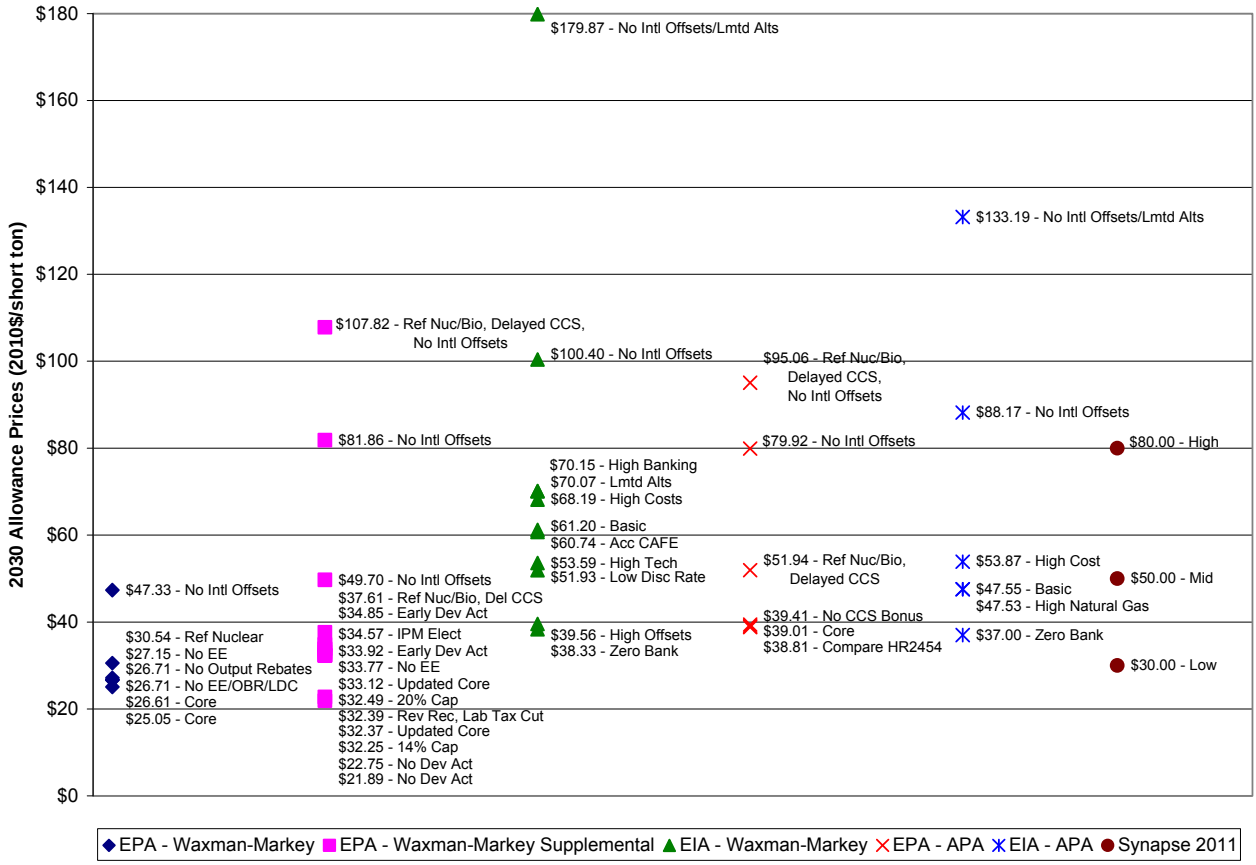


Figure 13: 2030 Synapse CO_2 prices and greenhouse gas allowance price projections for HR 2454 and APA 2010



The Synapse projections represent a range of possible future costs. These recommended price trajectories will be useful for testing range-sensitivity of various investment possibilities in resource planning in the electric sector. There will certainly be variability and volatility in prices following supply and demand dynamics, as there is with other cost drivers. Nonetheless, we intend and anticipate that the projections represent a useful price range for resource planning and policy analysis in the face of uncertainty.

6. Conclusion

The lack of clarity on the future of climate change policies in the United States does not diminish the importance of appropriate consideration of likely future emissions costs in electric resource planning. To the contrary, a reasonable projection of a range of costs is critical to investment decisions and the selection of least-cost resource plans that will be robust under a variety of circumstances. As the most comprehensive source of information on potential costs under a variety of emission reduction scenarios, analyses of recent legislative proposals provide useful insight in developing a reasonable emissions price projection. These analyses of legislative proposals provide information that is useful in considering a variety of policy futures – well beyond those that

include a national emissions cap and allowance trading program. They explore the dynamic relationship between factors such as emission reductions, technology innovation, flexibility mechanisms (such as offsets), penetration of clean energy sources and efficiency, and others – all of which come into play under a variety of policy mechanisms. The Synapse February 2011 Carbon Forecast represents a reasonable range of values to use in investment decisions and resource selection. The range presented does not include the most extreme high or low values, which derive from a combination of factors that can reasonably be deemed unlikely to occur in combination. Rather, it represents a reasonable range to use for purposes of robust analysis of resource plans and policy options, recognizing that the future will always involve uncertainty.

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