

Review of Draft Pennsylvania Climate Impact Assessment
By
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Introduction

Under the Pennsylvania Climate Change Act (Act 70 of 2008), the Pennsylvania Department of Environmental Protection (DEP) is required to provide an assessment of the impact of global climate change on the state. Section 3 of Act 70 requires that the DEP report address the impact of climate change on Pennsylvania's climate, human health, economy and management of economic risk, forests, wildlife, fisheries, recreation, agriculture and tourism as well as any significant uncertainties about the impact of climate change. In addition, Section 3 of the Act requires the DEP to report on opportunities and barriers to their realization created by the need for alternative sources of energy, climate related technologies, services and strategies, carbon sequestration technologies, capture and utilization of fugitive greenhouse gas emissions and other mitigation strategies. Section 3 further notes that the DEP report should reflect the diversity of views within the scientific community.

The purpose of this brief paper is to address the question of whether or not the DEP's March 31, 2009 draft report, "Pennsylvania Climate Impact Assessment" (PCIA), adequately reflects diverse views on several key climate change issues facing Pennsylvania policymakers. Time constraints and the length and complexity of the PCIA report preclude a detailed review of the analysis but the absence of reference to climate science or impacts on various individual sectors should not be construed as acceptance of the study's findings. However, a review of the PCIA report suggests that it falls short of the goal of reflecting a diversity of views in several areas including: (1) economic impacts of GHG emission caps and reduced energy use in Pennsylvania; (2) role of renewable energy; (3) possible expansion of the role of nuclear power for electricity generation; (4) carbon sequestration opportunities for the state; (5) impact of climate change possibilities on the insurance industry; and (6) impact on agricultural output and food prices. The report also fails to put Pennsylvania's carbon emissions in a global perspective, thereby making it difficult for policymakers to understand the costs and benefits to the state and to the environment of possible mandatory GHG reduction policies in the state.

Economic Impacts of GHG Emission Reduction Targets

- **PCIA Perspective**

Throughout its discussion of energy and the economy in Chapters 10, 14 and 15, the PCIA report emphasizes the opportunities for GHG emission reductions in Pennsylvania through the imposition a cap-and-trade system or a tax on carbon emissions. One point that stands out is that in contrast to other chapters, there are no citations of outside

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analyses or reports in Chapters 14 (Economic Barriers and Opportunity) or in Chapter 15 (General Economy). Another point worth highlighting is that while Chapter 10 (Energy) does mention that the immediate impact of placing a price on greenhouse gas emissions from power plants will be to increase the cost of power generation, there is little discussion of the possible impact of higher energy prices on economic activity and overall employment in the state.² The main reference to the economic impact of GHG reduction targets on electricity prices in the PCIA report is a reference to an analysis of the Northeastern Regional Greenhouse Gas Initiative (RGGI) which showed little effect on electricity prices. This argument is flawed, however. Many observers have noted that since GHG emissions in most of the RGGI states are currently below the RGGI targets, most states will not have to reduce emissions until 2016 or beyond.

The chapter further notes that unless the price of the emission allowance is approximately \$80 per ton of CO₂, utilities will not switch from coal to natural gas and thus Pennsylvania's GHG emissions from electricity would not decline unless demand by industry and household declines.³ The PCIA report concludes that a cap-and-trade or a carbon tax alone will not decarbonize Pennsylvania's electric power system. Regulators will need to choose technologies and policies to bring about reductions in GHG emissions in the electricity and transportation sectors.

- **Alternative Views**

Curbing GHG emissions through a cap and trade system or a carbon tax raises energy prices and slows economic and job growth, according to numerous analyses by government, academic and private energy modeling firms. For example, recent private and government analyses of the impact of cap-and-trade proposals such as the Lieberman-Warner bill (S.2191), which sets targets to reduce GHGs to 15 percent below 2005 levels by 2020 and to 70 percent below by 2050, show that there are likely to be significant adverse consequences for the U.S. economy and job growth. (See **Table 1**). For example, an analysis S.2191 by the American Council for Capital Formation and the National Association of Manufacturers of S.2191 showed that by 2020, the cost of an emission allowance that industry would need to purchase that year for each ton of CO₂ emitted would range from \$55 to \$64 dollars (see study at <http://www.accf.org/pdf/NAM/fullstudy031208.pdf>). The ACCF/NAM analysis employed the National Energy Modeling System (NEMS), the same model used by the U.S. Department of Energy's Energy Information Administration when it measures the economic impact of proposals to reduce GHG emissions.

² Pennsylvania Climate Impact Assessment, Report to the Department of Environmental Protection, March 31, 2009, page 180-181.

³ Ibid. p. 183.

Table 1. Economic Impact of the Lieberman-Warner Bill: Summary of Key Modeling Results

	2020		
	Allowance Prices (2007\$ per metric ton)	GDP Impact (% Change from BAU)	Impact on Jobs (%Change from BAU)
ACCF/NAM-Low Cost ¹	\$55	-0.8%	-1,210,000
ACCF/NAM-High Cost ¹	\$64	-1.1%	-1,800,000
CRA/NMA ²	\$47	-1.2%	-3,269,000
EIA- NEMS Core Case ³	\$31	-0.3%	-270,000
EIA- NEMS Limited ³	\$44	-0.5%	-450,000
EPA- Scenario 2 ⁴	\$39	-0.7%	-
EPA- Scenario 7 ⁴	\$73	-1.5%	-
MIT- No Offsets, No CCS Subsidy ⁵	\$72	-0.7%	-
MIT- 15%, CCS Subsidy ⁵	\$61	-0.8%	-

	2030		
	Allowance Prices (2007\$ per metric ton)	GDP (% Change) (% Change from BAU)	Impact on Jobs (%Change from BAU)
ACCF/NAM-Low Cost ¹	\$228	-2.6%	-3,100,000
ACCF/NAM-High Cost ¹	\$271	-2.7%	-4,100,000
CRA/NMA ²	\$68	-1.0%	-2,393,000
EIA- NEMS Core Case ³	\$62	-0.3%	-280,000
EIA- NEMS Limited ³	\$93	-0.7%	-710,000
EPA- Scenario 2 ⁴	\$64	-0.9%	-
EPA- Scenario 7 ⁴	\$118	-2.3%	-
MIT- No Offsets, No CCS Subsidy ⁵	\$105	-0.3%	-
MIT- 15%, CCS Subsidy ⁵	\$89	-0.4%	-

1. "Analysis of The Lieberman-Warner Climate Security Act (S.2191) Using The National Energy Modeling System (NEMS/ACCF/NAM)," A Report by the American Council for Capital Formation and the National Association of Manufacturers, March 2008.
2. "Economic Analysis of the Lieberman-Warner Climate Security Act of 2007 Using CRA's MRN-NEEM Model," by CRA International, April 2008.
3. "Energy Market and Economic Impacts of S.2191, the Lieberman-Warner Climate Security Act of 2007," by the Energy Information Administration, U.S. Department of Energy, April 2008.
4. "EPA Analysis of the Lieberman-Warner Climate Security Act of 2007," by the U.S. Environmental Protection Agency, March 2008.
5. "Appendix D: Analysis of the Cap and Trade Features of the Lieberman-Warner Climate Security Act," by MIT.

Results of other modeling efforts from CRA International, DOE’s Energy Information Administration, the U.S. Environmental Protection Agency and the Massachusetts Institute of Technology show a similar range of allowance prices, especially when the availability of carbon capture and storage and new nuclear generation capacity are constrained (see **Table 1**). By 2030, carbon allowance prices are higher due to the tightening of emission reduction targets, increased demand and U.S. population growth.

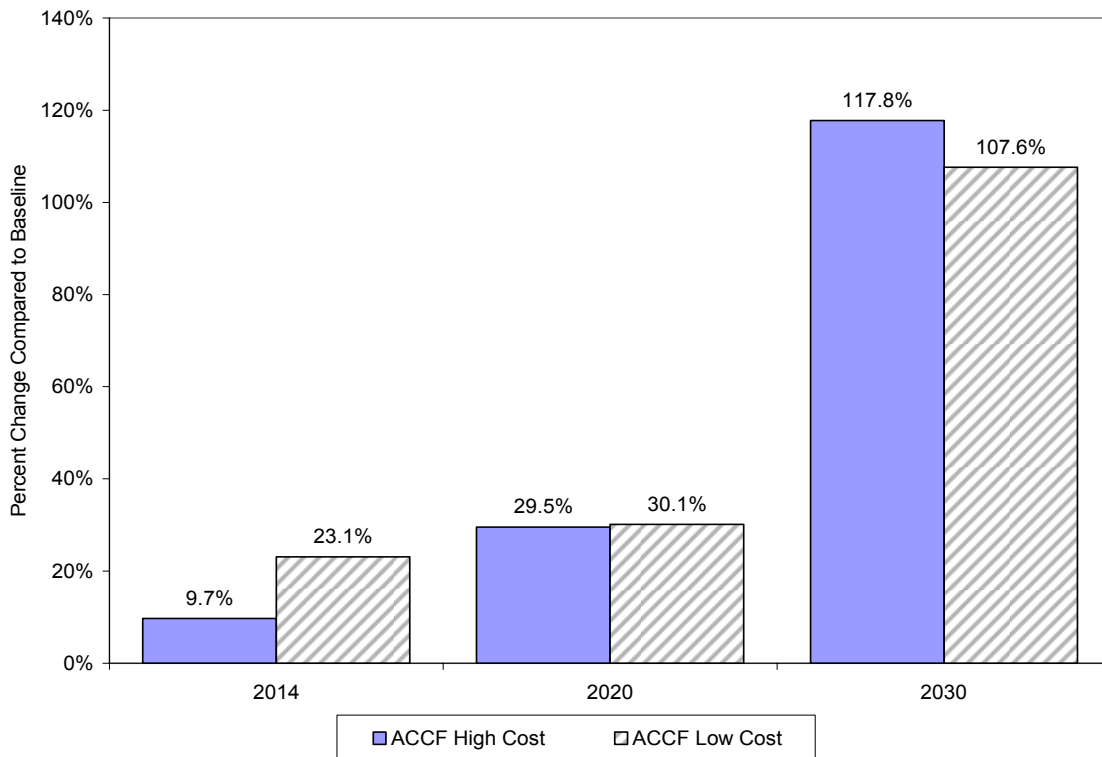
The ACCF/NAM analysis of the Lieberman/Warner bill shows significant energy price increases by 2030, primarily due to the impact of the cost of purchasing carbon permits but also from the construction and operation of a more costly suite of energy conversion technologies that help satisfy emission limits. As shown in **Table 2**, a revamped power generation sector is projected to increase the cost of electricity to the residential sector between 101 (Low Cost case) and 129 percent (High Cost case) by 2030, while the industrial natural gas price increase is projected to range between 180 (Low Cost case) to 244 percent (High Cost case). The effect of mandatory GHG reduction targets is to significantly increase the share of U.S. electricity generated by natural gas compared to the baseline forecast. By 2020, thirty percent more of the U.S. electricity supply would be generated by natural gas, and over 100 percent more by 2030 (see **Figure 1**).

Table 2. Impact of Lieberman-Warner Bill on the United States: Change in Energy Prices Compared to Baseline Forecast

	Low Cost Case			High Cost Case		
	2014	2020	2030	2014	2020	2030
Rise in Gasoline Prices	13%	20%	77%	50%	69%	145%
Rise in Residential Electricity Prices	13%	28%	101%	14%	33%	129%
Rise in Industrial Electricity Prices	22%	41%	142%	23%	49%	185%
Rise in Industrial Natural Gas Prices	36%	49%	180%	40%	66%	244%

Source: "Analysis of The Lieberman-Warner Climate Security Act (S.2191) Using The National Energy Modeling System (NEMS/ACCF/NAM)," A Report by the American Council for Capital Formation and the National Association of Manufacturers, March 2008.

Figure 1. Change in Electricity Generated by Natural Gas under Lieberman-Warner Bill (S.2191) (Compared to Baseline Forecast)



Source: "Analysis of The Lieberman-Warner Climate Security Act (S.2191) Using The National Energy Modeling System (NEMS/ACCF/NAM)," A Report by the American Council for Capital Formation and the National Association of Manufacturers, March 2008.

Higher energy prices slow economic growth because more expensive renewable energy is being substituted for cheaper energy from fossil fuels. The ACCF/NAM study shows that GDP declines by as much as 1 percent in 2020 and by up to 2.7 percent in 2030. GDP losses in the other studies reported in **Table 1** show losses of up to 1.5 percent in 2020 and 2.3 percent in 2030.

The ACCF/NAM analysis shows that the drag of higher energy prices caused by the cap-and-trade system in S.2191 reduces total U.S. employment (net of new jobs created in green industries) by 1,210,000 to 1,800,000 jobs in 2020 and by as many as 4,100,000 in 2030, compared to the baseline forecast. In other analyses cited in **Table 1**, job losses range from 270,000 to 3,269,000 in 2020 and up to 2,393,000 by 2030.

- **Impact on Pennsylvania**

The ACCF/NAM analysis also quantified the impact of the Lieberman/Warner bill on Pennsylvania’s economic and job growth. Meeting the emission reduction targets in the

Lieberman/Warner bill would reduce Pennsylvania’s Gross State Product by \$6 to \$8 billion by 2020 and by \$22 to \$26 billion compared to the baseline forecast by 2030. Fewer jobs are created. For example, by 2020 up to 66,000 fewer jobs would be created. Household income is reduced by \$1,018 to \$3,299 by 2020 and by up to \$7866 by 2030.

Table 3. Macroeconomic Impact of Lieberman-Warner Bill: Changes in Pennsylvania Economy Compared to Baseline Forecast

	Low Cost Case		High Cost Case	
	2020	2030	2020	2030
Loss in GSP (million 2007\$)	-\$6,100	-\$22,496	-\$8,453	-\$26,561
Loss in Jobs	-44,000	-104,000	-66,000	-139,000
Loss in Household Income (2007\$)	-\$1,018	-\$4,314	-\$3,299	-\$7,866

Source: "Analysis of The Lieberman-Warner Climate Security Act (S.2191) Using The National Energy Modeling System (NEMS/ACCF/NAM)," A Report by the American Council for Capital Formation and the National Association of Manufacturers, March 2008.

Just as energy prices across the U.S. rise when significant GHG reduction targets are imposed, Pennsylvania’s energy prices are also significantly impacted by the requirement to reduce carbon emissions (see **Table 3**). For example, by 2020, Pennsylvania’s natural gas prices could be up to 32 percent higher and gasoline prices up to 66 percent higher than the baseline forecast.

Table 4. Macroeconomic Impact of Lieberman-Warner Bill: Change in Energy Prices in Pennsylvania Compared to Baseline Forecast

	Low Cost Case		High Cost Case	
	2020	2030	2020	2030
Rise in Gasoline Prices	20%	74%	66%	143%
Rise in Residential Electricity Prices	22%	78%	26%	113%
Rise in Residential Natural Gas Prices	23%	93%	32%	133%

Source: "Analysis of The Lieberman-Warner Climate Security Act (S.2191) Using The National Energy Modeling System (NEMS/ACCF/NAM)," A Report by the American Council for Capital Formation and the National Association of Manufacturers, March 2008.

Impact on global GHG Emissions

- **PCIA Perspective**

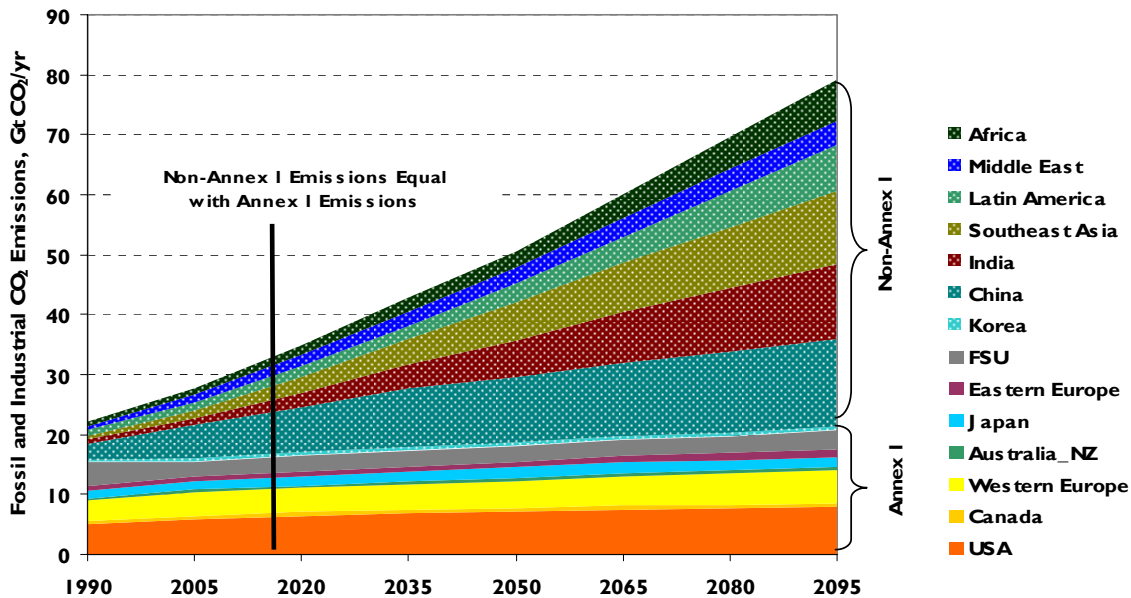
The PCIA report does not address the fact that reducing Pennsylvania’s GHG emissions will have almost no impact on global GHG concentrations in the atmosphere. The PCIA report overlooks the point that whatever economic costs residents of Pennsylvania bear as a result of policies to reduce emissions will far outweigh any environmental benefits from their actions.

- **Alternative Views**

Another view is the fact that Pennsylvania’s GHG reduction policies cannot impact the rate of change in global concentrations of GHGs since the state’s share is only 1 percent of annual global emissions and its share is declining as developing country emissions grow.

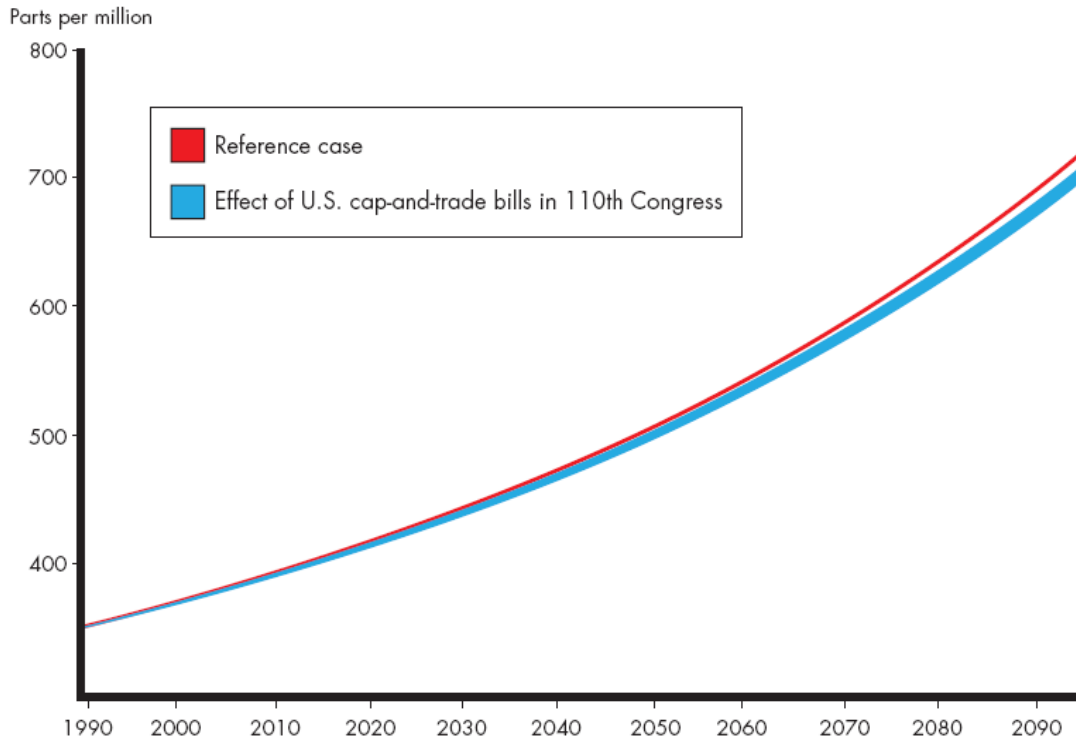
Most of the growth in CO2 emissions in the 21st century will be in the developing world (see **Figure 2**). Thus, meeting the mandatory reduction targets of proposed legislation such as the Lieberman/Warner bill or the Waxman-Markey bill are likely to have a significant impact on U.S. economic and job growth due to the sharply higher energy prices needed to bring down emissions. However, U.S. (or Pennsylvania) climate change policies will have virtually no environmental benefits unless developing countries, whose emissions are growing strongly, also participate. As noted in the new 2009 *Council of Economic Advisers Report to the President*, global concentrations of CO2 in 2100 will be almost unaffected by U.S. emission reductions (See **Figure 3**). Thus, without strong international participation to reduce GHGs, the slower U.S. economic and job growth that would result from the emission reduction targets being debated by U.S. policymakers would yield little environmental benefit.

Figure 2. World Carbon Dioxide Emissions



Source: Data derived from Global Energy Technology Strategy, Addressing Climate Change: Phase 2 Findings from an International Public-Private Sponsored Research Program, Battelle Memorial Institute, 2007.

Figure 3: Global CO2 Concentrations:
Carbon emissions are projected to rise over the next several decades



Source: Economic Report of the President, Annual Report of the Council of Economic Advisers, January 2009, Chart 3-6, pg 124.

Renewable Energy

- **PCIA Perspective**

According to the PCIA report, increased use of renewable energy could help Pennsylvania significantly reduce its GHG emissions. The report notes that plug-in hybrid vehicles (PHEVs) would charge when the wind was blowing and cease when the wind ceased to blow. For example, the batteries of (PHEVS) could be used to store electricity generated by windpower. The PHEV batteries could then send electricity to the grid during peak times, avoiding the need to build new peaking plants. Before this renewable technology could be widely deployed, smart grids and advanced metering would need to be deployed. It appears that PCIA has omitted a discussion of some of the challenges in interegrating wind power into the grid. In addition, the PCIA report suggests that climate change policies could be used deemphasize food production and encourage the production of ethanol and carbon sequestration by taking farm land out of production. Failure to discuss the connection between greater use of biofuels and U.S. and global food prices as well as collateral environmental damage is another area where the PCIA report does not adequately present alternative expert views.

- **Alternative views**

Integrating significantly more renewable electricity into the grid will be an expensive and time consuming project according to a recent report, “Reliability Impacts of Climate Change Initiatives”, by the North American Electric Reliability Corporations (NERC).

The ability to reduce the carbon emissions of the electric sector hinges on having a robust transmission system, the report notes. A recent study by the Power Systems Engineering Research Center (PSERC) suggests that: “Regardless of contractual arrangements that are subject to environmental regulation, the ultimate dispatch pattern that will determine the actual emissions is largely dependent on transmission constraints and reliability considerations.” California ISO echoes these concerns, naming transmission limitations as the “fundamental obstacle” to achieving the state’s environmental objectives and maintaining reliability.

Ensuring a suitable transmission system will require a two-pronged approach: building new infrastructure and changing current planning mechanisms to focus more heavily on interregional and continent-wide planning and operation. For example, cost allocation issues need to be resolved in order to develop meaningful, continent-wide planning processes as this influences how planning is conducted. Existing transmission infrastructure is inadequate to reliably integrate new renewable resources to demand centers. Evidence of this exists today, as transmission limitations are already imposing significant constraints on wind development, with massive interconnection queue backlogs and forced curtailments of wind. Further, the transmission grid was not designed for the long distance continental transport of power, and will require enormous study to ascertain the best plan to meet potential requirements of climate change initiatives.

Several factors compound the need for new transmission infrastructure. New generation resources under consideration are typically location-constrained — meaning they must be sited in a particular area, such as where the wind blows, the sun shines, or, in the case of clean coal with carbon capture and sequestration, where the infrastructure exists to support them. Nuclear is also typically included in this category, as nuclear facilities generally cannot be located near major population centers. These types of low or non-emitting resources can require long-distance transmission lines to areas not already served by existing transmission infrastructure, as areas that are rich in renewable do not correspond with areas where the transmission system is the strongest. Significant transmission siting challenges can arise as longer lines are considered, especially when needed transmission lines cross state or regional boundaries. Cost-allocation of this infrastructure also remains a significant concern of respondents, as these needs can significantly impact the cost competitiveness of renewable energy projects, the NERC report concludes.

Regarding biofuels production for transportation and using farm land to sequester carbon, it is important to recognize the connection between using crops as biofuels and using

agricultural land for CCS and food prices. The competing uses of agricultural land and crops, puts an upward pressure on food prices. Demand for ethanol and other biofuels is a "significant contributor" to soaring food prices around the world, World Bank President Robert Zoellick says. Droughts, financial market speculators and increased demand for food have also helped create "a perfect storm" that has boosted those prices, he says. <http://www.npr.org/templates/story/story.php?storyId=89545855> Meanwhile, a study commissioned by food manufacturers pegs the contribution of biofuels on food prices at between 25 percent and 35 percent. <http://www.foodbeforefuel.org/files/Role%20of%20Biofuels%206-19-08.pdf>

Insurance Industry Outlook

- **PCIA Perspective**

The PCIA report notes that “While climate change does not threaten Pennsylvania’s insurers to the extent that it does insurers in higher risk areas, insurance companies operating in Pennsylvania will still benefit from reductions in greenhouse gas emissions. This creates an incentive for insurers to implement new policies that help in climate change mitigation. However, this is only to the extent that these policies also reduce risk exposures for insurance companies. There is little incentive for insurance companies to offer such policies if reduced emissions are not correlated with risk reductions (Hecht 2008).” Climate change also presents new investment opportunities for insurers. In addition to helping the environment, mitigation activities can improve the corporate image of participating companies. Green products are a potential opportunity for insurers. Insurers have begun to offer rate reductions for policyholders utilizing such products. AIG offers up to a 10% rate reductions for new pollution legal liability insurance for LEED (Leadership in Energy and Environmental Design) certified properties. They also provide property coverage that enables policyholders to rebuild using green products after suffering a loss (AIG 2007). Similarly, Fireman’s Fund offers 5% rate reductions for green products such as solar panels, green roofs, and recycled water supply systems (Kunreuther and Michel-Kerjan 2007).”

The PCIA report further notes that “The auto insurance industry has become involved in the ‘greening’ of insurance. Some auto insurers have begun to offer rate reductions for policyholders driving energy efficient hybrid vehicles. Another relatively new possibility is pay-as-you-drive (PAYD) auto insurance. Such policies would provide the incentive to reduce miles driven, thus combining environmentally friendly practices with risk reduction.”

- **An Alternative view**

Predicting weather-related catastrophes and trying to price insurance products accordingly is the ultimate risk management challenge for the industry. In recent years, insurance companies have begun incentivizing policyholders to consume greener products that could directly impact the greenhouse gas emissions. However, the persistence of these incentives is questionable since there is often no apparent link

between risk and incentives or no positive impact on insurance companies' bottom line, profits. For example, some auto insurers currently offer rate reduction for policyholders driving energy efficient hybrid vehicles. As noted by the National Association of Mutual Insurance Companies, "if there is no established link between risk and driving alternative fuel vehicles, it makes no sense actuarially to offer it and the industry will not perceive this pricing strategy viable."⁴

Recent years have also witnessed a wave of green building designs, with potential new risks for the insurance industry. According to Catha G. Pavloff, senior vice president of Marsh, insurers are warning design firms not to guarantee "an outcome, an energy savings, a water savings, improved employee productivity or... promising that you will achieve a certain level of Leadership in Energy and Environmental Design (LEED) certification."⁵ She attributed this warning to the usage of lots of new, untested materials in these new buildings. She said that "It's not yet known whether they will hold up, whether they will leak, whether they cause mold, whether they will be flammable."⁶

The insurance industry will play a major role in new technologies developed to reduce GHGs. Currently any climate change proposal includes heavy emphasis on Carbon Capture and Storage (CCS) technology. This report also underlines significant potential for long-term geologic storage of carbon dioxide emissions in Pennsylvania. However, a major point ignored, not only in this report but in the general discussion of CCS, is the involvement of the insurance industry for an appropriate modeling of business risk associated with this unproven technology. As noted by an executive from Duke Energy "utilities would be foolish to build large CCS facilities without having assurance that they would not be liable for damages if the CO₂ leaks out."⁷ Assuming that the insurance industry would be willing to cover the risks associated with CCS (construction, equipment, general liability, credit risks and unintended environmental risks resulting from possible leakages), the resulting addition to the cost of energy generated with this technology may not be cost effective and competitive. Ultimately, it is essential to analyze whether it would make economic sense for the insurance industry to undertake these risks.

The last point worth mentioning is the effect of increasing insurance prices to cover possible climate change effects on other types of insurance and general insurance ownership. Travelers' response to the Carbon Disclosure Project's survey underlines the worries of the company: "Our ability to adjust pricing, modify contractual underwriting terms or reduce exposure to certain geographies to the extent necessary to offset the rising costs of catastrophes may be limited due to considerations of public policy, the evolving political environment and/or social responsibilities. A consequence of trying to

⁴ Sean B. Hecht, "Climate Change and the Transformation of Risk: Insurance Matters", UCLA School of Law Research Paper No 08-24, pg 1559, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1159853

⁵ Al Slavin, "The Thin Green Line," Best's Review, January 2009, <http://www.aepronet.org/ge/no46.pdf>, pg 78

⁶ Al Slavin, "The Thin Green Line," Best's Review, January 2009, <http://www.aepronet.org/ge/no46.pdf>, pg 78

⁷ Evan Mills, "From Risk to Opportunity," A Ceres Report, April 2009, <http://www.ceres.org/Document.Doc?id=417>, pg 61

price this exposure appropriately is reduced consumer demand for property insurance coverage due to the increased cost of obtaining such coverage. Also, the inability to offer catastrophe exposed insurance coverage at affordable rates and at adequate financial returns may discourage our customers from purchasing non-catastrophe exposed insurance coverage from us.”⁸

Conclusions

The PCIA report contains information and speculation about how various industries might be affected by actual changes in the climate in Pennsylvania. However, the report fails to provide alternative views on several key areas. For example, alternative views on the possible negative economic effects of mandatory GHG emission reduction or a carbon tax are omitted from the PCIA report. The report also fails to put Pennsylvania’s carbon emission in a global perspective, thereby making it difficult for policymakers to understand the cost and benefits to the state and to the environment of possible mandatory GHG reduction policies in the state.

The report also fails to provide adequate discussion of the difficulties of integrating renewable energy into the grid and the impact of biofuels on food prices. Finally, the discussion in the report about benefits to the insurance industry from mandatory GHG reduction policies fails to include evidence from insurers whose view dissent from the arguments presented in the PCIA report. Pennsylvania policymakers need to receive more information and alternative views on several key areas addressed in the PCIA report as they deliberate climate change mitigation policies for the state.

⁸ <http://www.travelers.com/corporate-info/about/docs/TRVCDPResponseMay2007.pdf> ,
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