



# FACTS

## PENNSYLVANIA

A M E R I C A N S E C U R I T Y P R O J E C T

## Pay Now, Pay Later: Pennsylvania

Climate change severely threatens Pennsylvania's port, trade, wildlife, agricultural and related industries, which employ over 1 in 10 Pennsylvanians and contribute 7% of gross state product.<sup>1</sup>

Mean annual estimates project an increase of temperature (6.3°F) and precipitation (7%); Pennsylvania could see annual costs of \$1.1 billion from flooding and \$995 million from interruptions to shipping connectivity by 2100.<sup>2</sup>

Pennsylvania already ranks third among states in clean energy jobs,<sup>3</sup> and over 553,000 workers stand to benefit from wage increases or new jobs through clean energy investments.<sup>4</sup>

According to a new study, a failure to mitigate the effects of climate change could begin to cause serious gross domestic product and job losses within the next several decades. Between 2010 and 2050, it could cost Pennsylvania \$64.6 billion in GDP and over 459,000 jobs.\*

*\*GDP numbers are based on a 0% discount rate. Job losses are measured in labor years, or entire years of fulltime employment. Backus, George et al., "Assessing the Near-Term Risk of Climate Uncertainty: Interdependencies among the U.S. States," Sandia Report (Sandia National Laboratories, May 2010), 141. [https://cfwebprod.sandia.gov/cfdocs/CCIM/docs/Climate\\_Risk\\_Assessment.pdf](https://cfwebprod.sandia.gov/cfdocs/CCIM/docs/Climate_Risk_Assessment.pdf) (accessed March 23, 2011).*

Admittedly, the effects of climate change, a complex and intricate phenomenon, are difficult to predict with precision. Informed scientific and economic projections, as we have used in our research, however, allow us to see that Pennsylvania faces significant losses in industries crucial to its economy if no action is taken.

Moreover, data shows Pennsylvania is poised to benefit from the research, development, and distribution of renewable energy technologies. Already a net exporter of electricity, Pennsylvania produces over a third of its electricity using nuclear power and has substantial potential for renewable sources.<sup>5</sup> The state also has tremendous potential for carbon sequestration, a technology approaching commercial viability that would trap liquefied

carbon emissions deep under Pennsylvania's soil.<sup>6</sup> Should we fail to take action against climate change, Pennsylvanians have much to lose.

## Pay Later: The Cost of Inaction

Home to the world's first commercial oil well and still rich in anthracite coal,<sup>7</sup> Pennsylvania has played a key role in shaping the old energy economy. This wealth comes at a price, however. It has contributed, at least in part, to other economic losses across the state.<sup>8</sup> Pennsylvania produces more greenhouse gases than 101 nations combined, third only to Texas and California<sup>9</sup>—far larger, more populous states.

## Costs of Pennsylvania's Water Systems

Pennsylvania's unique location—as the only state abutting tidal water but not an ocean coast<sup>10</sup>—would seem to protect it from sea level rise, but this is not the case. **Rising ocean water will increasingly intrude into the Delaware River, threatening Philadelphia's drinking water.** While the city may not go thirsty, it costs as much as five times more to treat high salinity water than typically sourced freshwater. Anticipated heavier precipitation would worsen water quality through the runoff of contaminants, which—together with increased temperatures—could combine to increase harmful microbial life, further increasing treatment costs.<sup>11</sup>

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Flooding poses another major risk. Pennsylvania already has the fourth-highest total of losses from flooding

in the country. From 1954 to 2007, it suffered 85 major floods whose collective losses exceeded \$16 billion.<sup>12</sup> In June 2006 alone, three days of heavy rains forced the evacuation of hundreds of thousands of people and caused over \$100 million in damages. Climate models predict a 7% increase in annual precipitation, which could increase the economic losses from flooding by 19.6%.<sup>13</sup> **Over 50% of Pennsylvanians live in just nine counties;**<sup>14</sup> **in eight of those counties, a current 10-year flood would cost an estimated \$310 million each.**<sup>15</sup> In Allegheny County, the most populous, it would cost an estimated \$8.1 billion.<sup>16</sup> Unchecked trends suggest that such floods will likely occur more often than once per decade and inflict a greater amount of damage.<sup>17</sup>

Nearly four square miles of Philadelphia lie just 3.3 feet or less above high tide.<sup>18</sup> This does not include low-lying lands near Philadelphia International Airport that were reclaimed by generations of Pennsylvanians.<sup>19</sup> The waters may claim them back.

Even as the ocean rises and rains increase, the levels of Lake Erie and Pennsylvania's 80,000 miles of waterways are expected to drop, due largely to evaporation.<sup>20</sup> Increased dredging of the Great Lakes-St. Lawrence shipping routes may be required to maintain Pennsylvania's bustling commercial port trade, at an estimated annual cost of \$85-142 million.<sup>21</sup> Should system connectivity be impaired by 25%, losses would jump to nearly \$1 billion annually.<sup>22</sup>

The transportation and warehousing sectors account for nearly \$18 billion annually, and employ some 260,000 Pennsylvanians.<sup>23</sup>

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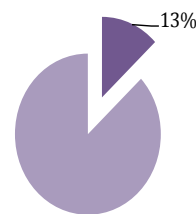
### A Sportsman's Nightmare

Pennsylvania is a sportsman's delight, with world-famous fishing and hardwood forests blanketing 58% of the state.<sup>24</sup> **Climate change directly threatens the \$5.5 billion in annual income and 56,000 jobs supported by hunting, fishing, and wildlife viewing.**<sup>25</sup> As spring rains arrive earlier and winters shorten—and both receive an increase in heavier precipitation—many of Pennsylvania's iconic wildlife species will suffer. Higher snowfall, a possibility in the mid-Atlantic, could likely thin the ranks of white-tailed deer,<sup>26</sup> while shorter winters may well eliminate snowshoe hares from the state, the current southern limit for the species.<sup>27</sup> Disappearing wetlands will substantially reduce the number of waterfowl, and warmer temperatures will make winter migration through Pennsylvania—a prime opportunity for duck hunting—unnecessary for mallards and other species. Heavier spring rains and hotter, drier summers could devastate trout and smallmouth bass habitat.<sup>28</sup>

### An Agrarian Heritage under Stress

Pennsylvania has a strong farming tradition and ranks among the top five states for production of milk, eggs, mushrooms, apples, and peaches.<sup>29</sup> Led by the dairy industry, agriculture and related economic activities generate over 20,000 jobs and \$21 billion annually.<sup>30</sup> The expected increase in temperature by 2100 would **reduce cows' milk productivity substantially, costing Pennsylvania \$480 million and affecting 5,300 jobs** in the dairy industry and related work.<sup>31</sup> Months-long droughts could occur every year or two<sup>32</sup> and crop yields could fall nearly 10%, resulting in almost \$150 million in direct economic losses.<sup>33</sup>

#### Pennsylvanian Labor Force Projected to be Directly Affected



Source: Bureau of Economic Analysis<sup>34</sup>

### Pay Now: The Benefits of Taking Action

Fortunately for Pennsylvania, the Keystone State is poised to benefit economically from addressing climate change. **Pennsylvania ranks third nationwide in clean energy jobs,**<sup>35</sup> **and more than 550,000 workers stand to gain jobs or higher wages thanks to clean energy investments.**<sup>36</sup> Although Pennsylvania still produces roughly half of its electricity from fossil fuels—understandable for a state that has helped fuel the nation

with oil and coal—it also generates a third of its electricity from nuclear power, with a total capacity second only to Illinois. It has begun tapping its great hydropower potential, and is already among the biggest users of landfill gas and municipal solid waste as biofuels.<sup>37</sup>

Pennsylvania's plans for the future are even more ambitious. It has implemented California's tailpipe emissions standards, which would reduce current tailpipe emissions (a quarter of all carbon emissions statewide) to fall roughly 30% below 2002 levels by 2016.<sup>38</sup> The governor has called for producing and using one billion gallons of biofuels annually by 2017,<sup>39</sup> and the state has committed to generating 18.5% of its electricity from alternative energy sources by 2020.<sup>40</sup>

In addition, two features of Pennsylvania's landscape hold the promise of facilitating its evolution to a clean energy economy. First are its forests. Increases in temperature, precipitation, and atmospheric carbon—as well as fewer deer—will likely increase the lumber yield of Pennsylvania's forests. While this increase might only be temporary, it could generate over 5,000 jobs and \$850 million.<sup>41</sup> The second feature is Pennsylvania's geology, which is rich in formations that can be used to sequester carbon.<sup>42</sup>

Deep saline formations are the most promising, with the estimated potential to trap all of Pennsylvania's CO<sub>2</sub> emissions for the next 300 years.<sup>43</sup> Once commercially viable, the technology will—almost ironically—create jobs putting carbon into the ground, just as its coal and oil industries have done taking it out.



		Major Electric Power Plants (>=100 MW)	Renewable Energy Potential
■	Coal Mine, Surface	▲ Coal	■ Biomass (>= 50 tons/sq km/yr)
■	Coal Mine, Underground	○ Geothermal	■ Geothermal (>= 80 milliwatts/m <sup>2</sup> )
★	Natural Gas Hub	◇ Hydroelectric	■ Solar (>= 6.0 kWh/m <sup>2</sup> /day)
■	Petroleum Refinery	▽ Natural Gas	■ Wind (>= 3 Power Class)
■	Oil Import Site	● Nuclear	
■	Oil Seaport	● Petroleum	
—	Electricity Transmission Line (>= 345 kV)	☀ Solar	
—	Natural Gas Flow (1 mile band width = 100 million cubic feet/day)	✕ Wind	
■	Oil and Gas Active Leases	🌳 Wood	
		● Other Renewable	

## Conclusion

Pennsylvania must consider action on climate change not just in terms of cost, but also in terms of opportunities. If we give Pennsylvania's population, businesses, and investors clear and consistent signals by properly offering initiatives and cultivating demand, investment and innovation in renewable technologies will follow.

**Pennsylvanians will have to pay for the effects of climate change.** The only remaining question is whether they will pay now, or pay later and run the risk of paying significantly more.

(Endnotes)

1 Daria Karentinkov et al., *Economic Impacts of Climate Change on Pennsylvania: A Review and Assessment Conducted by the Center for Integrative Environmental Research*, Center for Integrative Environmental Research, University of Maryland, September 2008, 8. <http://www.cier.umd.edu/climateadaptation/Pennsylvania%20Economic%20Impacts%20of%20Climate%20Change%20Full%20Report.pdf> (accessed October 19, 2010); Employment level and gross state product based on 2008 data. Bureau of Economic Analysis, *SA25N Total full-time and part-time employment by NAICS industry 1/ -- Pennsylvania*, September 20, 2010. <http://www.bea.gov/regional/spi/default.cfm?selTable=SA25N&selSeries=NAICS> (accessed October 20, 2010); Bureau of Economic Analysis, *Gross Domestic Product by State: Pennsylvania*, June 2, 2009. <http://www.bea.gov/regional/gsp/action.cfm?series=NAICS&querybutton=Download%20CSV&selTable=200&selFips=42000&selLineCode=ALL&selyears=2008> (accessed November 17, 2010).

2 Karentinkov et al., 9-10, 14. \$1.1 billion figure calculated by totaling estimated damages of 10-year floods in the nine most populous counties, dividing by 10 (to obtain annualized figure), then adding 19.6%, the increase in losses projected from a 7% increase in precipitation (2.8% increase in economic losses for every 1% increase in precipitation).

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- 4 Natural Resources Defense Council, *Job Opportunities in a Green Economy: Pennsylvania Can Gain from Fighting Global Warming*, May 2008, 1. <http://www.nrdc.org/globalWarming/jobs/pennsylvania.pdf> (accessed July 14, 2010).
- 5 U.S. Energy Information Administration, *Pennsylvania Quick Facts*, 2010. [http://www.eia.doe.gov/state/state\\_energy\\_profiles.cfm?sid=PA](http://www.eia.doe.gov/state/state_energy_profiles.cfm?sid=PA) (accessed July 14, 2010).
- 6 Union of Concerned Scientists, *Pennsylvania: Confronting Climate Change in the U.S. Northeast*, 2007, 4. [http://www.climatechoices.org/assets/documents/climatechoices/pennsylvania\\_necia.pdf](http://www.climatechoices.org/assets/documents/climatechoices/pennsylvania_necia.pdf) (accessed July 14, 2010) summarizing results of P.C. Frumhoff et al., *Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions: Synthesis report of the Northeast Climate Impacts Assessment*, Union of Concerned Scientists, 2007; Pennsylvania Department of Conservation and Natural Resources, *Carbon Sequestration*. <http://www.dcnr.state.pa.us/info/carbon/index.aspx> (accessed July 14, 2010).
- 7 U.S. Energy Information Administration.
- 8 Union of Concerned Scientists, *Pennsylvania: Confronting Climate Change in the U.S. Northeast* (\$44 million dairy loss from heat stress), 3; Karentinkov et al., 9, 10. The flood damages calculation assumes that a 7% increase in precipitation raises the current figures by 19.6%, in line with data showing 2.8% in extra economic damage for every 1% rise in precipitation. The dredging figure is the mean of high and low estimates. While coal and oil wealth are not entirely to blame, they are certainly not blameless.
- 9 PennFuture, *Special Campaigns: Global Warming*. <http://www.pennfuture.org/content.aspx?MenuID=17&SectionID=119> (accessed July 14, 2010).
- 10 James G. Titus et al., *Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region*, U.S. Climate Change Science Program and Subcommittee on Global Change Research, U.S. Environmental Protection Agency, January 2009, 210. <http://www.climate-science.gov/Library/sap/sap4-1/final-report/sap4-1-final-report-all.pdf> (accessed July 14, 2010).
- 11 Karentinkov et al., 11.
- 12 Ibid., 9.
- 13 Ibid., 8-9.
- 14 Ibid., 9.
- 15 National Conference of State Legislatures and Center for Integrative Environmental Research, University of Maryland, "Pennsylvania: Assessing the Costs of Climate Change" in *State Economic and Environmental Costs of Climate Change*, 1. <http://www.ncsl.org/print/enviro/ClimateChangePA.pdf> (accessed July 14, 2010).
- 16 Ibid.
- 17 Karentinkov et al., 9.
- 18 U.S. Environmental Protection Agency, *The Impact of Climate Change on the Mid-Atlantic Region*, April 2010. <http://www.epa.gov/reg3arid/globclimate/ccimpact.html> (accessed July 14, 2010). Converted from kilometers and meters to miles and feet; 10 square km = 3.86 square mi, 1 m = 3.28 ft.
- 19 Ibid.
- 20 Karentinkov et al., 10; National Wildlife Federation, *Target Global Warming in Pennsylvania: Hunters and Anglers Can Change the Forecast*, 2008, 1. <http://www.targetglobalwarming.org/files/PAfactsheet.pdf> (accessed October 20, 2010).
- 21 Karentinkov et al., 10.
- 22 Ibid.
- 23 Based on 2008 data. Bureau of Economic Analysis, *SA25N Total full-time and part-time employment by NAICS industry 1/ -- Pennsylvania*; Bureau of Economic Analysis, *Gross Domestic Product by State: Pennsylvania*.
- 24 Karentinkov et al., 11; National Wildlife Federation, 1.
- 25 National Wildlife Federation, 2.
- 26 Ibid., 1, 3-4; Karentinkov et al., 13.



- 27 National Wildlife Federation, 2.
- 28 Ibid., 1-2.
- 29 PennFuture, *Special Campaigns: Impacts on Economics*. <http://www.pennfuture.org/content.aspx?MenuID=17&SubSectionID=194&SectionID=119> (accessed October 19, 2010).
- 30 Karentinkov et al., 13.
- 31 Ibid., 13.
- 32 Union of Concerned Scientists, *Pennsylvania: Confronting Climate Change in the U.S. Northeast*, 2.
- 33 Karentinkov et al., 14.
- 34 Based on the 2008 employed labor force and includes the transportation and warehousing sectors, agriculture, hunting, fishing, trapping, hospitality and leisure industries. Bureau of Economic Analysis, *SA25N Total full-time and part-time employment by NAICS industry 1/ -- Pennsylvania*.
- 35 Pew Charitable Trusts, 1.
- 36 Natural Resources Defense Council, 1.
- 37 U.S. Energy Information Administration.
- 38 Union of Concerned Scientists, *Pennsylvania: Confronting Climate Change in the U.S. Northeast*, 5.
- 39 Ibid.
- 40 U.S. Energy Information Administration.
- 41 Karentinkov et al., 11-12.
- 42 Union of Concerned Scientists, *Pennsylvania: Confronting Climate Change in the U.S. Northeast*, 4-6; Pennsylvania Department of Conservation and Natural Resources.
- 43 Ibid.