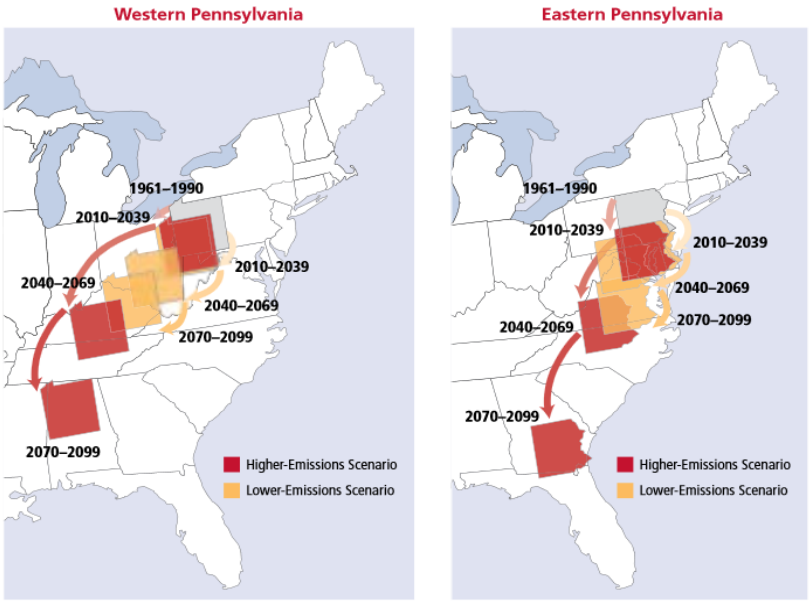
On The Need of the Commonwealth of Pennsylvania to Take Certain Actions to Reduce The Threat of Climate Change

Report to the Pennsylvania Environmental Resource Consortium.

April 24, 2013

FIGURE 3: Migrating Climates



(UCS, 2008)

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I. INTRODUCTION

This report has been prepared by Donald A. Brown, Scholar In Residence, Sustainability Ethics and Law, at the Widener University School of Law for the Pennsylvania Environmental Resource Consortium (PERC) in cooperation with Penn Future, and Interfaith Power and Light. It focuses on the need for the Commonwealth of Pennsylvania to make a legally binding commitment to reduce Pennsylvania greenhouse gases (GHG) to Pennsylvania's fair share of safe global emissions, to develop a climate change adaptation plan, and to recognize leadership on climate change by colleges and universities, religious and educational institutions, local governments, businesses, and organizations in Pennsylvania.

To understand the need for these actions, it is necessary to understand the urgency and scale of the climate change crisis, potential adverse climate impacts on Pennsylvania and other parts of the world, a 2008 Pennsylvania law requiring the Commonwealth of Pennsylvania to develop a climate action plan, Pennsylvania's contributions to human-induced global climate change, and Pennsylvania's existing programs on limiting GHG emissions compared to other State's climate strategies.

This report calls for the Pennsylvania government to build upon, update, and expand upon a Pennsylvania climate change action plan prepared in 2009 by the Pennsylvania Department of Environmental Protection (DEP) under Pennsylvania law and adopt a legally enforceable GHG emissions target.

In accordance with Act 70 of 2008, known as the Pennsylvania Climate Change Act, Pennsylvania produced a climate action plan in December 2009 that made 52 recommendations on how Pennsylvania could reduce its greenhouse gas emissions from 2000 levels by 30 percent by 2020 while increasing economic growth in Pennsylvania and jobs. (PaFCCAP, 2009) These recommendations were projected to create 65,000 new full-time jobs and add more than $6 billion to the Commonwealth's gross state product in 2020. (PaFCCAP, 2009)

The vast majority of the recommendations made in the 2009 Climate Action Plan have not been acted on by the current administration. While the 2008 law also required that the DEP update the plan in 2012, no update has yet been issued.

In addition, this report will explain the need for Pennsylvania to adopt an adaptation plan to protect Pennsylvanians and Pennsylvania's natural resources from likely climate change impacts. Despite relative inaction by the state government of Pennsylvania, this report also acknowledges leadership on climate change by many of Pennsylvania's colleges and universities, local governments, and religious institutions.

II. WHY PENNSYLVANIA NEEDS TO ADOPT A LEGALLY BINDING GHG EMISSIONS REDUCTION TARGET CONSISTENT WITH PENNSYLVANIA'S FAIR SHARE OF SAFE GLOBAL EMISSIONS.

A. THE SCALE OF THE PROBLEM AND THE NEED FOR GOVERNMENTS AT ALL SCALES TO BE PART OF THE SOLUTION

To understand the need for Pennsylvania to adopt a climate change strategy that will achieve a legally binding target, it is necessary to understand the scale and urgency of the problem facing the world.

In the 2009 Climate Change Action Plan referenced above, DEP found:

> The world's climate is changing and Pennsylvania, which is responsible for 1 percent of the planet's man-made greenhouse gas emissions, is positioned to become a leader in the fight against this global threat. The Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) concluded unequivocally that as aresult of the substantial increase in atmospheric concentrations of carbon dioxide (CO2) and other greenhouse gases (GHG) caused by human activity, the Earth's climate system is warming. The United Nations Environment Programme just released its *Climate Change Science Compendium 2009*, an analysis of the latest IPCC science which provides a further wake-up call for the need to take immediate action. The report identifies impacts that are already underway and will be realized as a result of current atmospheric GHG concentrations including the following:
>
> - Ocean acidification that will damage or destroy coral reefs and many species of marine life that live in or around or otherwise depend upon these ecosystems
> - Sea Level Rise over the next millennium, with greater than 3 feet likely in the next century, but with 5 or 10 times that in the following centuries
> - Tropical and temperate mountain glacier loss that will disrupt irrigation systems, drinking water supplies and hydroelectric installations, as well as alter the socio-economic and cultural lives of perhaps 20-25 per cent of the human population.
> - Shifts in the hydrologic cycle that will result in the disappearance of regional climates with associated ecosystem destruction and species extinction as drier regions shift towards the poles
> - A global temperature increase of 2.4^0C (4.3^0F) above pre-industrial temperatures, even if GHG concentrations had been held constant at 2005 levels

The scientific community is overwhelmingly in agreement that anthropogenic climate change occurring and that mitigation and adaptation actions need to be implemented. This is not opinion and is further supported in the October 21, 2009 letter to the United States Senate signed by the American Association for the Advancement of Science, American Chemical Society, American Geophysical Union, American Meteorological Society, the

American Statistical Association and numerous other scientific organizations. The letter is located at www.agu.org/sci_pol/pdf/Climate.Letter.pdf. A portion of the letter follows:

> "Observations throughout the world make it clear that climate change is occurring, and rigorous scientific research demonstrates that the greenhouse gases emitted by human activities are the primary driver. These conclusions are based on multiple independent lines of evidence, and contrary assertions are inconsistent with an objective assessment of the vast body of peer-reviewed science. Moreover, there is strong evidence that ongoing climate change will have broad impacts on society, including the global economy, and on the environment. For the United States, climate change impacts include sea level rise for coastal states, greater threats of extreme weather events, and increased risk of regional water scarcity, urban heat waves, western wildfires, and the disturbance of biological systems throughout the country. The severity of climate change impacts is expected to increase substantially in the coming decades. If we are to avoid the most severe impacts of climate change, emissions of greenhouse gases must be dramatically reduced. In addition, adaptation will be necessary to address those impacts that are already unavoidable. Adaptation efforts include improved infrastructure design, more sustainable management of water and other natural resources, modified agricultural practices, and improved emergency responses to storms, floods, fires and heat waves."

Our own National Academy of Sciences and the academies of science from numerous other countries share this common understanding. In fact, the department is not aware of any credible scientific body substantiating a different view.

(PaFCCAP, 2009: ExS 1, 2)

The 2009 DEP Action Plan correctly concluded that there is very strong scientific support for the conclusion that human activities are greatly threatening human health and ecological systems on which life depends. Since DEP completed the action plan in 2009, additional scientific evidence has emerged that both confirms and strengthens the conclusion in the 2009 DEP Action Plan that there is a strong scientific basis supporting the urgent need to take action to reduce the threat of climate change.

In addition, the international community agreed in climate change negotiations under the United Nations Framework Convention on Climate Change in Copenhagen in 2009 that the international community should limit warming to 2°C to prevent dangerous climate change In fact, countries agreed on to further assess whether the 2°C warming limit needs to be replaced by a more stringent 1.5°C warming limit to avoid dangerous climate change impacts. This conclusion was confirmed in climate negotiations in Cancun in 2010, in Durban in 2011, and in Doha in 2012.

Recent reports also provide scientific support for the conclusion that there is an urgent need to dramatically reduce GHG emissions. For example, a November 2012 report by the Potsdam Institute for Climate Impact Research commissioned by the World Bank further concluded as follows:

While the global community has committed itself to holding warming below 2°C to prevent "dangerous" climate change, the sum total of current policies—in place and pledged—will very likely lead to warming far in excess of this level. Indeed, present emission trends put the world plausibly on a path toward 4°C warming within this century.

Levels greater than 4°C warming could be possible within this century should climate sensitivity be higher, or the carbon cycle and other climate system feedbacks more positive, than anticipated. Current scientific evidence suggests that even with the current commitments and pledges fully implemented, there is roughly a 20 percent likelihood of exceeding 4°C by 2100, and a10 percent chance of 4°C being exceeded as early as the 2070s. Warming would not stop there. Because of the slow response of the climate system, the greenhouse gas emissions and concentrations that would lead to warming of 4°C by 2100 would actually commit the world to much higher warming, exceeding 6°C or more, in the long term, with several meters of sea-level rise ultimately associated with this warming.

Despite the global community's best intentions to keep global warming below a 2°C increase above pre-industrial climate, higher levels of warming are increasingly likely. Scientists agree that countries' current United Nations Framework Convention on Climate Change emission pledges and commitments would most likely result in 3.5°C to 4°C warming. And the longer those pledges remain unmet, the more likely a 4°C world becomes.

The November 2012 Postdam Institute/World Bank report also examined climate change impacts that are likely if the world experiences the 4°C warming These impacts include but are not limited to the following:

- A world in which warming reaches 4°C above pre-industrial levels would be one of unprecedented heat waves, severe drought, and major floods in many regions, with serious impacts on human systems, ecosystems, and associated services.

- Projections for a 4°C world show a dramatic increase in the intensity and frequency of high-temperature extremes. Recent extreme heat waves such as in Russia in 2010 are likely to become the new normal summer in a 4°C world. Tropical South America, central Africa, and all tropical islands in the Pacific are likely to regularly experience heat waves of unprecedented magnitude and duration. In this new high-temperature climate regime, the coolest months are likely to be substantially warmer than the warmest months at the end of the 20th century. In regions such as the Mediterranean, North Africa, the Middle East, and the Tibetan plateau, almost all summer months are likely to be warmer than the most extreme heat waves presently experienced. For example, the warmest July in the Mediterranean region could be 9°C warmer than today's warmest July.

- Extreme heat waves in recent years have had severe impacts, causing heat-related deaths, forest fires, and harvest losses. The impacts of the extreme heat waves projected for a 4°C world have not been evaluated, but they could be expected to vastly exceed

the consequences experienced to date and potentially exceed the adaptive capacities of many societies and natural systems.

- 4°C will likely lead to a sea-level rise of 0.5 to 1 meter, and possibly more, by 2100, with several meters more to be realized in the coming centuries.

- A warming of 4°C or more by 2100 would correspond to a CO_2 concentration above 800 ppm and an increase of about 150 percent in acidity of the ocean. The observed and projected rates of change in ocean acidity over the next century appear to be unparalleled in Earth's history. Evidence is already emerging of the adverse consequences of acidification for marine organisms and ecosystems, combined with the effects of warming, overfishing, and habitat destruction.

- 4°C will likely also cause adverse impacts on human heath, water availability, food, biodiversity, and ecological systems.

- The projected impacts on water availability, ecosystems, agriculture, and human health could lead to large-scale displacement of populations and have adverse consequences for human security and economic and trade systems.

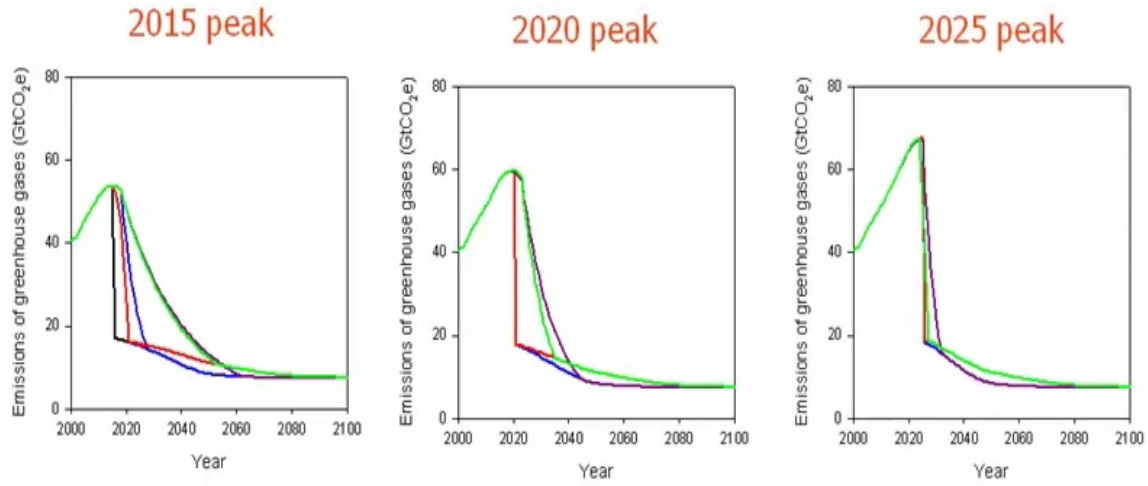
(World Bank, 2012: Executive Summary)

Other scientific studies since the 2009 Pennsylvania Action Plan have also strengthened the scientific basis for concluding that human-induced climate change is an immense threat to people around the world and ecological systems on which life depends. These include a report by the US Academy of Sciences published in 2011, *America's Climate Choices*. (National Resource Council, 2011)

To fully understand why Pennsylvania must adopt a greenhouse gas emissions target consistent with Pennsylvania's fair share of safe global emissions it is further necessary to understand the magnitude of the challenge of limiting warming to 2°C or perhaps the 1.5°C.

Limiting warming to 2°C or less will, with a high degree of probability, will require reductions in global GHG emissions to a level below current emissions by mid-century by as much as 80 percent. It is not possible to precisely identify the rate of emissions reductions necessary to limit warming to a specific goal such as 2°C or 1.5°C without making assumptions about when global emissions peak, what rate of emissions increase are experienced between any moment in time and the time in which global emissions peak, and an atmospheric GHG concentration goal in terms of carbon dioxide equivalent (CO_2e). Still the challenge facing the world to limit future warming to tolerable levels is daunting. Furthermore, because there is scientific uncertainty about the amount of warming that will be experienced at different GHG atmospheric concentration levels (an issue known as "climate sensitivity"), any atmospheric GHG stabilization goal will create different levels of confidence of limiting warming to specific temperature limits.

Yet, under any reasonable assumption about climate sensitivity, stabilizing atmospheric concentrations at levels that will avoid dangerous climate change requires immediate action. The entire world will need to peak its GHG emissions as soon as possible followed by emissions reductions at very ambitious rates over the next 30 years. The longer it takes for world GHG emissions to peak and the higher GHG emissions levels are when peaking is achieved, the steeper global emissions reductions need to be to prevent dangerous levels of warming. The following chart shows the emissions reduction pathways that are needed in this century to give the world any reasonable hope of limiting warming to 2°C, assuming global emissions continue to rise at current levels during the next few years. Like any such description of needed emissions reductions pathways, this analysis makes some assumptions about greenhouse gas emissions between now and 2020 and a GHG atmospheric stabilization level goal. In this graph, different assumptions about climate sensitivity are reflected in the different colored curves in the graphs. In any case, the later the peaking of total global emissions, the steeper the reduction pathways that are needed.



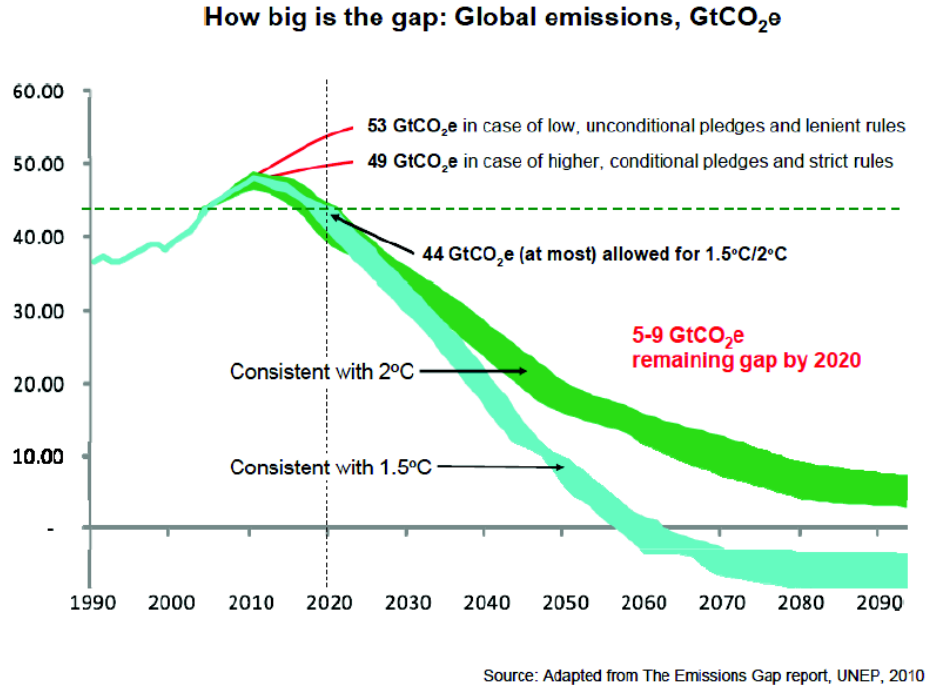
(Anderson, K. 2012)

According to a recent report by the United Nations Environment Program, atmospheric emissions of carbon dioxide equivalent (carbon dioxide and other greenhouse gases) in 2020 must be no greater than 44 gigatons (with a range of 41-47 gigatons) if we are to have any reasonable chance of limiting warming to 2°C. (One gigaton equals one billion tons.) Afterwards, global emissions must steeply decline (a median of 2.5 percent per year, with a range of 2.0 percent to 3.0 percent per year) to 2050. (UNEP, 2012) There are some uncertainties in these numbers entailed by the need to make assumptions about future GHG emissions rates, when global emissions peaking takes place, and climate sensitivity as we have seen above.

Yet, current global GHG emissions, based on 2010 data, are estimated at 50.1 gigatons of carbon dioxide equivalent, 14% higher than the median estimate (44 $GtCO_2e$) of the emission level in 2020 needed to have any hope of limiting warming to the 2°C target. In addition, global emissions are currently increasing at 2 to 3 percent per year. Thus, UNEP

concluded that the world is running out time to prevent dangerous climate change. (UNEP, 2012).

The challenge is even more daunting if it is determined that the world should try and limit warming to 1.5°C, rather than 2°C. The following chart demonstrates the enormity of the challenge after 2020 to limit warming to 2 or 1.5°C, making assumptions about when global peaking occurs and GHG emissions levels when peaking occurs. The thickness of the two lines represents differences in assumptions about climate sensitivity. The line representing the 1.5°C pathway demonstrates that after 2050 the emissions reduction rate must become negative, which means that the world must be taking more carbon out of the atmosphere than it is putting in. (This chart is an attempt to simplify the more complex data presented in the 2012 UNEP report.)



(CAN, 2012)

Climate change, perhaps more than any other environmental problem facing the world, raises questions of basic fairness because CO_2 is well mixed in the atmosphere. In other words, all CO_2 emissions are contributing to elevated CO_2 atmospheric concentrations without regard to where in the world the emissions come from. Because the level of atmospheric concentrations of GHG will determine the amount of warming that the world will experience and the amount of warming will differentially affect millions of the world's poorest people most harshly, all emitters of GHG emissions, without regard to where they

are located in the world, are threatening people around the world. Thus, a state like Pennsylvania cannot avoid questions of basic justice when establishing a GHG missions target because any GHG emissions target is implicitly a position on Pennsylvania's fair share of global emissions.

And so, Pennsylvania should adopt an enforceable greenhouse gas target consistent with Pennsylvania's fair share of safe global emissions because Pennsylvania GHG emissions are contributing to global emissions and there is an urgent need to dramatically reduce global GHG emissions to prevent dangerous warming. Because GHG emissions from Pennsylvania are contributing both to enormous threats to the world and will likely have adverse impacts on human health and ecological systems in Pennsylvania (a matter discussed below), the state should reduce its emissions to Pennsylvania's fair share of safe global emissions.

Describing Pennsylvania's exact fair share of safe global emissions is beyond the scope of this report and a matter about which there can be reasonable disagreement. Nonetheless, a strong case can be made that Pennsylvania should limit its emissions to achieve greater percentage of GHG reductions than required of the entire world to avoid dangerous climate change. Like all US states and most of the developed world nations, GHG emissions levels from Pennsylvania far exceed most of the world in per capita GHG emissions. In other words, if it is determined that the entire world must reduce its emissions by 80 percent below 1990 levels to prevent dangerous climate change, high-emitting nations or governments around the world, including US states, will need to reduce their emissions to even greater levels on the basis of equity and fairness. To require each nation or government to reduce emissions by the same percentage amount would freeze into place unjust emission levels for high-emitting governments. For this reason, almost all the nations of the world, including the United States in 1992 when it ratified the United Nations Framework Convention on Climate Change, agreed that each nation must reduce its emissions on the basis of "equity" to prevent dangerous climate change. (UNFCCC, 1992: Art 3, Para 1) If all nations need only reduce their emissions by equal percentage amounts, then a high emitting nation like the United States that emits GHG at rate of 17.3 tons per capita would be allowed to emit at a level 10 times more per capita than a country like Vietnam that emits 1.7 tons of GHG per capita. (World Bank, 2012b) As a result, all nations have agreed that national targets must be based upon fairness or equity although reasonable differences exist about what fairness requires.

An issue brief for New York State recently recognized the need of New York to set GHG emission targets on the basis of equity:

> Determining how much individual states or nations should reduce emissions through mid-century requires consideration of allocation equity and reduction effectiveness. The UNFCCC approach to apportioning GHG emission reduction requirements between developed and developing nations considers a broad spectrum of parameters, including population, gross domestic product (GDP), GDP growth, and global emission pathways that lead to climate stabilization. Applying these parameters, the UNFCCC concludes that, to reach the 450 ppm CO_2e stabilization target, developed countries need to reduce GHG emissions by 80 to 95 percent from 1990 levels by 2050. (New York State, 2009)

And so New York recognizes that its emissions reduction target must be based upon fairness. However, because reasonable differences exist about what equity requires of nations and states in setting emissions reductions targets, this report makes no specific final recommendations on what an enforceable GHG cap should be except to claim it should be. At the very minimum, however, it should be at least as stringent as emissions reductions levels needed by the entire world to provide reasonable confidence that dangerous climate change will be avoided. It should also be based on recognition that fairness likely requires Pennsylvania to be more aggressive in reducing its GHG emissions than most of the rest of the world. As the above quoted New York report recognizes, a state like Pennsylvania might set a target to reduce GHG emissions by 80 to 95 percent from 1990 levels by 2050.

Furthermore, any action plan and interim emissions reductions target should put Pennsylvania on an emissions reductions pathway consistent with the need to limit global emissions to levels that will stabilize atmospheric greenhouse concentrations at levels that provide reasonable confidence of preventing dangerous climate change. This requirement entails the need of any Pennsylvania action plan to consider not only what action steps are necessary to achieve a target at a specific year such as 2020, the target year recognized in the 2009 action plan, but also to consider actions that will put Pennsylvania on a reduction pathway capable of reducing GHG emissions from Pennsylvania necessary to prevent dangerous climate change in the years ahead. More specifically this means that Pennsylvania's action plan should consider how it will achieve emissions reductions to achieve any long-term goals such the potential goal of reducing GHG emissions by 80 to 95 percent below 1990 levels by 2050.

Pennsylvania also needs to adopt an enforceable GHG target because certain activities that affect GHG emissions are regulated at the state level and not at the federal level. Currently these include, among others, enforceable renewable energy targets for electricity providers, certain land use and transportation decisions, aspects of energy efficiency and building regulations, waste regulation, aspects of fossil fuel development and production, certain agricultural activities, and management of Pennsylvania's forest resources.

Pennsylvania should also produce a climate action strategy because it is likely to create economic opportunities and create jobs, conclusions reached in the 2009 Climate Action Plan. The citizens of Pennsylvania are in the best position to evaluate how to achieve benefits from climate action planning.

B. Pennsylvania's Contribution to Climate Change

a. Percentage of Total Global Emissions

According to the DEP 2009 action plan, Pennsylvania contributes a full 1 percent of the entire world's greenhouse gas emissions and 4 percent of the United States contribution. (PaFCCAP, 2009) The Pennsylvania population of approximately 12,742,886 is approximately 0.18 percent of global population of slightly over 7 billion people.

According to US Environmental Protection Agency (EPA) data from 2010, Pennsylvania ranks third among US states in CO_2 emissions.

Table

Rank	Jurisdiction	Annual CO_2 emissions (in thousands of metric tons)	Percentage of total emissions	Population (known population in 2010)	Percentage of total population	CO_2 emissions per capita (in metric tons)
-	[States Total]	6,821,821	100.00%	308,745,538	100.00%	22.10
01	Texas	653,245	11.65%	25,145,561	8.14%	25.98
02	California	370,890	6.61%	37,253,956	12.07%	9.96
03	Pennsylvania	253,699	4.52%	12,702,379	4.11%	19.97
04	Ohio	247,975	4.42%	11,536,504	3.74%	21.49
05	Florida	244,580	4.36%	18,801,310	6.09%	13.01
06	Illinois	230,701	4.11%	12,830,632	4.16%	17.98
07	Indiana	215,804	3.85%	6,483,802	2.10%	33.28
08	Louisiana	210,982	3.76%	4,533,372	1.47%	46.54
09	New York	173,825	3.10%	19,378,102	6.28%	8.97
10	Georgia	172,989	3.08%	9,687,653	3.14%	17.86

(US EPA, 2010, for additional data on state ranking on climate change also see, WRI, CAT Website, 2013)

Because Pennsylvania has less than 0.2 percent of the world population but approximately 1 per cent of global greenhouse gas emissions, and high per capita emissions compared to the rest of the world, a strong case can be made that any Pennsylvania GHG reduction target should be considerably more ambitious than emissions reduction levels required of most other countries prevent dangerous climate change.

b. RECENT GHG EMISSIONS TRENDS IN LIGHT OF NATURAL GAS HYDRAULIC FRACTURING.

The 2009 action plan's projected future GHG emissions need to be revisited in light of the impact of hydraulic fracturing of Marcellus Shale for natural gas. The 2009 plan found:

> If no action other than the recent state and federal government actions is taken to reduce GHG emissions, we project that Pennsylvania's emissions will increase slightly to 295 MMtCO2e (Million Metric Tons) by 2020, or about 1.8% above 2000 levels. This equates to a 0.1% annual rate of growth from

> 2000 to 2020. The most significant contributor to Pennsylvania's emissions growth is the electricity generation sector, two-thirds of which are the result of activities in residential and commercial buildings (primarily heating and cooling). Emissions from waste management and agriculture are modest contributors to future emissions growth, while emissions from all other sectors are expected to decrease or remain relatively constant from 2000 to 2020.

Given that a new action plan needs to be developed under the 2008 Pennsylvania Climate Law, and that any new plan will need to project Pennsylvania GHG emissions in the years ahead, one issue is particularly worthy of careful attention. That issue is how to project likely future GHG emissions given that many electric generation facilities in Pennsylvania are shifting from coal to natural gas combustion. Large amounts of natural gas are becoming available in Pennsylvania in response to the wide deployment of hydraulic fracturing technology, a fact which makes understanding the strengths and weaknesses of natural gas as a GHG crucial to Pennsylvania's climate planning.

Many claims have been made recently that Pennsylvania's GHG emissions will continue to fall dramatically because natural gas from hydraulic fracturing technologies are rapidly replacing coal in electricity sector generation. For instance, Reuters recently reported that:

> Carbon dioxide (CO_2) emissions from energy use in the first quarter of this year fell to their lowest level in the U.S. in 20 years, as demand shifted to natural gas-fired generation from coal-fired electricity due to record low gas prices, the energy department said.
>
> (Reuters, 2012)

It is often assumed that a switch to natural gas will significantly reduce GHG emissions from the electricity sector because natural gas emits almost 50 per cent less CO_2 per unit of energy produced than coal combustion. For this reason, natural gas is often referred to as a "bridge fuel." (See, e.g, Kirkland, 2010; Levi, 2013)

Switching from coal combustion to natural gas combustion in the production of electricity could be beneficial in reducing GHG emissions from Pennsylvania in the near- to middle-term. Yet several controversies need to be closely investigated before conclusions about the beneficial effects of natural gas in reducing GHG can be made. These controversies are relevant both to GHG emissions inventories in Pennsylvania and strategies to achieve GHG emissions reductions from Pennsylvania. These controversies include the following:

- **Unresolved Methane Leakage Rates**. Natural gas is mostly methane, a potent GHG. Natural gas production from hydraulic fracturing is known to leak methane. It is usually assumed that replacing coal with gas would reduce greenhouse gas emissions as long as the leakage of methane into the

air from gas production does not exceed 3.6 percent. (Reuters, 2012) Yet significant controversies remain about actual methane leakage rates. Recently, there has been a flurry of conflicting papers about methane leakage rates from natural gas production. For instance, US EPA concluded that methane leakage was 2.4 percent of total natural-gas production in 2009. Other recent studies have found leakage rates of 4 percent and 9 percent from hydraulic fracturing operations in Colorado and Utah. (Tollefson, 2013) As a result, no rational Pennsylvania climate change action plan or GHG inventory should ignore controversies about methane leakage from hydrofracturing operations. Until methane leakage rates are scientifically determined for Pennsylvania, any GHG inventory or projection of future emissions should identify the range of leakage rates that appear in the extant literature. In addition to leakage rates from natural gas production facilities, methane leakage is also known to occur in natural gas transmission lines as well as from vehicles powered by natural gas. Therefore, actual methane leakage rates into the atmosphere from natural gas need to be based on the sum of leakage from all of these sources.

Because methane leakage rate controversies are not yet resolved, any climate change action plan must be transparent about the limitations of predicting GHG emissions from natural gas consumption and fully identify all uncertainties about leakage rates.

- **The Need To Move Aggressively To Non-Fossil Renewable Energy Even If Natural Gas Is A Short-Term Bridge Fuel.** Methane leakage rates may be small enough to provide climate change emissions reduction benefits when coal combustion of electricity production is replaced by natural gas combustion. As we have seen this is an ongoing controversy. Still, given the enormity of global reductions of GHG emissions that are necessary to prevent dangerous climate change discussed above, natural gas is likely only to be a short-term bridge fuel. (IEA, 2012) According to a recent International Energy Agency (IEA) report, natural gas can play at best a limited, very temporary role "if climate objectives are to be met." The only viable response to the threat of catastrophic climate change is rapid deployment of existing carbon-free technology. (IEA, 2012) According to this report, fuel savings from investment in non-fossil fuel technologies will pay for the investments. (IEA, 2012) Even if natural gas is a short-term bridge fuel, delay in investing in non-fossil fuel technologies may make it impossible to meet the emissions reductions targets needed to prevent dangerous climate change. For this reason, any Pennsylvania climate action strategy must look at emissions reductions pathways beyond 2020 necessary to limit warming to 2^{o}C and consider what amounts of non-fossil energy are needed through 2050. The IEA report makes it clear that abundant cheap natural gas could push renewables out of the market unless there is a price on carbon or aggressive economic support for non-fossil renewable energy. It is also possible that cheaper natural gas prices may lead to higher rates of

consumption of electricity. For this reason, any reliance on natural gas combustion as a method of reducing CO_2 e emissions must provide for ramped up commitments to non-fossil fuel sources of energy at levels needed to prevent dangerous climate change. Reliance on natural gas alone will not achieve the 80 percent reductions of GHG needed to prevent dangerous climate change.

C. Pennsylvania Policy On Climate Change Compared to Other US States

a. Summary of 2009 Action Plan

The 2009 Climate Change Action Plan was prepared by the Pennsylvania Department of Environmental Protection (DEP) in cooperation with the Climate Change Advisory Committee (CCAC) created by the 2008 Pennsylvania Climate Change Act. The Act required that 18 members be appointed as follows:

6 members appointed by the Governor
6 members appointed by the Senate
- 4 members appointed by the majority party
- 2 members appointed by the minority party

6 members appointed by the House of Representatives
- 4 members appointed by the majority part
- 2 members appointed by the minority party

3 ex-officio members include:
- Secretary, Department of Conservation and Natural Resources
- Secretary, Department of Community and Economic Development
- Chair, Public Utility Commission

According to the Pennsylvania Climate Change Action Plan, the CCAC and DEP reviewed over 100 multi-sector GHG mitigation actions. Of these, they approved for inclusion in the Climate Action Plan a package of 52 work plan recommendations to reduce GHG emissions and address related energy and commerce issues in Pennsylvania. Of these 52 recommendations, the CCAC approved 32 unanimously, nine with only one objection or abstention, and seven with five or fewer objections or abstentions.

As mentioned above, the plan's 52 recommendations, if fully implemented, would have reduced GHG emissions in Pennsylvania from 2000 levels by 30 percent by 2020 while increasing economic growth in Pennsylvania and creating jobs. (PaFCCAP, 2009) The plan estimated that the plan's implementation would create 65,000 new full-time jobs and add more than $6 billion to the Commonwealth's gross state product in 2020.

The Pennsylvania Climate Act required that DEP prepare and publish a climate change action plan within 15 months after the act came into effect in 2008 and every 3 years thereafter. And so, according to law Pennsylvania should have published a new climate change action plan in 2012. Yet no revised plan has yet been published, and the first

action plan has largely been ignored. However, the law does not make the action plan binding on Pennsylvania government. Thus there may be no legal remedy under the Pa Climate Act if the state government ignores the recommendations of the Action Plan. Given that the current administration and legislature have ignored the first action plan, given the enormity of the need to reduce GHG emissions discussed above, Pennsylvania should adopt a legally binding GHG emissions target implemented through an action plan of the type prepared in 2009. The plan should be aggressive enough to put Pennsylvania on an emissions reduction path to reduce GHG emissions to levels that represent Pennsylvania's fair share of safe global emissions. For this reason it must consider not only a target for 2020 but should consider what needs to be done to reduce emissions to Pennsylvania's fair share of safe global emissions in 2050.

b. CLIMATE CHANGE PROGRAMS IN OTHER US STATES

According to the 2009 action plan, the most significant contributor to Pennsylvania's emissions growth rate is the electricity generation sector. Two-thirds of electricity generation emissions are the result of activities in residential and commercial buildings (primarily heating and cooling), while emissions from waste management and agriculture are modest contributors. Because of the importance of the electricity sector to any strategy that seeks to reduce Pennsylvania GHG emissions to the Pennsylvania fair share of safe global emissions, this section will focus on the electricity sector. In this section we will compare Pennsylvania's approach to reducing GHG from the electricity sector to what several other states are doing.

Most US states have adopted policies or laws to increase the percentage of renewable, non-fossil fuel, electricity sector by: (1) adopting a "renewable portfolio standard" that usually requires electricity providers to provide a specific percentage of energy from renewable sources by a certain date, and (2) by providing economic incentives to deploy renewable energy. These renewable portfolios standards and economic incentives vary greatly from state to state in ways that make easy comparison difficult. Renewable portfolio standards differ greatly from state to state in what kinds of energy production are assumed to be "renewable," whether different types of renewable energy have specific quantitative goals, whether renewable energy from other states can be included in achieving quantitative obligations through trading, and when goals have to be achieved. Economic incentives vary even more greatly from state to state and include grants, tax incentives, efficiency grants, feed-in tariffs, net metering rules, system benefit charges, and other kinds of economic incentives. Thus the complexity of policy approaches that US states have adopted to increase the amount of renewable energy makes simple comparison difficult and is beyond the scope of this report.

Another common feature of many State policies is a renewable electricity credit (REC) trading system structured to minimize the costs of compliance. Under these policies, a producer who generates more renewable electricity than required to meet its own RPS obligation may either trade or sell RECs to other electricity suppliers who may not have enough RPS-eligible renewable electricity to meet their own RPS requirement. In some cases, a State will make a certain number of credits available for sale. Because

comprehensive state-to-state comparison is beyond the scope of this report, we herein only compare quantitative goals for renewable energy that have been specified in law or regulation. (For a comprehensive analysis of state incentives for renewable energy see, US Department of Energy, Database on State Incentives on Renewable Energy) at http://www.dsireusa.org/.)

i. The Pennsylvania Alternative Portfolio Standard.

Incentive Type:	Renewables Portfolio Standard
Eligible Efficiency Technologies:	Clothes Washers, Dishwasher, Refrigerators, Dehumidifiers, Ceiling Fan, Lighting, Lighting Controls/Sensors, Chillers , Heat pumps, Central Air conditioners, Programmable Thermostats, Duct/Air sealing, Building Insulation, Windows, Motor VFDs, Custom/Others pending approval
Eligible Renewable/Other Technologies:	Solar Water Heat, Solar Space Heat, Solar Thermal Electric, Solar Thermal Process Heat, Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Geothermal Electric, Fuel Cells, Geothermal Heat Pumps, Municipal Solid Waste, CHP/Cogeneration, Waste Coal, Coal Mine Methane, Coal Gasification, Anaerobic Digestion, Fuel Cells using Renewable Fuels, Other Distributed Generation Technologies
Applicable Sectors:	Investor-Owned Utility, Retail Supplier
Standard:	~18% alternative energy resources by compliance year 2020-2021, Comprised of Tier 1 and 2 targets (see below) Tier I: ~8% by compliance year 2020-2021 (includes PV minimum) Tier II: 10% by compliance year 2020-2021 PV: 0.5% by compliance year 2020-2021

The PUC has adopted the following 15-year compliance schedule to implement Pennsylvania's AEPS.

Compliance Year (CY)	Tier I (including Solar PV)**	Tier II	Solar PV
CY 2007	1.5%	4.2%	0.0013%
CY 2008	1.5%	4.2%	0.0030%
CY 2009	2.0%	4.2%	0.0063%

CY 2010	2.5%	4.2%	0.0120%
CY 2011	3.0%	6.2%	0.0203%
CY 2012	3.5%	6.2%	0.0325%
CY 2013	4.0%	6.2%	0.0510%
CY 2014	4.5%	6.2%	0.0840%
CY 2015	5.0%	6.2%	0.1440%
CY 2016	5.5%	8.2%	0.2500%
CY 2017	6.0%	8.2%	0.2933%
CY 2018	6.5%	8.2%	0.3400%
CY 2019	7.0%	8.2%	0.3900%
CY 2020	7.5%	8.2%	0.4433%
CY 2021	8.0%	10.0%	0.5000%

(Dsire, 2012)

ii. NEW YORK

Incentive Type:	Renewables Portfolio Standard
Eligible Renewable/Other Technologies:	Solar Water Heat, Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Fuel Cells, CHP/Cogeneration, Anaerobic Digestion, Tidal Energy, Wave Energy, Ocean Thermal, Ethanol, Methanol, Biodiesel, Fuel Cells Using Renewable Fuels
Applicable Sectors:	Investor-Owned Utility
Standard:	29% by 2015

(Dsire, 2012)

iii. CALIFORNIA

Incentive Type:	Renewables Portfolio Standard
Eligible Renewable/Other Technologies:	Solar Thermal Electric, Photovoltaics, Landfill Gas, Wind, Biomass, Geothermal Electric, Municipal Solid Waste, Energy Storage, Anaerobic Digestion, Small Hydroelectric, Tidal Energy, Wave Energy, Ocean Thermal, Biodiesel, Fuel Cells using Renewable Fuels

Applicable Sectors:	Municipal Utility, Investor-Owned Utility, Electricity Service Provider, Community Choice Aggregator
Standard:	20% by December 31, 2013 25% by December 31, 2016 33% by 2020

(Dsire, 2012)

iv. NEW JERSEY

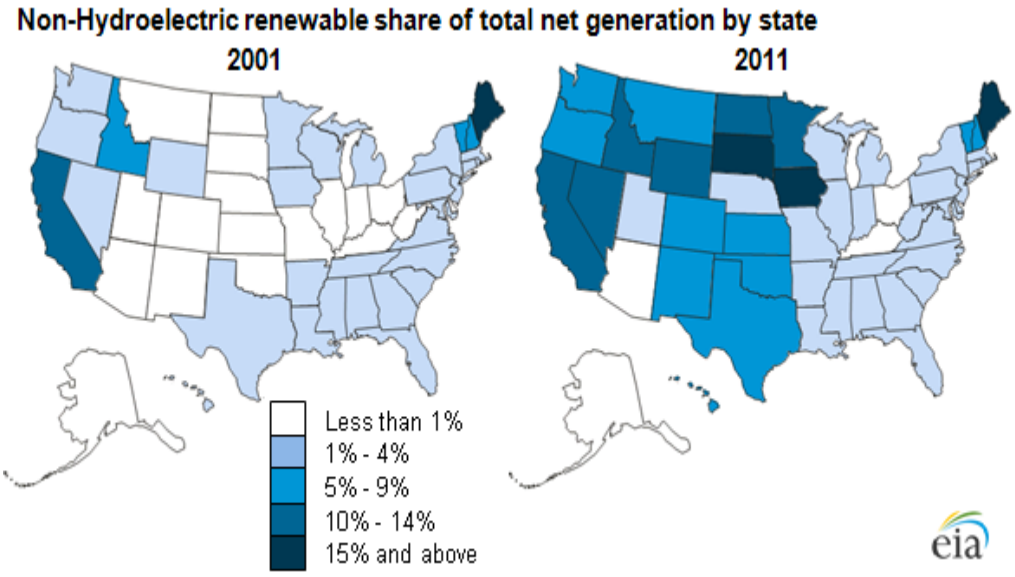
Incentive Type:	Renewables Portfolio Standard
Eligible Renewable/Other Technologies:	Solar Thermal Electric, Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Geothermal Electric, Municipal Solid Waste, Anaerobic Digestion, Tidal Energy, Wave Energy, Fuel Cells using Renewable Fuels
Applicable Sectors:	Investor-Owned Utility, Retail Supplier
Standard:	20-38% Class I and Class II renewables by energy year 2020-2021 + 4.1% solar-electric by energy year 2027-2028

(Dsire, 2012)

As we mentioned above, to fully understand US state support for renewable energy, any analysis must not only examine renewable portfolio standards, but also economic incentives that have been established to encourage renewable energy, and trading and credit systems that apply to renewable energy.

As we have seen, many US states have adopted much more aggressive renewable portfolio standards. A more thorough state comparison would also reveal more aggressive policies on renewable energy in the form of economic incentives.

Pennsylvania currently supplies about 3 per cent of its electricity generation from non-hydro renewables. The following chart from the Energy Information Administration demonstrates that other US state policies are providing higher levels of energy from non-renewable energy.



(EIA, 2012)

Given the enormity of GHG emissions reductions worldwide needed to prevent dangerous climate change, Pennsylvania needs to greatly ramp up its commitment to non-fossil energy.
As we have seen, New York, New Jersey, and California are examples of leadership on renewable energy that Pennsylvania could learn from.

Some nations around the world are making much stronger commitments to non-fossil energy than the United States. The New York Times reported recently that:

> As renewable energy gets cheaper and machines and buildings become more energy efficient, a number of countries that two decades ago ran on a fuel mix much like America's are successfully dialing down their fossil fuel habits. Thirteen countries got more than 30 percent of their electricity from renewable energy in 2011, according to the Paris-based International Energy Agency, and many are aiming still higher.
>
> (Rosenthal, 2013)

Pennsylvania and other US states can learn from what has worked in other nations to increase the use of non-fossil energy. Several nations around the world are greatly outperforming the United States on increasing the percentage of electric power from renewables as a result of aggressive economic incentives for non-fossil energy.

D. Adverse Climate Change Impacts Predicted For Pennsylvania Under Business-As-Usual

In response to its obligations under the 2008 Pennsylvania Climate Change Act, Pennsylvania DEP contracted with researchers at the Pennsylvania State University (PSU) to conduct an assessment report on climate change impacts for Pennsylvania that considered two emissions scenarios. (PSU, 2009)

Major impacts identified in the Pennsylvania action plan that were derived from the PSU assessment included the following:

- Changes in the amounts and intensity of precipitation.
- Increases in temperature.
- Impacts on the length of growing seasons.
- Impacts on aquatic resources and ecosystems.
- Increases in surface water temperatures which will have impacts on some aquatic species.
- Changes to the composition of Pennsylvania's forests and woods which will effect animal species inhabiting Pennsylvania forests.
- Changes to ideal growing conditions for certain crops and other agricultural commodities.
- Potential impacts to animal agriculture including potential decreases in milk production.
- Human health impacts including management of heat-related stress and risk of increased heat-related mortalities, potential increases in cases of vector-borne diseases, such as West Nile Virus, and diseases caused by other pathogens.

(PaFCCAP, 2009: Chapter 2)

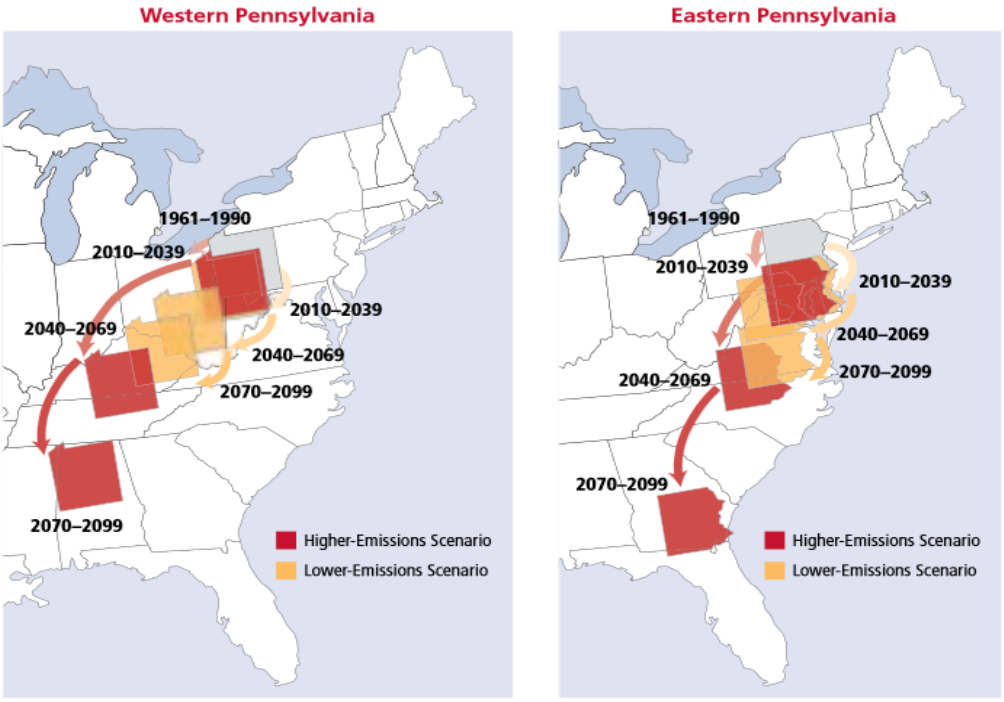
A 2008 report by the Union of Concerned Scientists also made predictions about climate impacts on Pennsylvania if higher GHG emissions rates continue to prevail:

- Many Pennsylvanian cities can expect dramatic increases in the numbers of summer days over 90°F, putting vulnerable populations at greater risk of heat-related health effects and curtailing outdoor activity for many individuals.
- Heat could cause urban air quality to deteriorate substantially, exacerbating asthma and other respiratory diseases.
- Heat stress on dairy cattle may cause declines in milk production.
- Yields of native Concord grapes, sweet corn, and favorite apple varieties may decrease considerably as temperatures rise and pest pressures grow more severe.
- Snowmobiling is expected to disappear from the state in the next few decades as winter snow cover shrinks.
- Ski resorts could persist by greatly increasing their snowmaking, although this may not be an option past mid-century as winters become too warm for snow—natural or human-made.
- Substantial changes in bird life are expected to include loss of preferred habitat for many resident and migratory species.
- Climate conditions suitable for prized hardwood tree species such as black cherry, sugar maple, and American beech are projected to decline or even vanish from the state.

(UCS, 2008)

With continued high global greenhouse-gas emissions, by the late 21st century Western Pennsylvania's climate could resemble northern Alabama and Eastern Pennsylvania's climate could resemble South Eastern Georgia according to the 2008 Union of concerned Sciences Report.

FIGURE 3: Migrating Climates



(UCS, 2008)

Some caution about the accuracy of these conclusions is warranted because of considerable scientific uncertainties entailed by any impact assessment at the state scale because of limitations of climate models below the global scale, the need to make assumptions about climate sensitivity, the inability of these assessments to take advantage of advances in climate science since 2009, the need to make assumptions about climate sensitivity, global peaking, and recent and short-term GHG emissions levels. Although it is therefore plausible that climate impacts on Pennsylvania will be less than or greater than those described above, however, because recent global GHG emissions have recently been exceeding worst case levels predicted just a few years ago (Plumber, 2011), it is more plausible that climate impacts on Pennsylvania could be significantly worse than those described above.

For this reason, this report will recommend that the Pennsylvania DEP update the climate change impacts predicted in the 2009 action plan to take into consideration most recent climate change science and recent higher than expected rates of global GHG emissions.

E. Adaptation Needs In Pennsylvania

As we have seen above, climate change is projected to have numerous adverse impacts on Pennsylvania. The law that required the 2009 Climate Action Plan did not require the Commonwealth to produce a climate change adaption plan, yet the 21-member Climate Change Advisory Committee (CCAC) and the Pennsylvania DEP that produced the 2009 action plan recognized the need to also address adaptation planning because "climate impacts are already occurring and will continue to occur even with lower carbon levels. (PaCAPR, 2010) In 2010 a Report was prepared by DEP in consultation with the Climate Change Advisory Committee on the need for Pennsylvania to create iterative climate change adaptation plans. The report was entitled the Pennsylvania Climate Adaptation Planning Report. (PaCAPR, 2010) On March 18, 2010, a planning process to develop an adaptation report received the support of the CCAC along with the recommendation that adaptation planning be part of future climate change action plans prepared under the 2008 Climate Change Act. (PaCAPR, 2010) Currently, it would appear that there is no adaptation planning taking place under the 2008 Climate Act as recommended.

The Pa Climate Adaptation Report recommended that future adaptation planning in Pennsylvania be organized around four sectors in Pennsylvania that are likely to be affected by climate change. They include:

1. Infrastructure (transportation, energy, water, buildings, communications, land use);
2. Public Health and Safety (public health, emergency management);
3. Natural Resources (forests, freshwater, plants and wildlife, agriculture); and
4. Tourism and Outdoor Recreation (fishing, boating, sports, adventure, golf, skiing, gardening).

The Adaptation Planning Report further recommended that future adaptation planning in Pennsylvania focus on 27 sub-issues that are relevant to how infrastructure, public health, natural resources, and tourism and outdoor recreation will be affected by climate change. (PaCAPR, 2010)

In any future adaptation planning, Pennsylvania needs to update conclusions on projected climate change impacts that were initially identified in the 2009 plan Climate Action Plan. This information should be posted online and made separately available to relevant stakeholders.

Pennsylvania should also begin climate adaptation planning following and expanding upon, where appropriate, the recommendations in the 2010 Adaptation Report while identifying, in cooperation with relevant stakeholders, the economic sectors, geographic locations, communities, and subpopulations that will be significantly adversely affected by climate change.

The most vulnerable sectors, locations, communities, and subpopulations should be prioritized. For each area of priority concern, the state, in consultation with relevant stakeholders, including those who are or will be most directly affected (e.g., municipal

water suppliers, agriculture), should identify potential adaptation strategies. Those strategies should be evaluated and prioritized, and the highest priority strategies should be implemented. Because the climate will continue to change for the foreseeable future, and because climate change adaptation involves learning by doing, these strategies should be revised and updated on a periodic basis consistent with the three year updates of climate change action plans required by the 2008 Pennsylvania Climate Law.

In addition because climate change will not only create harmful impacts on Pennsylvania but also economic and other opportunities, future adaptation planning should identify and prioritize those opportunities, and work with relevant stakeholders to remove barriers and otherwise enhance the likelihood that they will be realized.

III. ACKNOWLEDGEMENT OF PA CLIMATE CHANGE LEADERSHIP

In developing programs to reduce GHG emissions, the Commonwealth of Pennsylvania should encourage leadership from Pennsylvania institutions, organizations, businesses, and local governments. In this regard, we have collaborated with the Pennsylvania Environmental Resource Consortium, Penn Future, and Pennsylvania Interfaith Power & Light to make recommendations on examples of leadership on climate change from Pennsylvania higher education, religious institutions, and local governments.

a. PA COLLEGES AND UNIVERSITIES

The Pennsylvania Environmental Resources Consortium, and organization comprised of over seventy members and affiliate Pennsylvania colleges and universities, has made the following recommendations on recognizing leadership on climate change by Pennsylvania colleges and universities.

Many of Pennsylvania's colleges and universities have made significant commitments to reduce GHG emissions. Thirty-one Pennsylvania colleges and universities have committed to becoming carbon neutral by a specific date by drafting a Climate Action Plan. Of those colleges and universities, twenty-nine Presidents have signed the American Colleges and University Presidents Climate Commitment (http://www.acupcc.org). A list of all Pennsylvania colleges and universities with Climate Action Plans include:

ACUPCC Signatory Schools

Allegheny College^	Messiah College
Bryn Mawr College	**Montgomery County Community College^**
Bucknell College^	Penn State Berks
Chatham University^	Philadelphia University*
Dickinson College^	Slippery Rock University of Pennsylvania
Drexel University*	Swarthmore College*
Franklin & Marshall College	**Temple University^**
Gettysburg College^	**University of Pennsylvania^**

Harrisburg Area Community College	Ursinus College
Haverford College	**Villanova University^**
Juniata College	**Washington & Jefferson College^**
Keystone College^	West Chester University of Pennsylvania*
Lafayette College	Wilkes University
Lincoln University*	Wilson College
Mercyhurst University^	

*Recent Signatories (Carbon Neutrality target dates yet to be published)
^ Early ACUPCC Signatories with published Climate Action Plan Progress Reports.

Climate Action Plans (not signatory schools)

Carnegie Mellon	Duquesne University

Three Pennsylvania colleges stand out as leaders in reducing GHG emissions and integrating sustainability into campus culture and the curriculum. They are:

Allegheny College
- Carbon Neutrality Date: 2020
- 100% wind power purchase
- College supplies waste oil to the City of Meadville's biodiesel operations
- LEED™ Certified buildings
- Onsite composting of food, paper and compostable plastic\
- EPA Green Power Partner – Leadership Club
- Sustainability integrated into the curriculum
- Sustainability webpage link: http://sites.allegheny.edu/green/

Dickinson College
- Carbon Neutrality Date: 2020
- LEED™ Certified buildings
- Center for Sustainable Living
- Center for Sustainability Education
- EPA Green Power Partner – Leadership Club
- Sustainability integrated into the curriculum
- Sustainability webpage link: http://www.dickinson.edu/about/sustainability/

University of Pennsylvania
- Carbon Neutrality Date: 2042
- EPA Green Power Partnership – Leadership Club (top purchaser of wind power)
- Green Labs and Office Certification Programs
- Eco-Reps
- LEED Certified buildings
- Green Fund

- Sustainability integrated into the curriculum
- Sustainability webpage link: http://www.upenn.edu/sustainability/

b. RELIGIOUS INSTITUTIONS

Pennsylvania Interfaith Power & Light has made the following recommendations in regard to religious institutions in Pennsylvania showing leadership on climate change.

Many Pennsylvania religious institutions recognize that their common callings to care for Creation and to care for the most vulnerable are joined in the need to respond to climate change. Pennsylvania Interfaith Power & Light (PA IPL) is a community of congregations, faith-based organizations, and individuals of faith responding to climate change as a moral issue, through advocacy, energy conservation, energy efficiency, and the use of clean, renewable energy. PA IPL works with many religious communities who are exhibiting leadership on climate change, and with many individuals working to provide hope through action in and with their congregations.

PA IPL particularly recognizes the Central Baptist Church in Wayne for their longstanding and ongoing leadership on climate change issues. The Central Baptist Church is notable in its approach to emissions reduction primarily as part of their mission and justice work, and secondarily for its financial co-benefits. As such, they have worked steadily to reduce their energy use for about 10 years, and have a working group with the goal of becoming a net zero emissions church (including transportation to and from church) that continues to spur them forward. In the context of this report, it should also be noted that the largest external signal of Central Baptist Church's emissions reduction work, their solar PV panels, was jump-started by an Energy Harvest grant through the PA DEP in 2008.

c. LOCAL GOVERNMENTS

Although not yet prepared to identify specific municipal governments at this time for special recognition, Penn Future has provided the following analysis relevant to the need of the Commonwealth of Pennsylvania to support municipality work on climate change

The work of the Commonwealth to research and provide a Climate Action Plan should not go unnoticed. The state plan identified 52 recommendations that would bring about immediate results in reducing carbon emissions. Due to its non-binding nature, current political climate, and economic stagnation, there has been little action at the state level to support municipalities interested in climate change. A relatively standardized portfolio of climate work includes energy efficiency and conservation, green building, waste reduction, environmentally preferable purchasing, renewable energy, improved public transportation systems, offsetting carbon emissions, and land use planning.

Today, there are numerous online resources available for any municipal manager or concerned resident. That said, in order to be efficient with time and resources, and to

mount change at scale with regard to greenhouse gas emissions, climate action planning efforts should be efficacious and collaborative.

With little to no collective effort at the state level, it can be difficult to uncover the action that is actually taking place across the state in a variety of towns and boroughs.

After outreach efforts spanning May, June, July, and August of 2012; PennFuture proceeded to synthesize feedback into five focus areas: 1) available resources; 2) overarching needs; 3) obstacles; 4) recommendations for moving forward; and 5) inventory of supporting organizations. In order to provide a narrative thread for the examples cited below, this section will highlight key findings.

Available Resources:
While funding for climate-related efforts have been ramping down, there remains the opportunity to identify and secure funding for projects. However, in order to secure such funding, efforts have to be coordinated and often regionalized. For example, the Delaware Valley Regional Planning Commission (DVRPC) Circuit Rider Program received funding from a U.S. Environmental Protection Agency (EPA) Climate Showcase Communities Grant. This three-year grant will provide funding for DVRPC to operate a circuit rider program focused on energy savings reductions by offering one-on-one assistance, seminars, customized resources, and coordinated bulk purchasing. The program, which was only launched in July 2012, will provide a potential model for other regions looking to support and facilitate climate action planning. Metropolitan Planning Organizations (MPO) have been identified as a vehicle with which to advance climate action planning, but the work and interests of MPOs vary from region to region. Other federal and state funding opportunities can be found on the EPA's State and Local Climate and Energy Program website. Other funding opportunities, offered by foundations and corporations, are available but vary in grant size, eligibility requirements, and scope of project. In order for climate action plans to have a real impact, funding needs to be consistently available and systematic in its requirements.

Overarching Needs:
For many of the municipalities and counties interviewed, the involvement of institutions of higher education was paramount. First and foremost, most municipal governments do not have dedicated sustainability staff, or staff with specialized training to operate programs like emissions software. As such, graduate students and professors from neighboring universities are invaluable resources in helping municipalities perform greenhouse gas emission inventories and energy benchmarking. In a similar vein, the support of professors and students can often ignite and sustain climate action planning efforts over time.

Another requirement for driving success is the availability of options for municipal governments. It may, more often than not, be the case that local governments do what they do because it is what they have always done. One example might be vehicle fleet purchases for a municipality. It may be the case that a council of

government (COG) facilitates purchases for the members. As such, interested parties like PennFuture would do well to reach out to COGs and other local government institutions to work on other initiatives, i.e. alternative transportation fuels or GPS systems in municipal vehicles to optimize driving routes and save on fuel costs. Many municipalities are interested in switching away from vapor lights to something more efficient. However, due to contracts with their utility service, the tariffs for street lighting prevent many municipalities from being able to make the switch. Here is another example, like that of funding, where coordinated efforts are in the best interest of a successful outcome. Neighboring municipalities should pull resources and work with MPOs and other governing bodies to approach their utilities and facilitate change. Absent open communication and support, few municipalities will take the steps necessary to make the change.

Municipalities, at least those interviewed, are in need of a liaison on most of these issues. Until climate adaptation and mitigation becomes more standardized and integrated into general municipal responsibilities, many localized efforts will need the continuous support of outside organizations. Two examples, one a program and the second a coalition, speak to what may be successful models. As previously mentioned, southeastern Pa.'s Delaware Valley Regional Planning Commission has recently begun its circuit rider program for energy efficiency planning in municipalities. The circuit rider program will offer one-on-one assistance and will provide guided steps from start to finish. This program will be discussed in greater detail below. Another model is the Congress for Neighboring Communities (CONNECT), operational in southwestern Pennsylvania. CONNECT works with 38 municipalities that border the City of Pittsburgh. CONNECT facilitates the interests of the municipalities by working on shared challenges and common goals. As will be apparent throughout the remainder of this memo, supporting organizations (of which there are many) have the potential to leverage municipalities' willingness to engage in local climate planning efforts when they might not do so left to their own devices.

Obstacles:
The most immediate impediments have been identified as follows: 1) the current political climate; 2) the recession and dwindling financial incentives; 3) staffing constraints; 4) lack of understanding; and 5) only spotty and sporadic partnerships available for support.

The current administration in Harrisburg has not prioritized local climate action planning efforts. Previously, during the Rendell administration, the Pennsylvania Department of Environmental Protection (DEP) used $300,000 of funding appropriated in the 2007-2008 state budget to incentivize communities to complete municipal climate change inventories and action plans through the Local Government Greenhouse Gas Pilot Grant Program. State Representative Greg Vitali introduced legislation for the appropriation in 2006. Since that time, no other funding has been designated for the program, which closed in June 2010. The state's climate advisory committee continues to meet, but has little authority or

influence. As to the federal level, there is more willingness to discuss the importance of local action on climate change but limited funding to support such activities. The EPA's State and Local Climate and Energy Program offers a plethora of resources and programs to complement a municipality's efforts at implementing a climate action plan. Since climate legislation failed to pass in 2010, legislative efforts in this area have all but disappeared. Many states and regions have been encouraged to take climate action planning into their own hands. Climate Solutions, a non-profit organization involved in building the clean energy economy of Pacific Northwest states, released the publication *Powering the New Energy Future from the Ground Up* in 2012. The report states that "city-led efforts to catalyze local clean energy economic development are important to watch as federal grants sunset, especially in the absence of a comprehensive national energy or climate policy." Federal agencies have been supportive both in a symbolic sense as well as offering technical assistance through their channels of influence. In 2009, the U.S. EPA, Department of Housing and Urban Development, and Department of Transportation partnered to create a united front in the name of sustainability, *Partnership for Sustainable Communities*. Supported by the Obama administration, it would be unlikely that this initiative would continue without a second term for the Obama administration. The political nature of climate action planning in the U.S. continues to thwart consistent messaging of calls for action to communities across the country.

With the collapse of the American economy taking hold in late 2008, most priorities for states and local governments have been fundamental: keeping the lights on and snow cleared from roads in the winter. And while climate action efforts can also save money, the connection between the two is not always obvious.

Without exception, the lack of dedicated staff or available staff time is a clear impediment to climate action planning efforts. The City of Meadville, which was a recipient of Local Government Greenhouse Gas Pilot funding, has not been able to track energy use in municipal buildings consistently due to staffing constraints. While many facilities managers often have familiarity with municipal systems and operations down to a minute level of detail, they are not necessarily aware of the benefits of environmentally friendly practices. There is often a disconnect between what a municipality can do to save money and what they can do to reduce their carbon footprint. Those actions, of course, are not mutually exclusive. In order for municipalities, especially smaller ones, of which there are many across the Commonwealth, to readily engage in climate action, climate action support and directives should be made with current staff positions in mind – who is already doing what and how can their role and responsibilities align with steps to reduce carbon emissions.

Lastly, the inconsistency of support is a finding borne of the outreach done for this project. As will be made evident in the supporting organizations section below, there are numerous organizations involved in municipal outreach. There is little communication between supporting organizations, which oftentimes creates a

duplication of efforts, or even results in mixed messaging that can be confusing for municipal staff looking for decisiveness and clarity. Furthermore, these efforts require momentum. Once an inventory has been completed and a plan created, municipalities require handholding to carry out their objectives. Consistency also provides a signal to municipalities about investments. If municipalities are interested in creating clean vehicle fleets, that initial interest needs to be encouraged, as well as an assurance that they will not only be able to recoup costs but will be able to gain positive recognition from the decision. More importantly is the aspect of benchmarking, and laying a foundation for future priorities at the state level. Hopefully, future state-coordinated efforts and funding will be a reality once again. In the meantime, it is beneficial to know what groundwork has been laid and who is doing what and where across the state. It would also benefit supporting organizations to do more in the way of coordinating efforts – municipalities would be better served, networking opportunities improved, best practices more readily shared, and more comprehensive support for policy measures gained.

III. CONCLUSION: THE NEED FOR POLICIES ON CLIMATE CHANGE IN PENNSYLVANIA THAT REDUCE PENNSYLVANIA GHG EMISSIONS CONGRUENT WITH THE SCALE OF THE CLIMATE CHANGE PROBLEM

For the reasons stated in the report, we conclude that the Commonwealth of Pennsylvania should as soon as possible:

1. Adopt a legally-binding GHG emissions reduction target consistent with Pennsylvania's fair share of safe global emissions.
2. Working with the Climate Change Advisory Committee identified in the 2008 Pennsylvania Climate Act and vigorous public participation, identify strategies to reduce Pennsylvania GHG necessary to achieve the legally-binding GHG emissions reduction target.
3. Adopt any laws or regulations necessary to implement the action plan and achieve the target.
4. Greatly ramp up its commitment to non-fossil energy.
5. Develop and periodically update a climate change adaptation plan.
6. Encourage, support, and recognize actions and programs to reduce the threat of climate change by Pennsylvania sub-state level governments, businesses, organizations, and educational and religious institutions.

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