

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
EVALUATION REPORT
ON THE
ASHLEY FUNK PETITION FOR RULEMAKING
TO REDUCE CARBON DIOXIDE EMISSIONS

April 15, 2014

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A. DESCRIPTION OF THE PETITION FOR RULEMAKING PROCEDURE

Under 25 Pa. Code Chapter 23, the Environmental Quality Board (“EQB”) developed a policy for processing petitions for rulemaking (relating to Policy for Processing Petitions – Statement of Policy). *See also* 71 P.S. § 510-20(h) (Any person may petition the Environmental Quality Board to initiate a rulemaking proceeding for the issuance, amendment, or repeal of a regulation administered and enforced by the department). Among other things, a petition for rulemaking must contain the following information: (1) the petitioner’s name, address, and telephone number; (2) a description of the action requested including suggested regulatory language if the petition requests the EQB to adopt or amend regulations; (3) the reason the petitioner is requesting the action from the EQB; and (4) the types of persons, businesses and organizations likely to be impacted by the proposal. 25 Pa. Code § 23.1 (relating to Petitions).

When a petition for rulemaking is submitted the Pennsylvania Department of Environmental Protection (“Department”) examines the petition before it is submitted to the EQB to determine if it meets the following conditions: (1) the petition is complete as required by § 23.1; (2) the petition requests an action that can be taken by the EQB; and (3) the requested action does not conflict with Federal law. 25 Pa. Code § 23.2 (relating to Departmental review).

The Department then notifies the EQB and the petitioner of its determination. If the Department determines that the petition is not appropriate, the notification will state why and give the petitioner 30 days to modify the request. 25 Pa. Code § 23.3 (relating to Notifications).

Where the Department determines that a petition is appropriate, the petitioner may make a five-minute presentation to the EQB and the Department may also make a recommendation as to whether to accept the petition. 25 Pa. Code § 23.4 (relating to Oral presentations).

The EQB may refuse to accept a petition if: (1) the EQB has within the past two years considered the issue addressed in the petition; (2) the action requested by the petitioner is currently under litigation; (3) the requested action is inappropriate for policy or regulatory considerations; (4) the petition involves an issue previously considered by the EQB, and it does not contain information that is new or sufficiently different to warrant reconsideration of that issue. 25 Pa. Code § 23.5 (relating to Board determinations).

If the EQB accepts the petition, a notice of acceptance will be published in the *Pennsylvania Bulletin* and a report will be prepared. 25 Pa. Code § 23.6 (relating to Notice of acceptance and Department report).

Once the report is completed, the Department will send a copy of it to the petitioner who may then submit to the Department a written response to the report within 30 days of the mailing of the report. 25 Pa. Code § 23.7 (relating to Response to report).

The Department will prepare a recommendation to the EQB based on the report and comments received from the petitioner. If regulatory amendments are recommended, the Department will develop a proposed rulemaking for EQB consideration within 6 months after the Department mailed its report to the petitioner. If regulatory amendments are not recommended, the Department will present its recommendation and basis to the EQB at the first meeting occurring at least 45 days after the Department mailed its report to the petitioner. 25 Pa. Code § 23.8 (relating to Board consideration).

B. DESCRIPTION OF THE ASHLEY FUNK PETITION

1. Procedural Description

On September 6, 2013, the Department received a petition to promulgate a rule to regulate fossil fuel carbon dioxide (“CO₂”) emissions and to establish an effective emissions reduction strategy that will achieve safe atmospheric concentrations of CO₂ by 2100.

The petition was submitted by Kenneth T. Kristil, Esq., Widener Environmental and Natural Resources Law Clinic, 4601 Concord Pike, Wilmington, DE, 19803, on behalf of Ashley Funk, 330 Black Street, Mount Pleasant, PA, 15666.

On October 10, 2013, the Department sent a letter to Ms. Funk that notified her that the petition met the established criteria in Section 23.2 of the EQB’s petition policy. The letter also set November 19, 2013 as the date the EQB would consider the petition.

At the November 19, 2013 EQB meeting, Attorney Kristil, representing Ms. Funk, made a brief presentation as to why the EQB should accept the petition for further study. The Department recommended that the EQB accept the petition for further study. The EQB voted unanimously to accept the petition for further study.

On December 7, 2013, the Department published a notice of acceptance of the petition in the *Pennsylvania Bulletin*. 43 Pa. Bull. 7095.

2. Petition Description

The petition asserts that the EQB should promulgate a rule “to regulate fossil fuel carbon dioxide emissions, and to establish an effective emissions reduction strategy that will achieve safe atmospheric concentrations of carbon dioxide by 2100.” In support of this petition, Ms. Funk cites a number of scientific studies to support her conclusions that - the science

unequivocally shows that anthropogenic climate change is occurring and it's threatening the stability of the global climate; and climate change is already occurring in Pennsylvania and is projected to significantly impact the state in the future.

To remedy the threat identified in the petition, Ms. Funk suggests that the rule should be designed to achieve the general goal of reducing CO₂ emissions through the following means:¹

1. **Regulatory Goal.** Starting in 2013, annual fossil fuel CO₂ emissions in Pennsylvania will be reduced by at least 6 percent per year as determined by the previous year's annual CO₂ emission rate through 2050.

2. **Baseline Emission Rate.** The Department shall determine the amount of CO₂ emitted in 2012 from all fossil fuel-burning sources in the Commonwealth, which will be the Baseline CO₂ Emission Rate for purposes of this regulation.

3. **Determination of Annual CO₂ Emission Rate.** The Department shall undertake such actions as are necessary to determine the amount of CO₂ emitted each year from all fossil fuel-burning sources in Pennsylvania.

4. **Reductions in Annual CO₂ Emission Rate.** The Department shall undertake such actions as are necessary to achieve at least a 6 percent reduction in the annual CO₂ emission rate from the baseline CO₂ emission rate by the end of 2013, and then at least a 6 percent reduction in the annual CO₂ emission rate each year compared to the annual CO₂ emission rate of the previous year, through the year 2050.

¹ See Appendix of this Evaluation Report for the specific suggested regulatory language.

C. DEPARTMENT RESPONSE TO THE PETITION

1. Introduction

Pennsylvania has developed and will continue to develop statutory and regulatory strategies to reduce Greenhouse Gas (“GHG”) emissions.² Many of these strategies fall under the purview of statutes implemented by the Department like the Air Pollution Control Act, (“APCA”) 35 P.S. § 4001 *et seq.* The Department also successfully litigated against the federal Department of Energy (“DOE”) in federal court for improved appliance energy efficiency standards. Other GHG reduction strategies fall under the jurisdiction of the Pennsylvania Public Utility Commission (“PUC”), the Pennsylvania Department of Agriculture, or the Pennsylvania Department of Conservation and Natural Resources. Still other laws and regulations may be implemented jointly by the federal and state governments.

a. Pennsylvania Climate Change Act

The Pennsylvania Climate Change Act, 71 P.S. §§ 1361.1 – 1361.8, was enacted on July 9, 2009. The Act requires the Department to submit to the General Assembly within nine months a report on the potential impact of climate change in Pennsylvania and any potential economic opportunities resulting from any mitigation strategy. 71 P.S. § 1361.3. The Act also requires the Department to compile an annual inventory of GHG emissions from all sources within Pennsylvania. 71 P.S. § 1361.4. The Act also directs the Department to establish within 90 days a GHG registry where entities can record voluntary reductions or avoidances of GHG emissions. 71 P.S. § 1361.6.

² While the Ashley Funk Petition requests the reduction of CO₂ emissions from fossil fuel sources, the Department’s strategies are much broader in that the aim is to reduce all GHGs, which includes CO₂, but also includes methane, nitrous oxide, and fluorinated gases like hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

The Act creates a Climate Change Advisory Committee (“CCAC”) to advise the Department on implementation of the Act. This committee is required to meet within sixty days and regularly thereafter. 71 P.S. § 1361.5.

Additionally, the Act requires the Department to submit to the Governor and General Assembly a "climate change action plan" within fifteen months that, among other things, evaluates cost-effective strategies for reducing or offsetting GHG emissions from various sectors within Pennsylvania and recommend potential legislative changes necessary to implement the action plan. 71 P.S. § 1361.7. This action plan must be updated every three years. *Id.*

Lastly, the Act anticipates that the U.S. Congress may enact federal climate change legislation that may duplicate the programs established by the Act. 71 P.S. § 1361.8. If the Department determines that any federal legislation is as or more comprehensive than the Act, the Department must publish this determination in the *Pennsylvania Bulletin* along with a notice that compliance with the federal law will constitute compliance with the Act. *Id.*

Under this Act, the Department in consultation with the CCAC has reviewed all of the issues associated with climate change, including, but not limited to, the science, technology, and economic and social impacts. Based on this review the Department has published two reports on climate change in 2009 and 2013, respectively – the Climate Change Action Plan,³ (“2009 Plan”) and Climate Change Action Plan Update (“2013 Update”).⁴ Much of the work associated with this Evaluation Report on the Ashley Funk Petition for Rulemaking relies on the findings and recommendations in these two climate change action plan reports.

³ The Climate Change Action Plan, December 18, 2009, is available at http://www.portal.state.pa.us/portal/server.pt/community/climate_change_advisory_committee/10412.

⁴ The “Climate Change Action Plan Update”, December 2013, is available at http://www.portal.state.pa.us/portal/server.pt/community/climate_change_advisory_committee/10412

It is also important to note that the obligations of the Department and the CCAC are ongoing and are not concluded with the finalization of the 2009 Plan and 2013 Update. Under the Climate Change Act, the Department is mandated to continue to evaluate cost-effective strategies for reducing or offsetting GHG emissions from various sectors within Pennsylvania and recommend potential legislative changes necessary to implement the action plan. This evaluation must be updated every three years.

b. The 2009 Plan

The 2009 Plan includes the following: identification of GHG emissions, and emissions baseline and trends; trends of GHG emissions sequestration; evaluation of cost-effective strategies that can help reduce GHG emissions; identification of costs, cost savings, benefits and co-benefits associated with emission reduction strategies with emphasis on meeting future energy needs of Pennsylvania; recognition of agreement and disagreement among the CCAC members with regard to the specifics of the action plan; and recommendations to the General Assembly for necessary actions to be taken for the implementation of the action plan.

It is important to note that not all of the strategies identified in the 2009 Plan have been implemented. Nevertheless, the 2009 Plan remains an important resource for the Department in its ongoing process of identifying, developing, and implementing cost-effective strategies to reduce GHG emissions in Pennsylvania. As the 2013 Update shows, additional actions to reduce GHG emissions have been identified and are in the process of being implemented.

c. The 2013 Update

The 2013 Update summarizes the activities and actions that have taken place to reduce emissions since the publication of the 2009 Plan. Since the Plan was prepared in 2009, there

have been broad-based changes to Pennsylvania's economy and energy portfolio. Many of the changes have resulted in fewer emissions of GHGs in Pennsylvania.

This Update summarizes Pennsylvania GHG emissions and sinks for the base year 2000, 2010, and target year 2020. Throughout this Evaluation Report on the Petition for Rulemaking, emissions are provided in as CO₂ equivalency ("CO₂e") for consistency. For gross emissions by sector, Pennsylvania's percentage of emissions by sector is lower than the U.S. percentage of emissions for the transportation, waste, and agriculture sectors. Pennsylvania's percentage of emissions by sector is higher than the U.S. percentage of emissions by sector for the industrial and residential/commercial sectors.

Overall, Pennsylvania's gross GHG emissions are expected to be lower in 2020 than in 2000, with reductions in the residential, commercial, transportation, agriculture, and waste sectors. The total statewide emissions sinks are also expected to increase, creating additional net GHG benefits through 2020.

In the electricity production, transmission, and distribution sectors there have been huge changes in Pennsylvania since 2009. Due, in part, to new or anticipated federal regulations and the availability of natural gas, many coal-fired power plant owners have either retired electric generating units, experienced reduced operations or are considering fuel-switching to natural gas resulting in significantly lower CO₂ emissions.

Even with the anticipated coal plant retirements and shifts to natural gas, Pennsylvania remains a net exporter of electricity. Recently, data from the U.S. Environmental Protection Agency ("EPA") confirmed that the retirement of coal plants in Pennsylvania will result in an emissions savings of about 14 million metric tons of CO₂e ("MMtCO₂e") annually.⁵ The new

⁵ *Infra* Table 8.

generating capacity proposed for Pennsylvania will produce about 6.45 MMtCO₂e in 2020, resulting in a total of 5.5 MMtCO₂e savings.⁶

Pennsylvania has also developed and implemented measures to reduce emissions from oil and gas extraction activities, and compression and processing operations. These measures include a revised General Plan Approval and/or General Operating Permit for Natural Gas Compression and/or Processing Facilities (“GP-5”) and revised permit exemption criteria for the oil and gas activities, Exemption Category No. 38 (“Exemption 38”). GP-5 and Exemption 38 require operators to employ leak detection and repair (“LDAR”) programs to reduce and control emissions of methane in a manner that is more extensive and restrictive than required by federal rules. These LDAR requirements will have a significant impact on the reduction of methane emissions from these sources. The Department also adopted similar LDAR requirements for natural gas refueling stations.

Governor Corbett also signed Act 11 of 2012, allowing water and wastewater utilities, natural gas distribution companies, city natural gas distribution operations and electric distribution companies to petition the PUC for approval to implement a Distribution System Improvement Charge. This law will allow utilities to recover the reasonable and prudent costs incurred for the repair, improvement or replacement of property to ensure efficient, safe and reliable services, which will provide additional co-benefit GHG emission reductions.

There have also been great strides made since 2009 in the alternative fuel vehicle sector. The Alternative Fuel Incentive Grant (“AFIG”) program, which was first implemented in the early 1990s, remains a very effective grant program in Pennsylvania. AFIG continues to provide rebates for lower-emitting alternative fueled vehicles (“AFVs”) and also provided a \$1 million

⁶ U.S. EPA, Clean Air Market Emissions Report – Pennsylvania (2010).

grant for the installation of electric vehicle charging infrastructure at each of the rest stops along the Pennsylvania Turnpike.

In addition to this program, Act 13 of 2012 provided \$20 million, funded by natural gas operator impact fees, over three years for the purchase or retrofit of heavy-duty vehicles to operate on natural gas. In the two of three grant rounds, 713 heavy-duty vehicles were purchased or converted to run on natural gas, which will support 30 new re-fueling stations in Pennsylvania. It is projected that these projects will displace 8.34 million gallons of gasoline each year which will result in the reduction of CO₂ emissions.

The 2013 Update also identifies nine different actions that the Department recommends to the Pennsylvania Legislature to further reduce GHG emissions. These recommendations include addressing the long-term liability of carbon capture and sequestration; providing incentives for coal mine methane usage; evaluating Act 11 of 2012 (Utility Distribution System Improvement Charge); expanding access to natural gas utilities; providing incentives for AFVs; considering legislation for energy use profiling of commercial buildings; expanding competitive electricity markets to foster and encourage alternative and renewable energy suppliers to enter Pennsylvania's market; supporting the implementation of the Alternative Energy Portfolio Standard ("AEPS"); and amending AEPS to include additional waste-to-energy facilities.

2. Climate Science

The current science related to climate change was examined by the Department as part of the 2009 Plan.⁷ Impacts that are already underway and will be realized as a result of current atmospheric GHG concentrations include 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; and
- 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°C (4.3°F) above pre-industrial temperatures, even if GHG concentrations had been held constant at 2005 levels.

The 2009 Plan states that the scientific community is overwhelmingly in agreement that anthropogenic climate change is occurring and that mitigation and adaptation actions need to be implemented. Moreover, the 2009 Plan plainly states that the need to reduce GHG emissions is clear.⁸

⁷ 2009 Plan at ExS-2.

⁸ *Id.*

3. The 2009 Plan GHG Emissions Inventory and Reference Case Projections

The Department, as part of the 2009 Plan, prepared Pennsylvania's anthropogenic GHG emissions inventory and reference case projections covering the period from 1990 to 2020.⁹ The inventory and reference case projections provided the Department with an initial, comprehensive understanding of current and possible future GHG emissions.

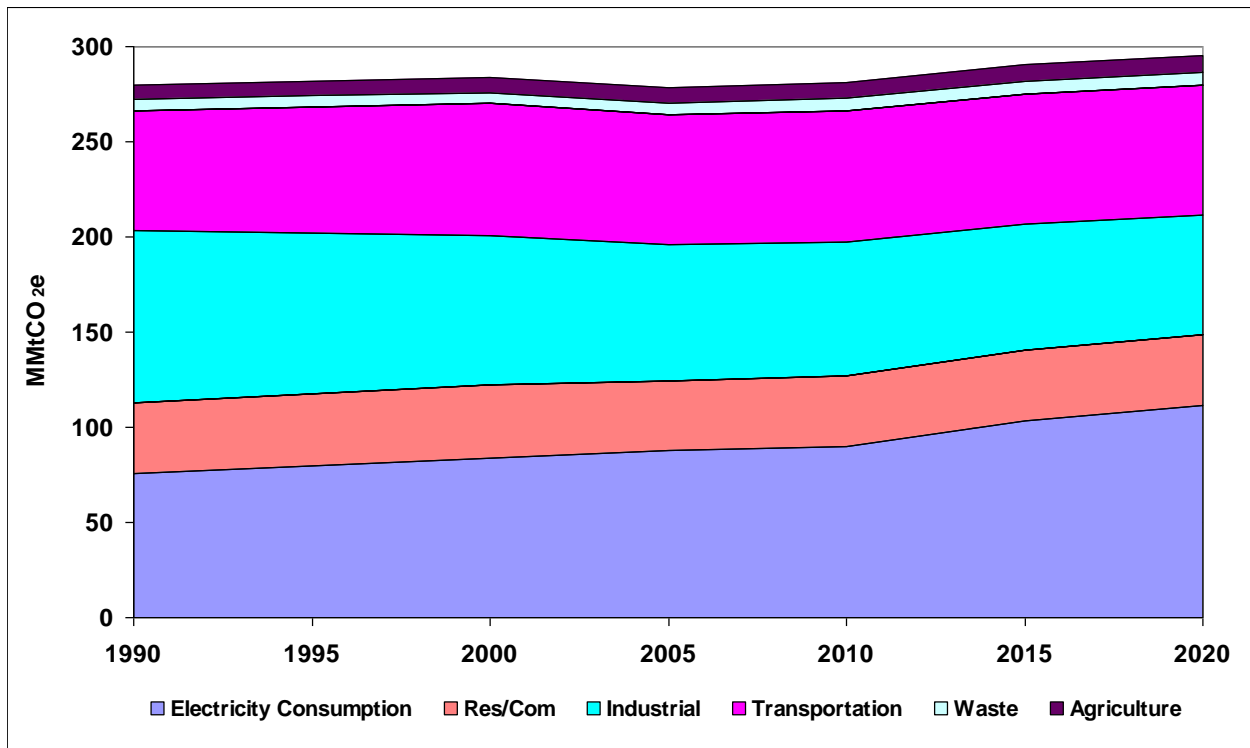
The inventory and projections cover the six types of gases included in the U.S. anthropogenic GHG inventory: carbon dioxide ("CO₂"), methane ("CH₄"), nitrous oxide ("N₂O"), hydrofluorocarbons ("HFCs"), perfluorocarbons ("PFCs"), and sulfur hexafluoride ("SF₆"). Emissions of these GHGs are presented using a common metric, CO₂e, which indicates the relative contribution of each gas, per unit mass, to global average radiative forcing on a global warming potential-weighted basis.

As illustrated in Figure 1, activities in Pennsylvania accounted for approximately 284 MMtCO₂e of gross anthropogenic GHG emissions (consumption basis) in 2000, an amount equal to about 4.0 percent of total U.S. gross anthropogenic GHG emissions (based on 2000 U.S. data). On a net emissions basis (i.e., including carbon sinks), Pennsylvania accounted for approximately 264 MMtCO₂e of emissions in 2000, an amount equal to 4.1 percent of total U.S. net anthropogenic GHG emissions. Pennsylvania's GHG anthropogenic emissions remained flat in comparison with those of the nation as a whole. From 1990 to 2000, Pennsylvania's gross anthropogenic GHG emissions increased by only 2 percent, while national gross emissions rose by 14 percent. From 2000 to 2010, Pennsylvania's GHG emissions decreased 7 percent, while national gross emissions decreased 3.8 percent.

⁹ *Id.* at 3-1.

On a per capita basis, Pennsylvania residents emitted about 23 metric tons (t) of gross CO₂e in 2000, less than the national average of about 25 tCO₂e. Both Pennsylvania and national per capita emissions remained relatively flat from 1990 to 2000. In both Pennsylvania and the nation as a whole, economic growth exceeded emissions growth throughout the 1990–2000 period. From 1990 to 2000, emissions per unit of gross product dropped by 19 percent nationally and by 35 percent in Pennsylvania. In 2010, Pennsylvania residents emitted about 20 tCO₂e less than the national average of about 23 tCO₂e.

Figure 1. Gross Anthropogenic GHG Emissions by Sector, 1990–2020: Historical and Projected (Consumption-Based Approach) Business-as-Usual / Base Case¹⁰



MMtCO_{2e} = million metric tons of carbon dioxide equivalent; Res/Com = residential and commercial.

Also illustrated in Figure 1 under the reference case projections from the 2009 Report, Pennsylvania’s gross anthropogenic GHG emissions are projected to increase to approximately 295 MMtCO_{2e} by 2020, or about 4.0 percent above 2000 levels. This equates to a 1.0 percent average annual rate of growth in emissions from 2000 to 2020. Relative to 2000, the share of emissions associated with electricity consumption increases to 38 percent by 2020. The share of emissions from the industrial sector drops to 21 percent by 2020. The shares of emissions from the residential and commercial fuel use sectors and the transportation sector both decrease slightly (i.e., 1.0 percent each) from their relative share of emissions in 2000. The share of emissions from the waste management and agriculture sectors remain the same in 2020 as their shares in 2000.

¹⁰ *Id.* at 1-9.

Emissions associated with electricity consumption are projected to be the largest contributor to future GHG emissions growth by far;¹¹ emissions from waste management and agriculture are modest contributors to future emissions growth as shown in Figure 1, while emissions from all other sectors decrease from 2000 to 2020.

4. Pennsylvania GHG Mitigation Actions Identified in the 2009 Plan

a. Introduction

The Department developed the 2009 Plan based on the recommendations of the CCAC as an initial step in establishing a basis for moving forward on the implementation of climate change actions in Pennsylvania. The CCAC and the Department reviewed over 100 GHG mitigation actions covering a wide range of emissions impacts and cost-benefit results.¹² Fifty-two mitigation actions were recommended by the CCAC. Of these 52 recommendations, the CCAC approved 28 unanimously, 11 with only three or less not in support, and 13 plans were voted with at least 13 in-support to eight not-in-support. The 2009 Plan found that these 52 recommendations or work plans that have the potential to reduce Pennsylvania's GHG emissions by approximately 85 MMtCO₂e or by roughly 30 percent below 2000 while providing cumulative savings of about \$12 billion between 2009 and 2020. The weighted-average cost effectiveness of these recommendations is estimated to be a savings of about \$21 per metric tCO₂e emissions reduced.

It must be noted that not all of the 52 recommendations were implemented. However, the Department continues to work with stakeholders in developing cost-effective GHG emissions

¹¹ *But see infra* Table 3 where current projections suggest a decline in CO₂ emissions from the electricity generation sector.

¹² *Id.* at 1-11.

reduction strategies like those identified in the 2013 Update. While each work plan will not be described in this Evaluation Report on the Petition for Rulemaking, the following summary in Table 1 is illustrative of those recommendations.

Table 1. Summary by Sector of Estimated Impacts Associated with Implementing All of the CCAC Work Plan Recommendations (cumulative reductions and costs/savings)¹³

Sector	Annual Results (2020)			Cumulative Results (2009-2020)		
	GHG Reductions (MMtCO ₂ e)	Costs (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	GHG Reductions (MMtCO ₂ e)	Costs (NPV, Million \$)	Cost-Effectiveness (\$/tCO ₂ e)
Residential Commercial	32	-\$538	-\$17	215	-\$3,668	-\$17
Electricity Generation, Transmission, and Distribution	21.4	\$248	\$12	120	\$638	\$5
Industry	5.8	-\$365	-\$62	33	-\$1,072	-\$33
Waste	5.9	-\$49	-\$8	37	-\$298	-\$8
Land Use & Transportation	7	-\$494	-\$75	60	\$2,805	\$47
Agriculture	1.4	-\$62	-\$44	10	-\$380	-\$37
Forestry	11.3	-\$1,376	-\$121	98	-\$10,177	-\$104
Total (includes all adjustments for overlaps)	85	-\$2,636	-\$31	572	-\$12,151	-\$21

GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent.

Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost savings associated with the work plans.

Within each sector, values have been adjusted to eliminate double counting for work plan recommendations or elements of work plan recommendations that overlap. In addition, values associated with work plan recommendations or elements of work plan recommendations within a sector that overlap with recommendations or elements of recommendations in another sector have been adjusted to eliminate double counting.

In addition to these 52 work plans, in the 2009 Plan, the Department identified recent federal and state actions that reduced GHG emissions even more than that projected through

¹³ *Id.* at 1-13.

implementation of the 52 recommendations alone.¹⁴ Those actions are additional strategies that target the electricity generation, residential/commercial, and transportation sectors.

b. Electricity Generation Statutory Strategies

i. The Pennsylvania Alternative Energy Portfolio Standard (AEPS)

The Alternative Energy Portfolio Standards (“AEPS”) Act of 2004, 73 P.S. §§ 1648.1-1648.8, requires electric distribution companies (“EDCs”) and electric generation suppliers (“EGSs”) to supply 18 percent of electricity using alternative energy resources by 2021. The percentage of Tier I, Tier II and solar alternative energy credits that must be included in sales to retail customers gradually increases over this period. EDCs and EGSs meet their AEPS requirements through the purchase of alternative energy credits (“AECs”) in amounts corresponding to the percentage of electricity that is required from alternative energy sources.

The PUC is responsible for carrying out and enforcing the provisions of the law. The Department is charged with rendering determinations of resource eligibility and ensuring compliance with all environmental, health and safety laws and standards relevant to the law’s implementation. The PUC and Department are charged with monitoring compliance with the Act, the development of the alternative energy market and the costs of alternative energy, and to conduct an ongoing alternative energy planning assessment. The PUC and Department are to report their findings and any recommendations for changes to the Act to the General Assembly via an annual report. As of the 2012 reporting year, all EDCs and EGSs were in compliance for their AEPS obligations through the purchase of the requisite number and/or retirement of Solar, Tier I, and Tier II AECs.¹⁵

¹⁴ *Id.* at 1-9.

¹⁵ The 2012 Annual Report Alternative Energy Portfolio Standards Act of 2004 is available at http://www.puc.pa.gov/electric/pdf/AEPS/AEPS_Ann_Rpt_2012.pdf.

The Department estimates, that based on the cumulative results (2009-2020), GHG reductions for this program is 76 MMt CO₂e.¹⁶

ii. Act 129 of 2008 - Phases I, II, and III

Act 129 of 2008 was signed into law on October 15, 2008 and requires electricity reduction measures. The Pennsylvania PUC has primary implementation responsibility and has established an energy efficiency and conservation program implementation order. This order requires all EDCs to develop and implement cost-effective energy efficiency and conservation plans to reduce consumption and peak load within their service territories.

In October 2009, the PUC approved plans from seven Pennsylvania EDCs – Allegheny Power Co.; Duquesne Light Co.; Metropolitan Edison Co.; PECO Energy Co.; Pennsylvania Electric Co.; Pennsylvania Power Co. and PPL Electric Utilities Corp. – detailing how the companies intend to achieve consumption and peak demand reductions. In general, the EDC plans for residential consumers include, among other things, residential ENERGY STAR™ and high efficiency appliance programs that provide rebates to customers for the purchase of certain energy efficiency appliances, and residential compact fluorescent lighting (“CFL”) rewards programs that provide rebates and point of sale discounts for the purchase and installation of CFLs.

Phase I of the Act required a reduction of 1 percent below consumption levels for the period of June 1, 2009 through May 31, 2010 in total electricity consumption by May 31, 2011. Phase I also required a 3 percent reduction in total electricity consumption by May 31, 2013 from the same period benchmark. Phase II of Act 129 requires a reduction in total electricity consumption from June 1, 2012 through May 31, 2016 equal to 3,313,246 MWh, which equates

¹⁶ 2009 Plan at 4-9.

to about 1,104,415 MWhs per year. Phase III, if implemented, through the years 2017 to 2020, annual reductions equal to 0.75 percent of projected electricity consumption would be required.

The Department estimates that based on the cumulative results (2009-2020) GHG reductions will be 40 MMtCO_{2e}.¹⁷

c. Residential and Commercial Regulatory Strategies

i. Residential/Commercial Energy Efficiency Standards

In *New York v. Bodman*, 05 Civ. 7807 (S.D.N.Y.), the Department and a number of other states secured a federally enforceable settlement agreement with DOE to establish energy efficiency standards for a range of consumer and commercial products that use large amounts of energy including electricity, natural gas, and home heating oil as required under the Energy Policy Conservation Act, 42 U.S.C. §§ 6291 *et seq.*¹⁸

As part of that agreement, the Department and its litigation partners secured energy efficiency standards for 23 categories of sources including: Room Air Conditioners; Central Air Conditioners; Water Heaters; Pool Heaters; Direct Heating Equipment; Furnaces and Boilers; Small Furnaces; Mobile Home Furnaces; Dish Washers; Clothes Dryers; Fluorescent Lamp Ballasts; Gas Kitchen Products; Gas and Electric Kitchen Products; General Service Fluorescent Lamps; Incandescent Reflector Lamps; General Service Fluorescent and General Service Incandescent Lamps; Packaged Terminal Air Conditioners and Heat Pumps; Packaged Boilers; Instantaneous Water Heaters less than 10 Gallons Volume; Electric Motors; High Intensity Discharge Lamps; Electric Distribution Transformers; and Small Electric Motors.

¹⁷ *Id.* See also “Act 129 Statewide Evaluator Quarterly Report 2nd Quarter, Program Year 3”, March 27, 2012, available at http://www.puc.pa.gov/electric/pdf/Act129/SWE_PY3-Q2_Report.pdf.

¹⁸ See also “Energy Conservation Standards Activities Report to Congress,” August 2012, available at http://www1.eere.energy.gov/buildings/appliance_standards/schedule_setting.html

The improved energy efficiency standards will result in less energy usage and lower GHG emissions. Additionally, DOE has established a multi-year schedule of rulemaking activities for energy conservation standards and test procedures.¹⁹

The Department estimates that such standards are projected to reduce GHG emissions in Pennsylvania cumulatively (2009-2020) by 28.7 MMtCO₂e by 2020.²⁰

d. Transportation Regulatory Strategies

*i. **Pennsylvania Clean Vehicles Program***

Under 25 Pa. Code Chapter 126, Subchapter D, the Pennsylvania Clean Vehicles Program was established to achieve emission reductions from new motor vehicles. Starting with model year 2008, any subject motor vehicle must be certified by the California Air Resources Board (“CARB”). Any changes to California’s low-emission vehicle program are automatically incorporated by reference into the Pennsylvania program.

The Department estimates that cumulative (2009-2020) GHG reductions from this program alone will result in 1.27 MMtCO₂e by 2020.²¹

On May 7, 2010, EPA and the National Highway Transportation Safety Administration (“NHTSA”) issued a joint Final Rulemaking establishing GHG emission standards and CAFE standards for model years 2012-2016 passenger vehicles. The combined GHG and fuel economy standards are referred to as the National Program. 75 Fed. Reg. 25,324. The 2012-2016 National Program overall is expected to result in fuel economy improvement levels equivalent to 35.5 miles per gallon. On October 15, 2012, EPA and NHTSA issued a joint Final Rulemaking to extend the National Program of harmonized GHG and fuel economy standards to model years

¹⁹ *Id.* at 19.

²⁰ 2009 Plan at 5-5.

²¹ *Id.* at 6-6.

2017-2025 passenger vehicles. 77 Fed. Reg. 62624. The 2017-2025 National Program overall is expected to result in fuel economy improvement levels equivalent to 54.5 miles per gallon.

The federal government worked with CARB and others to establish a consistency between the National Program and the CARB standards that Pennsylvania adopted. The CARB standards are more stringent for the early model years, but almost identical to the National Program starting with model year 2016. Pennsylvania receives additional GHG reduction benefits from the implementation of the National Program, as opposed to the CARB GHG regulations alone. In addition to the GHG reductions from new CARB-certified vehicles belonging to Pennsylvania residents, there will also be a reduction in GHG emissions from new vehicles traveling in the state that may have originated in states that do not require CARB certification.

The Department estimates Pennsylvania's cumulative emission reductions from 2009 through 2020 to be 57.3 MMtCO₂e.²²

ii. Biofuel Development

The Biofuel Development and In-State Production Incentive Act, 73 P. S. §§ 1650.1—1650.7, which is enforced by the Pennsylvania Department of Agriculture, requires minimum volumes of cellulosic ethanol and biodiesel to be blended into gasoline and diesel fuel, commensurate with specified in-state production levels of these biofuels.

The Department estimates that cumulative (2009-2020) CO₂e emission reductions will amount to 14.8 MMtCO₂e.²³

²² *Id.*

²³ *Id.*

iii. Diesel Anti-Idling

The Diesel-Powered Motor Vehicle Idling Act, 35 P.S. § 4601 *et seq.*, restricts diesel idling to 5 minutes in any continuous 60-minute time period for diesel-powered vehicles with a gross weight of 10,001 pounds or more engaged in commerce. This act is primarily an air pollution control measure, and reductions in fuel use and CO₂ emissions are incidental. However, the Department estimates CO₂e emission reductions of 0.7 MMtCO₂e.²⁴

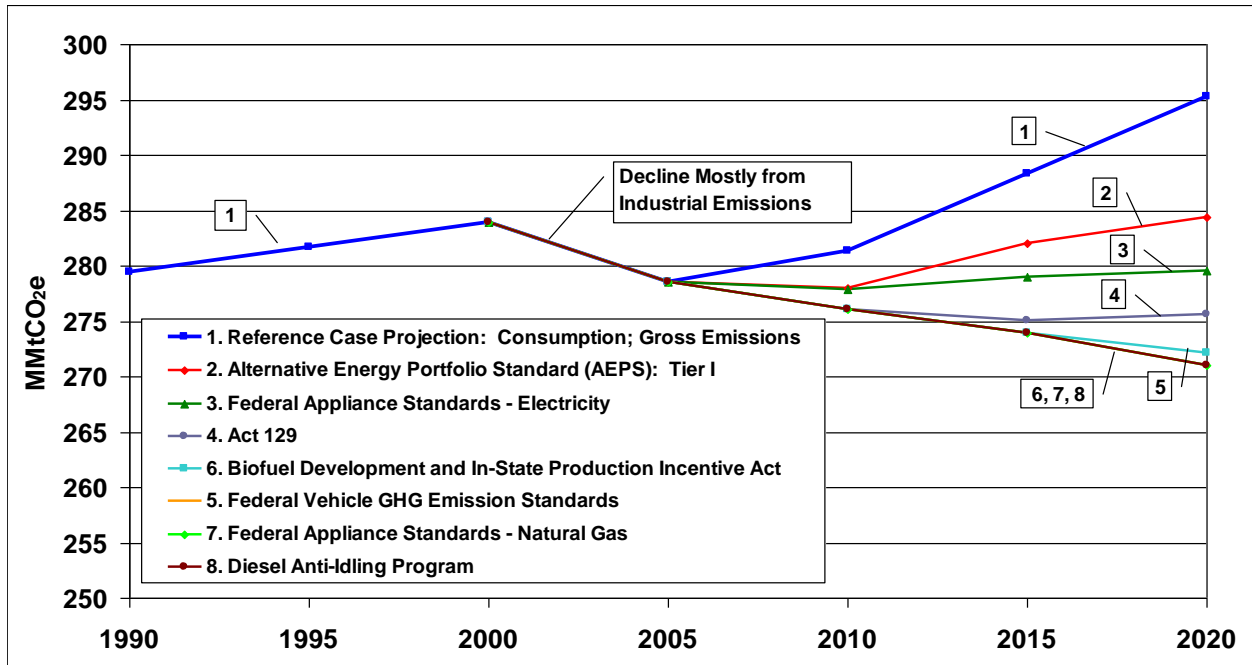
5. Recent Federal and State Actions Emission Reduction Projections

The recent federal and state actions described above were not included in the original GHG emissions forecast for the 2009 Plan. The Department identified and analyzed these actions separately in the 2009 Plan and quantified their emission reductions. These GHG emission reductions are summarized in Figure 2. Table 2 provides the numeric estimates underlying Figure 2. Together the seven actions are projected to reduce GHG emissions in Pennsylvania by approximately 24.6 MMtCO₂e in 2020, representing an 8.7 percent reduction in GHG emissions below 2000 levels.

²⁴

Id.

Figure 2. Estimated Emission Reductions Associated with the Effect of State and Federal Actions in Pennsylvania (Consumption-Basis, Gross Emissions)²⁵



²⁵ *Id.* at 1-10.

Table 2. Estimated Annual GHG Emission Reductions (MMtCO₂e) Associated with the Effect of State and Federal Actions in Pennsylvania (Consumption-Basis, Gross Emissions)²⁶

Actions*	Emissions Reductions (MMtCO ₂ e)				
	2000	2005	2010	2015	2020
State Alternative Energy Portfolio Standard (AEPS): Tier I			3.40	6.29	11.00
Federal Appliance Standards – Electricity			0.14	3.05	4.77
State Act 129			1.74	3.99	3.99
Federal Vehicle GHG Emission Standards			0.00	0.02	1.05
State Biofuel Development and In-State Production Incentive Act			0.02	1.07	3.47
Federal Appliance Standards - Natural Gas			0.00	0.07	0.30
State Diesel Anti-Idling Program			0.06	0.06	0.06
Total GHG Reductions from Actions			5.36	14.55	24.64
	Emissions (MMtCO ₂ e)				
	2000	2005	2010	2015	2020
Reference Case Projection: Consumption; Gross Emissions	283.9	278.6	281.4	288.4	295.3
Reference Case Projection after Subtracting Reductions from Recent Actions	283.9	278.6	276.0	273.8	270.7

* Actions are listed in descending order by their emission reductions.

²⁶

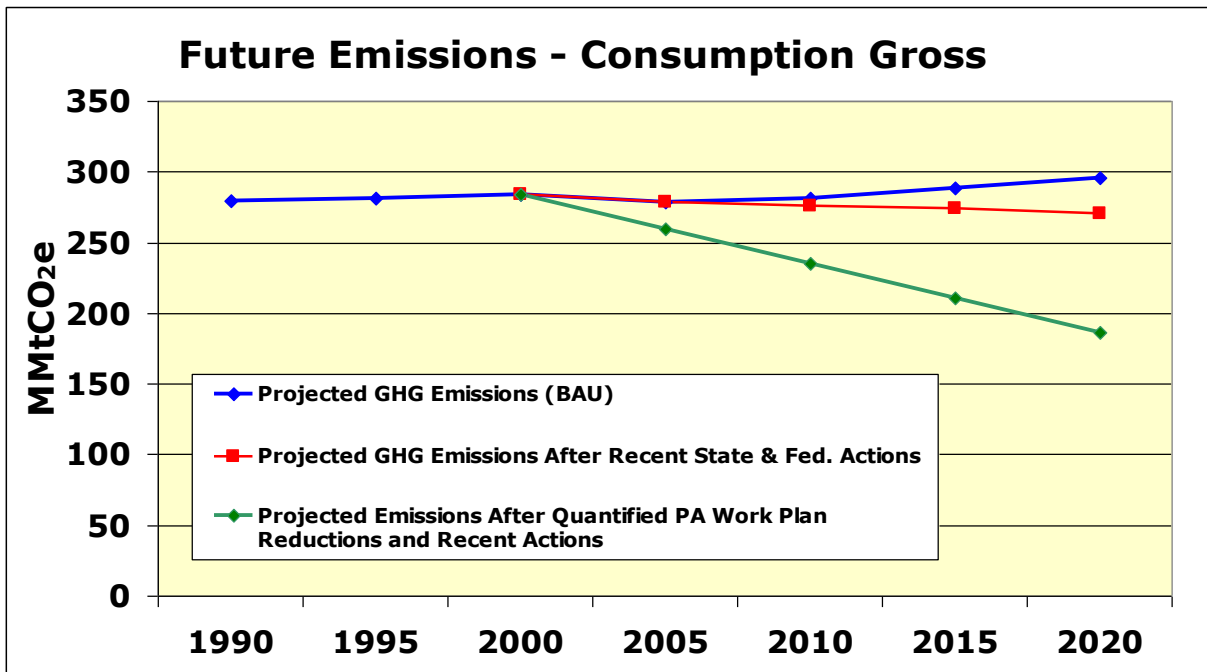
Id.

6. Combined Emission Reduction Projections Identified in the 2009 Plan

The 2009 Plan found that combination of emission reductions associated with the 52 work plan recommendations and additional recent state and federal actions suggest that Pennsylvania has the potential to reduce its annual GHG emissions in 2020 by about 39 percent below 2000 levels. Note that these estimates of the cumulative impacts of the work plans include adjustments to remove potential double counting of emission reductions and costs associated with work plans that overlap. Documentation of the adjustments for overlaps is provided in the sector-specific appendices containing the work plan recommendations.

Figure 3 presents a graphical summary of the potential cumulative emission reductions associated with the quantified work plans and federal actions relative to the business-as-usual (“BAU”) reference case projections.

Figure 3. Annual GHG Emissions: Reference Case Projections and Work Plan Recommendations (Consumption Basis, Gross Emissions)²⁷



MMtCO2e = million metric tons of carbon dioxide equivalent; GHG = greenhouse gas; BAU = business-as-usual.

²⁷ *Id.* at 1-12.

Table 3 provides the numeric estimates underlying Figure 3.

Table 3. Annual Emissions: Reference Case Projections and Impact of Work Plan Recommendations (Consumption Basis, Gross Emissions)²⁸

Consumption Basis - Gross Emissions	1990	2000	2005	2010	2015	2020
Projected GHG Emissions (BAU)	279.5	283.9	278.6	281.4	288.4	295.3
Reductions from Recent State and Federal Actions			0.0	5.4	14.6	24.6
Projected GHG Emissions After Recent State and Federal Actions			278.6	276.0	273.8	270.7
Total GHG Reductions from PA Work Plans						84.7
Percent Below 2000 Levels from PA Work Plans						30%
Projected Emissions After Quantified PA Work Plan Reductions and Recent Actions						186.0
Percent Below 2000 Levels from PA Work Plans and Recent State and Federal Actions						39%

The 2009 Plan found that the 52 specific recommendations as well as several recent actions taken by Pennsylvania and the federal government combined will provide GHG emissions reductions in Pennsylvania of 39 percent below 2000 levels in the year 2020. The 2009 Plan found that the 52 recommendations on their own are anticipated to yield a 30 percent reduction in emissions by 2020, putting Pennsylvania well on the path to making the critical reductions needed to prevent further impacts on the world’s climate.²⁹ In the 2009 Plan the Department specifically found that these values are within the range of reductions that is recommended by the IPCC as being necessary to stabilize the effects of climate change.³⁰

However, as previously mentioned not all of the 52 recommendations have been implemented. Nevertheless, Pennsylvania’s GHG mitigation strategies have not remained static.

²⁸ *Id.* at 1-13.

²⁹ *Id.* at ExS-3.

³⁰ *Id.*

The 2013 Update identifies additional strategies that are being or will be deployed in the near term to further reduce anthropogenic GHG emissions from sources in Pennsylvania.³¹

7. Pennsylvania GHG Mitigation Actions Identified in the 2013 Update

Under the APCA, the Department has the power and duty to implement the provisions of the federal Clean Air Act, (“CAA”) 42 U.S.C. § 7401 et seq. 35 P.S. § 4004(1). Moreover, under Section 5(a)(8) of the APCA, the EQB has the power and the duty to adopt rules and regulations to implement the provisions of the CAA. 35 P.S. § 4005(a)(8). Some of the CAA provisions that the Department implements are New Source Performance Standards, Prevention of Significant Deterioration requirements, and Maximum Achievable Control Technology Standards.

a. Current Electricity Generation Regulatory Strategies

i. New Source Performance Standards³²

The Department incorporates by reference U.S. EPA’s New Source Performance Standards into its regulatory program under 25 Pa. Code Chapter 122 (relating to National Standards of Performance for New Stationary Sources). *See* 9 Pa. Bull. 1447 (April 28, 1979). As EPA develops GHG performance standards for new stationary sources, these standards are automatically incorporated into Pennsylvania law.

For example, on January 8, 2014, EPA announced proposed new source performance standards for emissions of CO₂, a GHG, for fossil fuel-fired electric utility generating units. 79 Fed. Reg. 1430. The rule will apply only to new fossil fuel-fired electric utility generating units (“EGUs”). For purposes of this rule, fossil fuel-fired EGUs include utility boilers,

³¹ 2013 Update at 6.

³² *Id.*

integrated gasification combined cycle (“IGCC”) units and certain natural gas-fired stationary combustion turbine EGUs that generate electricity for sale and are larger than 25 megawatts (“MW”).

EPA is proposing to set separate standards for natural gas-fired stationary combustion turbines and for fossil fuel-fired utility boilers and IGCC units. However, the rule will not apply to: liquid oil-fired stationary combustion turbine EGUs; new EGUs that do not burn fossil fuels (e.g., those that burn biomass only); and low capacity factor EGUs that sell less than 1/3 of their power to the grid.

EPA is proposing two limits for fossil fuel-fired utility boilers and IGCC units, depending on the compliance period that best suits the unit: 1,100 lb. CO₂/MWh-gross over a 12-operating month period, or 1,000-1,050 lb. CO₂/MWh-gross over an 84-operating month (7-year) period. EPA is proposing two standards for natural gas-fired stationary combustion units, depending on size: 1,000 pounds of CO₂ per megawatt-hour (lb. CO₂/MWh-gross) for larger units, those greater than 850 mmBTU/hr.; or 1,100 lb. CO₂/MWh-gross for smaller units, those less than 850 mmBTU/hr.

To date the Department has issued two plan approvals for the construction of combined cycle natural gas turbine projects with best available technology emission rates consistent with the proposed New Source Performance Standards for natural gas-fired EGUs as illustrated in Table 4.

Table 4. NSPS Emission Rates for New Natural Gas-Fired EGUs³³

Plan Approval Number	06-05150A Scenario 1	06-05150A Scenario 2	37-337A Scenario 1	37-337A Scenario 2	37-337A Scenario 3	37-337A Scenario 4
Date Issued	3/6/2013	3/6/2013	4/13/2013	4/13/2013	4/13/2013	4/13/2013
Applicant	Berks Hollow Energy Associates, LLC	Berks Hollow Energy Associates, LLC	Hickory Run Energy, LLC	Hickory Run Energy, LLC	Hickory Run Energy, LLC	Hickory Run Energy, LLC
No. of Turbines	2	2	2	2	2	2
Turbine Size (MW)	427.5	427.5	450	450	450	450
Turbine Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CO ₂ e (lb/MW-hr, 12-month average)	1000	1000	1000	1000	1000	1000

While the Department cannot estimate any overall CO₂e reduction that will result from the implementation of the NSPS, EPA estimates that based on the emission rate requirements under this proposal CO₂ emissions will be reduced by an average of 40 percent when compared to the expected emissions of a new super-critical pulverized coal boiler.³⁴

b. Current Industry Regulatory Strategies

i. Greenhouse Gas Tailoring Rule

In June 3, 2010, U.S. EPA promulgated its *Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule* which regulates GHG emissions from new and modified air contamination sources. 75 Fed. Reg. 31514. Pennsylvania implements these GHG requirements through its Prevention of Significant Deterioration of Air Quality (“PSD”) program under 25 Pa. Code Chapter 127, Subchapter D and Title V Operating Permits program under 25 Pa. Code Chapter 127, Subchapter G.

³³ The information for this table was taken directly from the plan approvals.

³⁴ 79 Fed. Reg. at 1471.

To date, the Department has issued four plan approvals for natural gas-fired EGUs that have GHG emission rates, which will reduce the growth of GHG emissions in Pennsylvania as shown in Table 5.³⁵

Table 5. PSD Facility-wide GHG Emission Rates for New Natural Gas-Fired EGUs³⁶

Plan Approval Number	08-00045A Scenario 1	08-00045A Scenario 2	41-00084A Scenario 1	41-00084A Scenario 2	06-05150A Scenario 1	06-05150A Scenario 2	37-337A Scenario 1	37-337A Scenario 2	37-337A Scenario 3	37-337A Scenario 4
Date Issued	10/10/12	10/10/12	1/31/13	1/31/13	3/6/13	3/6/13	4/13/13	4/13/13	4/13/13	4/13/13
Applicant	Moxie Liberty, LLC	Moxie Liberty, LLC	Moxie Patriot, LLC	Moxie Patriot, LLC	Berks Hollow Energy Associates LLC	Berks Hollow Energy Associates LLC	Hickory Run Energy LLC	Hickory Run Energy LLC	Hickory Run Energy LLC	Hickory Run Energy LLC
No. of Turbines	2	2	2	2	2	2	2	2	2	2
Turbine Size (MW)	468	454	472	458	427.5	427.5	450	450	450	450
Turbine Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CO ₂ e (TPY, facility-wide)	2,960,347	2,777,255	3,145,276	2,803,217	2,779,224	2,779,224	2,909,658	2,997,542	3,693,660	3,679,784

ii. Industrial Boilers and Process Heaters³⁷

The Department incorporates U.S. EPA’s Maximum Achievable Control Technology (“MACT”) requirements into its regulatory program under 25 Pa. Code Chapter § 127.35 (relating to Maximum Achievable Control Technology Standards for Hazardous Air Pollutants). See 24 Pa. Bull. 5899, (November 26, 1994). The performance or emission standards adopted by U.S. EPA under Section 112 of the CAA are also incorporated by reference into the Department’s permitting program under Section 6.6(a) of the APCA, 35 P.S. § 4006.6(a).

³⁵ For further discussion on how natural gas-fired EGUs are reducing GHG emission in Pennsylvania, see Pennsylvania GHG Emissions Trends under the 2013 Update, *infra*, page 43.

³⁶ The information for this table was taken directly from the plan approvals.

³⁷ 2013 Update at 16.

On December 20, 2012, EPA finalized MACT emissions standards for industrial boilers and process heaters. 78 Fed. Reg. 7138. In general, this final rule requires facilities classified as major sources of hazardous air pollutants with affected boilers or process heaters to reduce emissions of harmful toxic air emissions from these combustion sources. Existing affected boilers are required to comply with the MACT requirements by January 31, 2016, unless a one-year extension is granted under the CAA.

In order to comply with these standards, several existing industrial and institutional coal-fired boilers are in the process of being converted to burn natural gas, which will result in additional GHG emission reductions.

iii. Natural Gas Compression and Processing Facilities - General Permit 5 (GP-5)

On February 2, 2013, the Department finalized revisions to a general plan approval and general operating permit for natural gas-fired engines and equipment at gas processing plants and compressor stations which help move gas from well sites into transmission pipelines.³⁸

The revised general permit establishes requirements for best available technology and a comprehensive leak detection and repair program to minimize emissions including GHG emissions. The revised general permit also limits the GHG emissions including leaks from all sources and associated air pollution control equipment located at a natural gas compression and/or processing facility to 100,000 tons expressed as CO₂e on a 12-month rolling sum basis.

iv. Natural Gas Well Sites (Exemption Category No. 38)³⁹

On August 10, 2013, the Department finalized an amendment to the Air Quality Permit Exemption List for Category No. 38 (pertaining to oil and gas exploration, development, production facilities and associated equipment and operation). The final guidance for Category

³⁸ *Id.*

³⁹ *Id.*

No. 38 provides flexibility by allowing each owner or operator to seek an air quality Plan Approval from the Department or demonstrate compliance with requirements for controls and work practices more stringent than the federal rules. The Category No. 38 exemption criteria include practices such as Reduced Emission Completion or “green completion” instead of current practice of either venting or flaring. The criteria also include a leak detection and repair program for the entire well pad and facility, rather than just the storage vessels as required by federal rules.

This leak detection and repair program will have a significant impact on the reduction of methane emissions at these sources. According to EPA natural gas (methane) is approximately 25 times more harmful as a GHG than CO₂.⁴⁰ The GHG emissions including leaks from all sources and associated air pollution control equipment located at a well site is limited to 100,000 tons expressed as CO₂e on a 12-month rolling sum basis.

v. ***Emissions Reporting***⁴¹

The Department annually compiles an emissions inventory submitted by owners and operators of certain regulated air contamination sources as provided under 25 Pa. Code § 135.3 (related to reporting). The Chapter 135 reporting requirements were adopted under the authority of section 5(3) of the APCA, 35 P.S. § 4005(3), which specifically authorizes the EQB to require any person who owns or operates an air contaminant source to make reports. 16 Pa. Bull. 443, (February 15, 1986).

On December 26, 2012, the Department electronically notified the owners and operators of sources that report their emissions data electronically that they would be required to report by

⁴⁰ See “2013 Revisions to the Greenhouse Gas Reporting Rule and Final Confidentiality Determinations for New or Substantially Revised Data Elements,” 78 Fed. Reg. 71904, 71909. November 29, 2013.

⁴¹ 2013 Update at 10.

March 1st of the previous year, GHG emissions on an annual basis starting with 2012 as provided under 25 Pa. Code § 135.3. The Department also mailed notices to the owners and operators of air contamination sources that submit emissions inventory data using paper forms of the requirement to report GHG emissions on an annual basis starting with 2012.

In addition, EPA has instituted a GHG reporting rule for many industry sectors.⁴² These inventory efforts will allow the Department to develop more accurate GHG projections and will provide useful data for projecting and assessing future climate impacts.

*vi. PUC Efforts to Reduce Methane Leakage*⁴³

There are two PUC programs that will contribute to the reduction of natural gas leaks and thus decrease fugitive methane emissions in Pennsylvania. The amount of emission reduction has not been calculated by the PUC as such a reduction is viewed as a co-benefit and not the main driver for either program. The two programs are Act 11 of 2012 (or Distribution System Improvement Charge (“DSIC”)) and the PUC’s April 4, 2013, final rulemaking at L-2012-2294746, regarding unaccounted-for-gas (“UFG”).

On Feb. 14, 2012, Act 11 of 2012 was signed by Governor Tom Corbett and amended Title 66 (Public Utilities) of the Pennsylvania Consolidated Statutes to allow jurisdictional water and wastewater utilities, natural gas distribution companies, city natural gas distribution operations and EDCs to petition the commission for approval to implement a DSIC. The DSIC must be designed to provide for "the timely recovery of the reasonable and prudent costs incurred to repair, improve or replace eligible property in order to ensure and maintain adequate, efficient, safe, reliable and reasonable services." 66 Pa.C.S. § 1353 (a).

⁴² This GHG data is available at <http://www.epa.gov/ghgreporting/index.html>

⁴³ 2013 Update at 12.

Starting January 1, 2013, public utilities were eligible to petition the PUC for approval to establish a DSIC. A petition must contain the following elements: initial tariff; testimony and exhibits to demonstrate that the DSIC will ensure the provision of adequate, efficient, safe, reliable and reasonable service; long-term infrastructure plan; certification that a base rate case has been filed within the past five years; and any other information required by the PUC. Moreover, the petition must demonstrate that granting the petition and allowing the DSIC to be charged will accelerate the replacement of infrastructure. To date, Equitable, Peoples, Peoples TWP, PGW, UGI Penn Natural Gas, Inc., UGI Penn Gas, Inc. and Columbia Gas have filed DSIC petitions with the PUC.

The second program relates to UFG. In general, UFG is defined as the difference between total gas supplies delivered to the natural gas distribution company (“NGDC”) and the amount of that gas the NGDC subsequently delivers to its retail, commercial and industrial customers, adjusted for company use, temperature, pressure variations or other allowed variables. As the name implies, UFG is gas that is “lost” during transport from supplier to customer. This PUC rulemaking establishes the uniform terminology of UFG to describe gas lost from an NGDC’s system and determines that an end state UFG metric should be set at a maximum of 3 percent for distribution system UFG.

c. Current Transportation Strategies

*i. Retail Vehicle-Fueling Operations at Industrial Facilities (Exemption Category No. 33)*⁴⁴

On August 10, 2013, the Department also finalized an amendment to the Air Quality Permit Exemption List for Category No. 33 (pertaining to retail gasoline dispensing facilities and similar vehicle-fueling operations at industrial facilities). The criteria also include a leak

⁴⁴ 2013 Update at 17.

detection and repair program for the compressed natural gas fueling station to minimize GHG emissions. The GHG emissions including leaks from all sources and associated air pollution control equipment located at these facilities are limited to 100,000 tons expressed as CO₂e on a 12-month rolling sum basis.

ii. Alternative Fuel Grant Programs

The Alternative Fuel Incentive Grant (“AFIG”) program, which was first implemented in the early 1990s, remains a very effective grant program in Pennsylvania. AFIG continues to provide rebates for AFVs and also provided a \$1 million grant for the installation of electric vehicle charging infrastructure at each of the rest stops along the Pennsylvania Turnpike.⁴⁵

Pennsylvania’s AFIG Program allows for organizations, non-profit agencies, for-profit companies, Commonwealth or municipal authorities, and local transportation organizations to apply for grant funding for alternative fueled vehicles. This program allows eligible applicants to propose projects which will convert or purchase natural gas vehicles weighing less than 26,000 pounds, as well as convert or purchase electric, propane, or other AFVs of any size. The program also provides grants for innovation in alternative fuel transportation, including non-road vehicles, such as natural gas-powered trains or marine vessels.

Most recently, the AFIG Program awarded grants for 33 different projects that are expected to result in the deployment of 351 natural-gas-fueled vehicles and 337 propane-fueled vehicles. The vehicles deployed in this grant round will support 15 new and 30 existing fueling stations. The AFIG Program has also deployed a very successful rebate program, providing Pennsylvania consumers with 376 rebates for plug-in hybrid electric vehicles, 87 rebates for plug-in hybrid electric vehicles with smaller battery capacities, natural-gas fueled vehicles or propane-fueled vehicles.

⁴⁵ 2013 Update at 17.

iii. Natural Gas Energy Development Program⁴⁶

In addition to this program, Act 13 of 2012 provided \$20 million, funded by natural gas operator impact fees, over three years for the purchase or retrofit of heavy-duty vehicles to operate on natural gas. In the first of three grant rounds, 329 heavy-duty vehicles were purchased or converted to run on natural gas, which will support 16 new re-fueling stations in Pennsylvania. It is projected that these projects will displace 3.67 million gallons of gasoline each year, which will result in the reduction of 45,703 tons (.04 MMtCO₂e) of CO₂ per year.

Act 13 of 2012 provided \$20 million over three years, out of impact fees paid by natural gas operators, for the purchase or retrofits of large fleet vehicles 14,000 pounds or less to operate on CNG or LNG. In the first two years of the grant, 713 vehicles were converted to CNG or LNG, which supported the construction of 30 new natural gas fueling facilities. Of these new facilities, 12 have full public availability, 14 have limited public availability, and four are private facilities. The first two years of this three-year program will account for 8.34 million gallons of gasoline displaced each year.

d. Future Electric Generation Strategies

i. Performance Standards from Existing Sources⁴⁷

On June 25, 2013, the President of the United States, Barack Obama, directed U.S. EPA to issue proposed carbon pollution standards for existing power plants under Section 111(d) of the federal CAA, 42 U.S.C. § 7411(d), no later than June 1, 2014, and final standards no later than June 1, 2015. 78 Fed. Reg. 39535, (July 1, 2013). Any final standards will be incorporated into the Department's air quality regulatory program under 25 Pa. Code Chapter 122 (relating to

⁴⁶ *Id.* at 16.

⁴⁷ *Id.* at 7.

National Standards of Performance for New Stationary Sources). The timeline calls for states to submit implementation plans to EPA for the 111(d) existing source program by June 30, 2016.

Regulating under section 111(d) involves a three-step process. First, U.S. EPA releases the emission guidelines that identify systems of emission reduction and the best system of emission reduction for the covered pollutant, which in this case would be CO₂. Second, each state creates a plan that establishes a standard of performance and provides for implementation and enforcement of that standard. In the third and final step, each state submits to the U.S. EPA a section 111(d) plan, which the agency approves or denies based upon whether the plan satisfies the criteria laid out in the EPA's guidelines. If a state fails to submit a plan or submits a plan that the EPA determines is unsatisfactory, the EPA may develop a federal plan to implement and enforce the requirements for the state.

In anticipation of these new standards, the Department conducted two "listening sessions" on December 9 and 16, 2013, with stakeholders and the public to get their feedback on any potential U.S. EPA proposal.

8. Future Industry Strategies That May Reduce GHG Emissions Not Identified in the 2009 Plan or 2013 Update

a. Petroleum Refineries

On December 22, 2008, U.S. EPA proposed "Standards of Performance for Petroleum Refineries; Standards of Performance for Petroleum Refineries for Which Construction, Reconstruction, or Modification Commenced after May 14, 2007." 73 Fed. Reg. 78,522. According to EPA, refineries are estimated to be the second largest direct stationary source category of GHGs in the United States. Certain state and environmental groups filed petitions for judicial review of the final action under the CAA Section 111, 42 U.S.C. § 7411, entitled

"Standards of Performance for Petroleum Refineries, Final Rule," published at 73 Fed. Reg. 35,838 (June 24, 2008). EPA entered into a settlement agreement to resolve lawsuits filed by these groups seeking the promulgation of a NSPS to limit GHG emissions from petroleum refineries.⁴⁸ The deadline for EPA's actions on proposed determinations has been changed from February 14, 2014, to May 15, 2014. The deadline for EPA to take action on final determinations has been changed from December 19, 2014, to April 17, 2015.⁴⁹ Once this NSPS is finalized, it will be incorporated by reference under Pennsylvania law at 25 Pa. Code Chapter 122.

There are currently three refineries in Pennsylvania. Should any of these facilities seek to reconstruct or modify an affected unit, they would become subject to the requirements of any NSPS regulation promulgated by EPA.

9. Pennsylvania GHG Emissions Trends under the 2013 Update

a. Introduction

According to 2010 EPA data, on a gross emissions consumption basis (i.e., excluding carbon sinks), Pennsylvania accounted for approximately 264 MMt of CO₂e emissions, an amount equal to about 4.4 percent of total U.S. gross GHG emissions. On a net emissions basis (i.e., including carbon sinks), Pennsylvania accounted for approximately 230 MMtCO₂e of

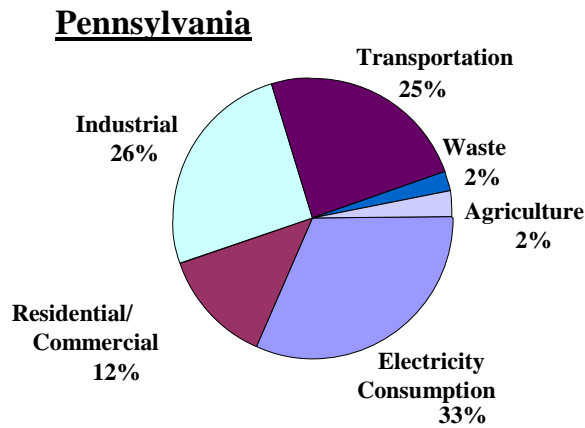
⁴⁸ The EPA settlement agreement is available at <http://www2.epa.gov/sites/production/files/2013-09/documents/refineryghgsettlement.pdf>

⁴⁹ The joint motion to amend the consent decree is available at http://www2.bloomberglaw.com/public/desktop/document/AIR_ALLIANCE_HOUSTON_et_al_v_JACKSON_Docket_No_112cv01607_DDC_Sep/1

emissions in 2010, an amount equal to 3.9 percent of total U.S. net GHG emissions.⁵⁰ Pennsylvania’s GHG emissions decreased along with those of the nation as a whole. From 2000-2010, Pennsylvania’s gross GHG emissions decreased by 7 percent, while national gross emissions decreased 3.8 percent.⁵¹ On a per capita basis, Pennsylvania residents emitted about 20 metric tons (t) of gross CO₂e in 2010, less than the national average of about 23 metric tCO₂e.

Figure 4 shows the gross anthropogenic GHG emissions by sector.

Figure 4. Gross Anthropogenic GHG Emissions by Sector, 2010: Pennsylvania



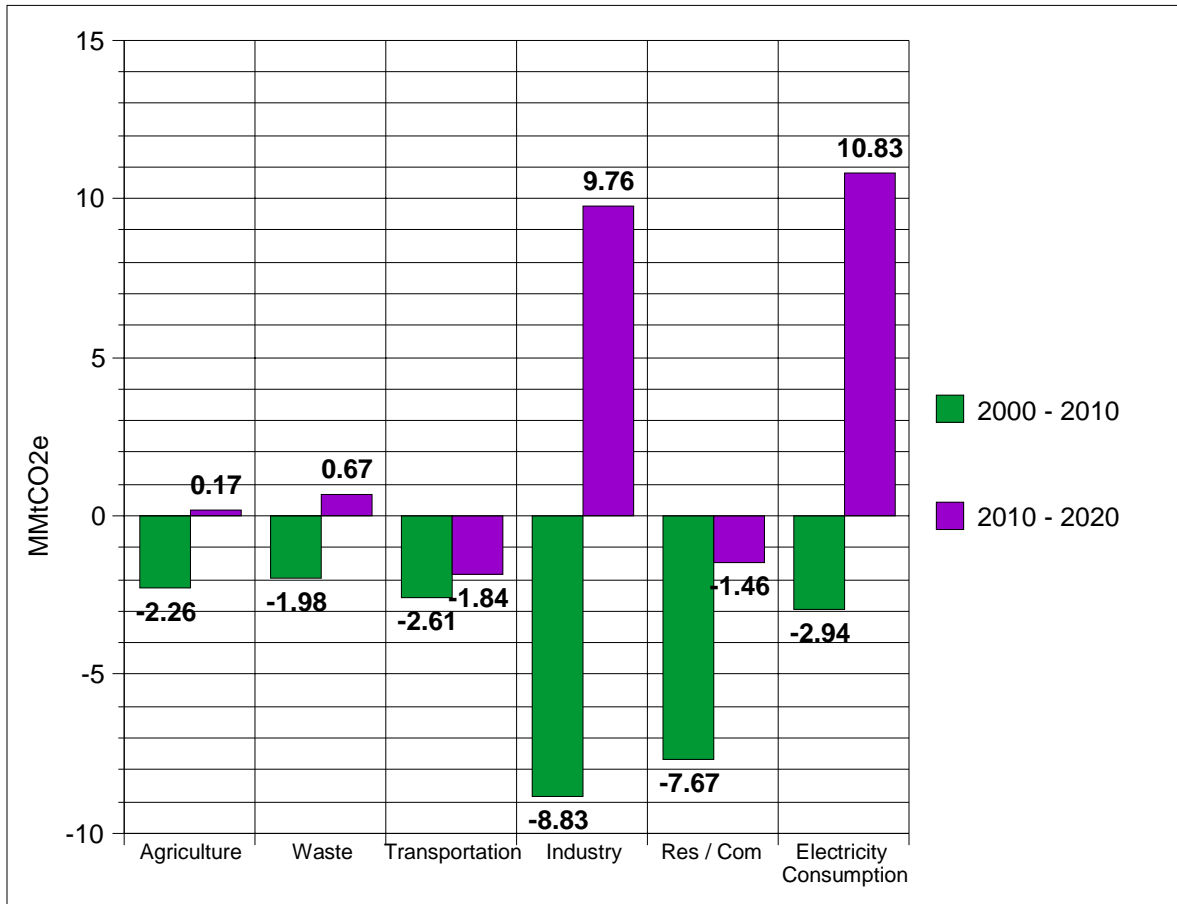
Relying on a variety of sources for projections, a simple reference case projection of GHG emissions through 2020 was developed in the 2013 Update as shown in Figure 5.⁵²

⁵⁰ The national emissions used for these comparisons are based on 2010 emissions from EPA, *Inventory of U.S. GHG Emissions and Sinks: 1990–2000*, April 15, 2008, EPA430-R-12-00. Available at: <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>

⁵¹ During this period, population grew by 3.2 percent in Pennsylvania and by 9.7 percent nationally.

⁵² 2013 Update at 23.

Figure 5. Sector Contributions to Gross Emissions Growth in Pennsylvania, 2000–2020: Reference Case Projections⁵³



b. Key Sector Analysis – Industrial

The Department in the 2013 Update determined that the industrial sector accounted for 26 percent of Pennsylvania’s gross GHG emissions in 2010, higher than the national average of 21 percent.⁵⁴ Fuel combustion to provide space heating, water heating, process heating, cooking, and other energy end-uses makes up the majority of industrial emissions.

Emissions from industrial processes account for 19 percent of the state’s industrial emissions in 2020. These emissions include: the use of hydrofluorocarbons (“HFCs”) and

⁵³ *Id.* at 25.

⁵⁴ *Id.*

perfluorocarbons (“PFCs”) as substitutes for ozone-depleting chlorofluorocarbons;⁵⁵ CO₂ released by cement and lime manufacturing; CO₂ released during soda ash, limestone and dolomite use; CO₂ released during iron and steel production; SF₆ used in electricity transmission and distribution systems; and HFCs, PFCs, and SF₆ released during semiconductor manufacturing. The fossil fuel production sector accounts for the remaining 25 percent of emissions from the industrial sector. These emissions are primarily from coal mining, although there are also emissions associated with the natural gas industry.

Using the currently available data, under the reference case projections, GHG emissions from the industrial sector are projected to increase by 13.36 percent from 2010 to 2020, to 78.96 MMtCO₂e in 2020. However, it should be noted that this inventory does not take into account recent actions like the Petroleum Refinery NSPS or natural gas conversions in the industrial sector that will further reduce GHG emissions from this sector.

c. Key Sector Analysis – Transportation

The Department in the 2013 Update determined that GHG emissions from transportation fuel use have decreased from 2000 to 2010 at an average annual rate of 3.8 percent.⁵⁶ In 2010, gasoline-powered on-road vehicles accounted for about 66 percent of transportation GHG emissions; on-road diesel vehicles for 22 percent; jet fuel and aviation gasoline for 7 percent and marine vessels, rail and other sources (natural gas- and liquefied petroleum gas-fueled vehicles used in transport applications) for the remaining 5 percent.

Overall, emissions from the transportation sector are expected to decline at a rate of about 0.1 percent annually from 2010 to 2020 to 65 MMtCO₂e. This overall decrease is driven by the

⁵⁵ Chlorofluorocarbons are also potent GHGs; however, they are not included in GHG estimates because of concerns related to implementation of the Montreal Protocol on Substances That Affect the Ozone Layer.

⁵⁶ 2013 Update at 27.

decrease in on-road gasoline emissions, declining at a rate of 0.7 percent per year from 2000 to 2020, reaching 39 MMtCO_{2e} in 2020. In contrast, the vehicle miles traveled by gasoline vehicles are expected to increase at a rate of 1.4 percent per year in the same time period. The decrease in on-road gasoline emissions is driven by the assumed increase in vehicle fuel economy resulting from the Energy Independence and Security Act of 2007 which increase Corporate Average Fuel Economy standards. Emissions from on-road diesel vehicles are projected to increase by 2.5 percent annually from 2010 to 2020.

Since 2008, Pennsylvania-based production in biodiesel has increased from an initial annual production of 25 million gallons to more than 40 million gallons in 2011. Production in the first six months of 2012 was more than 45 million gallons, and in 2013 through June 22.9 million gallons had been produced. Once statewide production reached 40 million gallons as it did in 2011, all diesel fuel sold in Pennsylvania was mandated to contain at least 2 percent biodiesel (“B2”) in the following year. This requirement for blending biodiesel increases as statewide production increases accordingly: 5 percent biodiesel (“B5”) one year after in-state production of biodiesel reaches 100 million gallons; 10 percent biodiesel (“B10”) one year after in-state production of biodiesel reaches 200 million gallons; and 20 percent biodiesel (“B20”) one year after in-state production of biodiesel reaches 400 million gallons. Capacity to produce biodiesel in Pennsylvania has exceeded 100 million gallons but due to changes with regard to companies entering and exiting the Pennsylvania market place has resulted in capacity fluctuating from year to year. Production has rarely exceeded 50 to 60 percent of the available capacity in any year.

d. Key Sector Analysis – Electricity Generation

Historically, the largest component of Pennsylvania’s GHG emissions inventory has been the electricity sector - primarily coal-fired generating stations. Coal-fired electric generating stations have accounted for approximately 50 percent of all Pennsylvania electricity generation for many years. Recently, the increased availability of natural gas supplies, resulting from the Marcellus Shale, has been shifting the state’s power generation share away from coal-fired to natural gas-fired generation stations. Coal’s share has declined over the past few years because of growing competition from more efficient natural gas-fired plants, new federal emissions standards, subsidized electric programs and AEPS.

From the available data presented in the 2013 Update, the electricity sector share of GHG emissions is projected to increase to about 98 MMtCO_{2e} by 2020 (consumption basis), or 8 percent above 2000 levels and 11 percent above 2010 levels.⁵⁷ The same data also show an increase of 9 percent in coal emissions above 2010 levels and an increase of 1 percent above 2000 levels. The EPA data captured in the 2020 projection does not represent the emissions reductions that will result from the retirement and deactivation of 13 Pennsylvania coal-fired generating units by 2016. Instead, it is representative of the “business as usual” use of coal-fired generating stations for the production of electricity.

Recent data from the EPA indicates that with the anticipated coal unit deactivations, the cumulative CO_{2e} emissions reductions will be approximately 13 MMtCO_{2e} with a corresponding capacity reduction of 6,500 MW. In the same time frame, the PJM electricity market proposed 11,659 MW of new generating capacity for Pennsylvania. The new capacity will be new natural gas-fired combined cycle electric generation plants. This new natural gas

⁵⁷ *Id.* at 28.

generated electricity will produce about 6.45 MMtCO₂e in 2020, resulting in a negative offset of 7.0 MMtCO₂e to the projected 2020 electricity GHG emission.⁵⁸ This will reduce the projected increases to about 4 percent below 2000 levels and 3 percent below 2010 levels. The Department believes that natural gas will continue to play a more significant role in electricity generation in Pennsylvania. However, emissions associated with electricity consumption are still projected to be the largest contributor to future GHG emissions inventories.

Along with the GHG inventory in the 2013 Update, the Department prepared a CO₂ emissions trend analysis for EGUs operating in Pennsylvania. This trend analysis is projected to the year 2020, using EPA's State Inventory Tool. In preparing the analysis the following assumptions were used:

- A 0.9 percent per year growth of electricity demand; (U.S. EIA, AEO May 2013)
- All proposed new power projects were added;
- All EGUs that are scheduled to be shut down were removed; and
- All other data was extracted from the EPA Clean Air Markets Division database.

⁵⁸

Id.

Table 6. CO2 Emission Trends from All EGUs Projected to 2020⁵⁹

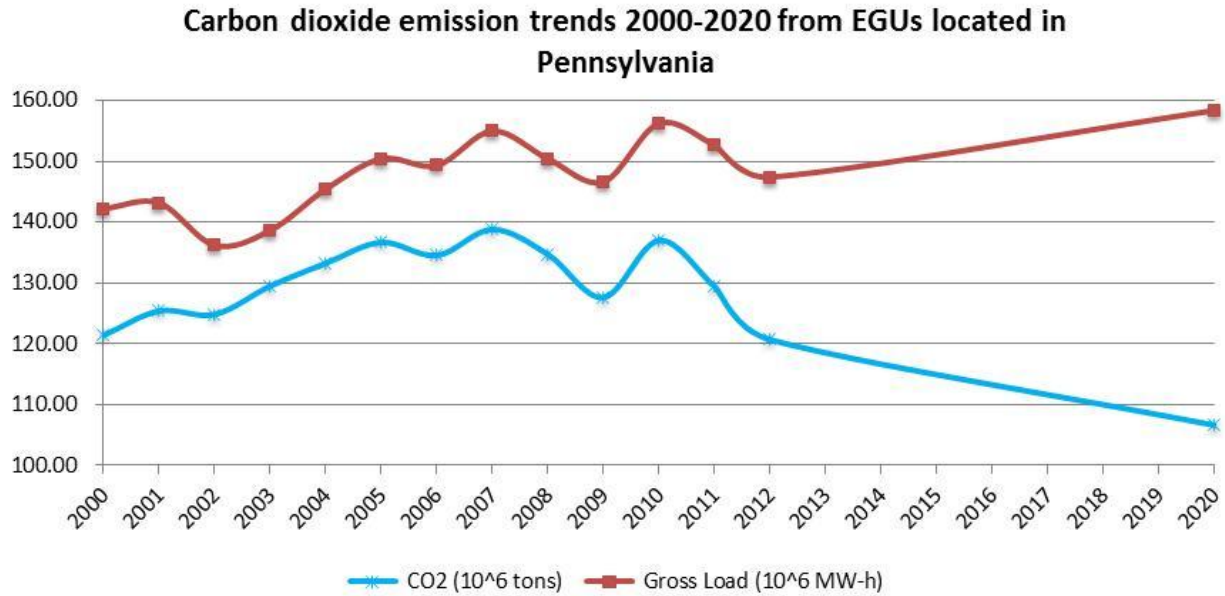
Year	CO2 (tons)	CO2 (10 ⁶ tons)	Heat Input (MMBtu)	Gross Load (MW-h)	Gross Load (10 ⁶ MW-h)	Average lbs/MWh
2000	121,409,680	121.41	1,206,528,839	142,254,370	142.25	1707
2001	125,402,320	125.40	1,180,119,246	143,184,791	143.18	1752
2002	124,854,653	124.85	1,251,865,327	136,215,651	136.22	1833
2003	129,509,485	129.51	1,292,537,172	138,653,840	138.65	1868
2004	133,263,467	133.26	1,356,529,559	145,464,463	145.46	1832
2005	136,691,667	136.69	1,383,442,193	150,458,619	150.46	1817
2006	134,546,579	134.55	1,362,254,850	149,364,836	149.36	1802
2007	138,832,451	138.83	1,424,203,567	155,042,650	155.04	1791
2008	134,714,655	134.71	1,381,296,576	150,455,844	150.46	1791
2009	127,645,017	127.65	1,353,775,190	146,679,469	146.68	1740
2010	137,014,082	137.01	1,445,867,861	156,273,105	156.27	1754
2011	129,419,962	129.42	1,395,662,942	152,683,792	152.68	1695
2012	120,696,891	120.70	1,347,762,894	147,450,917	147.45	1637
2020 (projected)	106,626,251	106.63	1,447,914,193	158,407,889	152.41	1346

Table 6 shows historical CO2 emissions data from 2000 to 2012 and the projected emissions for 2020. The historic data demonstrates a 1 percent decrease in CO2 emissions between 2000 and 2012. The projected 2020 data shows a 9 percent decline in emissions from 2012 levels and a decrease in CO2 of 10 percent below 2000 CO2 levels. The resulting decrease in CO2 emissions from EGUs is a result of two contributing factors: the shutdown of coal-fired EGUs across the state, and the conversion of other existing coal-fired EGUs to cleaner burning natural gas. Although CO2 emissions trends from EGUs show a decline through 2020, EGUs in

⁵⁹ *Id.* at 29.

Pennsylvania continue to increase gross load above 2000 levels. A 7 percent increase in gross load can be seen in Table 6 and Figure 6.

Figure 6. CO2 emission trend 2000-2020 from EGUs located in Pennsylvania⁶⁰



⁶⁰ *Id.* at 30.

Figure 7. Output based emission rate of CO2 2000-2020⁶¹
Output based emission rate of CO2 lbs/MWh 2000-2020

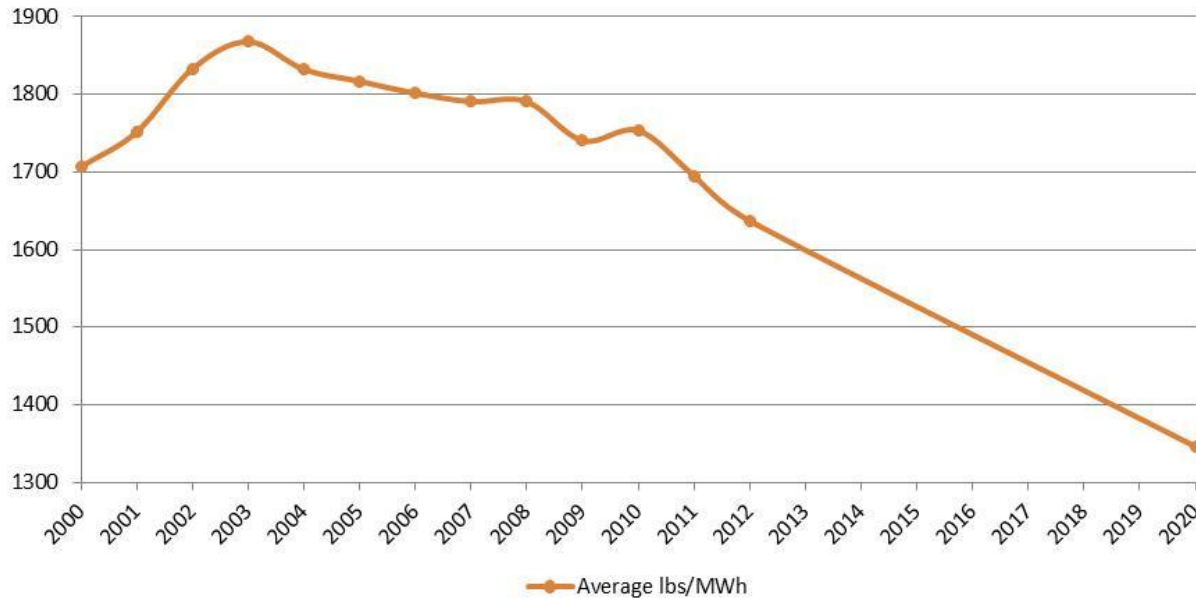


Figure 7 shows a decline in the emissions rate of CO2 projected from 2000 to 2020. As can be seen on the graph, the emissions rate declines from about 1,700 lbs/MWh in 2000 to about 1,350 lbs/MWh in 2020. This is approximately a 21 percent decrease in the CO2 emissions rate from PA’s EGUs over the projected 20-year period. The emissions rate reduction is also attributed to the planned retirement of coal-fired EGUs across the state and the planned conversion of other existing coal-fired EGUs to cleaner burning natural gas.

e. Electric Power Plant Conversions and Deactivations

There is a growing trend in the utility industry to convert existing coal-fired power plants to burn natural gas, deactivate or reduce operations. This trend is driven by a number of factors, including: state-level renewable portfolio standards; abundant and low-cost natural gas; federal environmental regulations, like the Mercury and Air Toxics Standards Rule,⁶² which is

⁶¹ *Id.*

⁶² 77 Fed. Reg. 9304, February 16, 2012.

incorporated by reference under Pennsylvania law; consumer demand; restructuring of the electric generation industry in Pennsylvania; competition from rate-based regulated out-of-state generators; and an economic climate that contributes to the reduced cost competitiveness of coal. The GHG emissions from a coal-fired power plant are reduced significantly after the plant is converted to burn natural gas.

Currently in Pennsylvania there are 12 projects that are proposed to be constructed as natural gas-fired electric generating stations. Moreover, there are 13 coal-fired EGUs that are either deactivated or slated for deactivation in the near term. The effect of this changing EGU profile will continue to reduce CO₂ emissions from the fossil fuel-fired electric generating fleet in Pennsylvania. The CO₂ emissions from the electric generating sector have declined by 12 percent from 2005-2012 and are projected to decline by 22 percent from 2005 through 2020. Some of the project details are illustrated in Table 7.

Table 7. Proposed New Power Projects⁶³

Proposed new facilities for 2016	Capacity (MW)	PTE CO2 (tons)	CO2 tons at 57.9 percent capacity	Gross Load (MW-h)	Gross load (MW-h) at 57.9 percent capacity	Average lbs/MWh
Moxie Liberty	900	2,960,271	1,713,997	7,884,000	4,564,836	751
Berks Hollow, Berks	855	2,761,798	1,599,081	7,489,800	4,336,594	737
Moxie Patriot	900	3,144,823	1,820,853	7,884,000	4,564,836	798
Tanaska	900	3,144,823	1,820,853	7,884,000	4,564,836	798
Tanaska II	900	3,144,823	1,820,853	7,884,000	4,564,836	798
Sunbury	1064	2,950,386	1,708,273	6,447,144	3,732,896	915
Future Power	300	1,074,847	622,336	2,628,000	1,521,612	818
Hickory Run	900	4,150,138	2,402,930	788,4000	4,564,836	1053
Crawford Renewable	90	854,324	494,654	788,400	456,484	2167
Robinson Power	120	619,360	358,609	1,051,200	608,645	1178
Proctor and Gamble	64	300,972	174,263	560,640	324,611	1074
New Castle	354	1,744,213	1,009,899	2,864,551	1,658,575	1218
Total	7,347	26,850,777	15,546,600	61,249,735	35,463,597	872

⁶³ AES Beaver Valley in Potter Twp., Beaver County, is also planning to convert its operations to natural gas.

Table 8. Planned Facility Shutdowns by 2016

Facilities planning to be shut down by 2016	Capacity (MW)	2012 CO2 (tons)
Armstrong	326	363,084
Hatfields Ferry	1,728	9,927,195
Mitchell	374	1,272,554
Cromby (2011 data)	420	243,168
Eddystone	707	98,025
New Castle	354	445,836
Elrama	510	130,751
Portland	621	176,956
Shawville	632	1,457,952
Titus	261	109,558
Sunbury	490	226,846
Piney Creek	36	407,753
Hunlock Creek (2011 data)	50	10,420
Total	6,509	14,870,098

Data from the EPA confirmed that the retirement of coal plants in Pennsylvania, as shown in Table 8, will result in an emissions savings of about 15 MMtCO₂ annually. The new generating capacity proposed for Pennsylvania will produce about 6.45 MMt CO₂e in 2020, resulting in a total of 5.5 MMtCO₂e savings.⁶⁴

⁶⁴ *Supra* note 5.

10. Effect of the Emission Reduction Measures Identified in the 2009 Plan and 2013 Update

Both the 2009 Plan and 2013 Update identify and quantify real GHG emission reductions for Pennsylvania. As previously stated, the 2009 Plan found 52 specific recommendations as well as the additional actions taken by Pennsylvania and the federal government that, combined, will provide GHG emissions reductions in Pennsylvania of 39 percent below 2000 levels in the year 2020. The 2009 Report found that the 52 recommendations, on their own, are anticipated to yield a 30 percent reduction in emissions by 2020, putting Pennsylvania well on the path to making the critical reductions needed to prevent further impacts on the world's climate.⁶⁵ The 2009 Plan specifically found that these values are within the range of reductions that is recommended by the IPCC as being necessary to stabilize the effects of climate change.⁶⁶ To be sure, not all of these recommendations were implemented, but the Department continues to work with stakeholders in finding cost-effective measures to reduce GHG emissions like those identified in the 2013 Update.

The 2013 Update concludes that Pennsylvania CO2 emissions have been reduced dramatically, in large part because Pennsylvania is generating more electricity with natural gas instead of coal.⁶⁷ However, other factors, including improved energy efficiency standards from consumer products and automobiles have contributed to the decline in CO2 emissions. Pennsylvania continues to be a leader in reducing methane emission from the natural gas industry and solid waste landfills. Moreover, further reductions are occurring and future reductions will occur through new regulatory requirements like the Tailoring Rule, NSPS and

⁶⁵ 2009 Plan at ExS-3.

⁶⁶ *Id.*

⁶⁷ 2013 Update at 19.

MACT. Consequently, these additional emission reductions will further reduce impacts on the Earth's climate.

D. DEPARTMENT ANALYSIS OF THE PETITION FOR RULEMAKING

1. Six Percent Reduction in Annual CO2 Emission Rate

The primary focus of the Petition for Rulemaking is to achieve a 6 percent reduction in the annual CO2 emission rate from 2013 through 2050 from fossil fuel-fired sources in Pennsylvania. Petition at page 42. The 2013 Update found that the gross anthropogenic GHG emissions from all sectors in Pennsylvania are approximately 264 MMt of CO2e emissions, an amount equal to about 4.4 percent of total U.S. gross anthropogenic GHG emissions.

2. Safe Atmospheric Concentration of CO2

The Petitioner asks the EQB to establish a regulation to achieve safe atmospheric concentrations of CO2 by 2100. While the Petitioner does not say so, it is presumed from a review of the materials in the Petition itself that a safe concentration would be 350 ppm based on a full reading of the Petition. The Petitioner believes that concentration will stabilize the atmosphere.

Under the 2009 Plan, the Department reviewed the science related to CO2 concentrations and endorsed the findings of the IPCC.⁶⁸ Climate models employed by the IPCC indicated that in order to avoid significant disturbance of physical and biological systems caused as a result of global climate change, it would be necessary to stabilize global average atmospheric CO2e concentrations to around 450 ppm and no more than 550 ppm.⁶⁹ This includes a number of

⁶⁸ 2009 Plan at ExS at 1.

⁶⁹ *Id.* at 1-24.

GHGs (not only CO₂), and corresponds to about 400 ppm CO₂ alone.⁷⁰ A stabilization at 400 ppm CO₂e corresponds to about 350 ppm CO₂.⁷¹

The concept of stabilization is linked to the United Nations Framework on Climate Change (“UNFCCC”), which is “to achieve [...] stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”. Policy discussions have also focused on a global temperature increase, rather than on GHG concentrations. The most prominent target currently discussed is the 2°C temperature target, that is, to limit global temperature increase relative to pre-industrial times to below 2°C. Limiting the temperature to this increase equates to a CO₂e concentration of about 450 ppm. Nevertheless, for the purposes of evaluating this Petition for Rulemaking, the Department will use the 350 ppm CO₂ metric as identified in the Petition.

3. Effectiveness of the Petition in Reducing CO₂ Emissions

The change in concentration in CO₂ since the beginning of the Industrial Revolution is of concern in addressing global climate change. Table 9 below shows the total volume and mass of CO₂ present in the atmosphere based on the measured concentration, and assuming that the mass of Earth’s atmosphere is 5.15x10¹⁸ kg, the density of air is 1.275 kg/m³, and the density of CO₂ is 1.96 kg/m³ (the density of the respective gases at standard temperature and pressure).

⁷⁰ “Climate change targets: 350 ppm and the EU two-degree target.” Available at <http://www.eea.europa.eu/highlights/climate-change-targets-350-ppm-and-the-eu-2-degree-target>.

⁷¹ *Id.*

Table 9. Concentration, Volume, and Mass of CO₂

Year	Concentration of CO ₂ (in ppmv)	Volume of CO ₂ (in m ³)	Mass of CO ₂ at STP (=ρ*m ³) (in kg)	Mass Fraction of CO ₂ (in ppm)
1750	278	1.12E+15	2.20E+15	427.36
1960	310	1.25E+15	2.45E+15	476.55
2007	383	1.55E+15	3.03E+15	588.77
2100 (IPCC best case)	541	2.19E+15	4.28E+15	831.65
2100 (IPCC worst case)	970	3.92E+15	7.68E+15	1491.14

The Department analyzed the Commonwealth’s contribution to global CO₂ emissions in order to determine the effect that reducing Pennsylvania’s emissions to zero would have on global CO₂ concentrations. In conducting this analysis, the Department took concentration from the National Oceanic and Atmospheric Agency database for the Mauna Loa Observatory in the month of January for the years of interest. The Department then calculated the change in concentration year-to-year as shown in Table 10.

Table 10. Pennsylvania’s Contribution to Global CO₂ Emissions

Year	Concentration (in ppm)	Change in Concentration (in ppm)
2008	385.44	
2009	386.94	1.50
2010	388.50	1.56
2011	391.25	2.75
2012	393.12	1.87
2013	395.54	2.42

From these changes in concentration, the Department then calculated the annual changes in the total mass of CO₂ in the atmosphere. Using data from the Energy Information Agency for global CO₂ emissions, and the projected growth rates calculated by the Carbon Dioxide Information Analysis Center, the Department tabulated the CO₂ emissions during the years of interest and calculated the expected changes in concentration based on the mass of the emissions. The Department then calculated ratios of actual to expected changes in concentration, which are theoretically identical to the ratios of actual to expected changes in mass in Table 11.

Table 11. Actual Versus Expected Change in CO₂ Concentration

Year	Change in Mass of CO ₂ in Atmosphere at STP (in kg)	Mankind's Emissions of CO ₂ (in kg)	Expected Change in Concentration Based on Emissions (in ppm)	Ratio of Actual vs. Expected Change in Concentration
2008		3.03E+13		
2009	1.174E+13	3.02E+13	3.82	0.39
2010	1.220E+13	3.15E+13	3.82	0.41
2011	2.152E+13	3.26E+13	3.98	0.69
2012	1.463E+13	3.33E+13	4.11	0.45
2013	1.893E+13	3.40E+13	4.20	0.58

The Department then took the figure for Pennsylvania's emissions in 2009 in Table 10 and used them to calculate the ratio to the global emissions total and assumed that ratio did not change. This is a very conservative estimate, as the emissions figure for Pennsylvania was reported in CO₂e and the total emissions contribution for the United States decreased, which the Department assumes would further reduce Pennsylvania's contribution as a percentage of global emissions. By subtracting Pennsylvania's calculated mass contribution from the total change in mass and adding the new mass total to the previous year's total, the Department calculated the

CO2 concentration that would have been observed if Pennsylvania emitted zero GHGs. The last columns in Table 11 show the total share of Pennsylvania’s contribution to the global concentration in ppm and as a percentage reduction of the total concentration for the respective year.

Table 12. Global CO2 Emission Totals without Pennsylvania’s Contribution

Year	Pennsylvania's Emissions of CO ₂ e (in kg)	Pennsylvania's Emission of CO ₂ e that Remains in the Atmosphere (in kg)	Change in Mass of CO ₂ in Atmosphere Without Pennsylvania's Contribution (in kg)	Concentration Without Pennsylvania (in ppm)	Pennsylvania's Share of the Concentration	
2009	2.43E+11	9.55E+10	1.16E+13	386.91	0.03	0.008%
2010	2.54E+11	1.04E+11	1.21E+13	388.47	0.03	0.008%
2011	2.62E+11	1.81E+11	2.13E+13	391.19	0.06	0.014%
2012	2.68E+11	1.22E+11	1.45E+13	393.08	0.04	0.010%
2013	2.74E+11	1.57E+11	1.88E+13	395.49	0.05	0.012%

By completely removing Pennsylvania’s emissions from global totals, the calculated global concentration would be, at a maximum, only 0.014 percent lower than the actual global concentration as seen in Year 2011 in Table 12. This translates into a ppm reduction of 0.06. This maximum is assuming a 100 percent reduction, which is more than the approximately 90 percent reduction based on the Petition for Rulemaking.⁷²

⁷² The Department’s analysis looks solely at emission reductions. It does not review the cost to jobs and the economy as a result of reducing all CO2 emissions in Pennsylvania.

The total CO₂e reduction based on the Petition for Rulemaking is summarized in Table 13.

Table 13. Total Reduction

Year	Pennsylvania's Emissions of CO ₂ e (in kg)	Percent Reduction
2013	2.74E+11	0.0%
2020	1.78E+11	35.2%
2030	9.57E+10	65.1%
2040	5.15E+10	81.2%
2050	2.78E+10	89.9%

4. Recommendation

As the science identified in the 2009 Plan, 2013 Update, and the Petition for Rulemaking recognizes, climate change is a global issue that requires a global response. However, the suggested regulatory language in the Petition for Rulemaking fails to recognize that, in order to achieve a safe atmospheric concentration of CO₂, or a CO₂ atmospheric concentration of 350 ppm, the remedy must be global in nature. The Petition for Rulemaking focuses on one discrete aspect of the issue (i.e., fossil fuel-fired sources) in one particular location (i.e., Pennsylvania). Consequently, the particular mechanism advocated in the Petition for Rulemaking (i.e., a 6 percent reduction in fossil fuel-fired sources in Pennsylvania) cannot achieve the particular remedy advocated for in the Petition for Rulemaking (i.e., a safe atmospheric concentration of CO₂ or a CO₂ atmospheric concentration of 350 ppm by 2100). This is particularly true because by completely removing Pennsylvania’s emissions from global totals, the calculated global concentration would only be 0.014 percent lower than the actual global concentration.

The Petition for Rulemaking fails to address growth rates for major emitter countries in 2012 like China (5.9 percent) and India (7.7 percent).⁷³ Cumulative emissions of CO₂ from all sources (fossil fuels plus land use change) since 1870 will reach 2015 billion tons of CO₂ this year.⁷⁴ Because of this failure to view the issue within a global context, the Petition for Rulemaking does not have a remedy for the central issue to the problem - that a continuation of the emissions growth trends observed since 2000 from *all global emitting sources* would place the world on a path to reach 2 degrees Celsius above pre-industrial times in 30 years.

The Petition for Rulemaking also fails to address the issue of carbon leakage. Carbon leakage is defined as the increase in CO₂ emissions outside the country, or in this case the state, taking domestic mitigation action divided by the reduction in the emissions of these other jurisdictions. An increase in local fossil fuel prices resulting, for example, from mitigation policies may lead to the re-allocation of production to regions with less stringent mitigation rules (or with no rules at all), leading to higher emissions in those regions and therefore to carbon leakage. For instance, the Petition for Rulemaking has no remedy for a circumstance where a business leaves Pennsylvania, because of a more stringent CO₂ regulatory regime, only to re-establish in a bordering state that has no CO₂ regulatory regime and continues to emit CO₂ at an unregulated rate.

The Petition for Rulemaking further fails to take into account the residence time of GHGs. Many GHGs stay in the atmosphere for long periods of time. As a result, even if emissions stopped increasing, atmospheric GHG concentrations would continue to increase and

⁷³ Carbon Dioxide Information Analysis Center, 2013 Global Carbon Project. Available at <http://cdiac.ornl.gov/GCP/carbonbudget/2013/>

⁷⁴ *Id.*

remain elevated for hundreds of years.⁷⁵ Concentration of GHGs would not return immediately to their pre-industrial levels if emissions were halted. Methane concentration would return to values close to pre-industrial level in about 50 years, N₂O concentrations would need several centuries, while CO₂ would essentially never come back to its pre-industrial level on time scales relevant for our society.⁷⁶ Complete elimination of CO₂ emissions is estimated to lead to a slow decrease in atmospheric CO₂ of about 40 ppm over the 21st century.⁷⁷ By some estimates, even with phase-out of coal emissions, CO₂ would remain above 350 ppm for more than two centuries.⁷⁸

There is no single solution to global warming. Cost-effective technologies and approaches like those outlined in the 2009 Plan and 2013 Update are important to bring down the emissions of these gases. This holistic approach includes - boosting energy efficiency; greening transportation; revving up renewables; phasing out outdated fossil fuel electricity plants; managing forests and agriculture; exploring nuclear; encouraging cleaning burning fossil fuels like natural gas; and developing and deploying new low-carbon and zero-carbon technologies, to name a few. Pennsylvania has enacted a number of these approaches into law already as a review of the 2009 Plan and 2013 Update indicate. These approaches have already resulted in real CO₂ emission reductions that benefit the public health and environmental resources in Pennsylvania.

⁷⁵ Climate Change 2007: Working Group I: The Physical Science Basis. Available at http://www.ipcc.ch/publications_and_data/ar4/wg1/en/spm.html.

⁷⁶ Climate Change 2013: The Physical Science, Chapter 12. Available at http://www.climatechange2013.org/images/report/WG1AR5_Chapter12_FINAL.pdf p.1106

⁷⁷ IPCC Fourth Assessment Report: Climate Change 2007 chapter 10. Available at http://www.ipcc.ch/publications_and_data/ar4/wg1/en/faq-10-3.html.rth Assessment Report: Climate Change 2007

⁷⁸ Hansen et al., *Target Atmospheric CO₂: Where Should Humanity Aim?*, Open Atmos. Sci. J. (2008), vol. 2, pp. 217-231

In analyzing the Petition for Rulemaking, the Department has determined that the 6 percent reduction requirement from Pennsylvania sources would not achieve the purpose of the Petition for Rulemaking, which is to achieve a safe atmospheric concentration of CO₂ or 350 ppm by 2100. As a result, it is recommended that the Petition for Rulemaking be denied.

E. CONCLUSION

Pennsylvania has implemented a number of cost-effective GHG emission reduction strategies for all major source categories in Pennsylvania. Additionally, Pennsylvania will continue to evaluate and implement cost-effective GHG emission reduction strategies in order to protect the public health and environmental resources in the Commonwealth. However, the suggested regulatory language in the Petition for Rulemaking that calls for a 6 percent CO₂ reduction from all fossil fuel-fired sources in Pennsylvania would not achieve the purpose of the Petition for Rulemaking, which is to achieve a safe atmospheric concentration of CO₂ or 350 ppm by 2100. As a result, it is recommended that the Petition for Rulemaking be denied.

F. APPENDIX: REGULATORY LANGUAGE SUGGESTED BY PETITIONER

Please Note: The suggested regulatory language that follows was provided by the petitioner and is not a product of the Department. This language is for reference only.

1. **Regulatory Goal.** In accordance with 35 P.S. § 4004(18), the Department shall prepare and develop a comprehensive plan for the control and abatement of carbon dioxide emissions that will specifically achieve the following:

(a) Carbon dioxide emissions from fossil fuels in the Commonwealth of Pennsylvania will peak no later than 2013 as determined by the Baseline CO₂ Emission Rate; and

(b) Starting in 2013, annual fossil fuel carbon dioxide emissions in the Commonwealth will be reduced by at least 6% per year as determined by the previous year's Annual CO₂ Emission Rate through the year 2050.

2. **Baseline Emission Rate.** In connection with its work required by 71 P.S. § 1361.4 (the Pennsylvania Climate Change Act, Act 70), the Department shall determine the amount of carbon dioxide emitted in 2012 from all fossil fuel burning sources in the Commonwealth. This amount shall be the Baseline CO₂ Emission Rate for purposes of this regulation.

3. **Determination of Annual CO₂ Emission Rate.** The Department shall undertake such actions as are necessary to determine the amount of carbon dioxide emitted each year from all fossil fuel burning sources in the Commonwealth. This amount shall be the Annual CO₂ Emission Rate for that given year.

4. **Reductions in Annual CO₂ Emission Rate.** The Department shall undertake such actions as are necessary to achieve at least a 6% reduction in the Annual CO₂ Emission Rate from the Baseline CO₂ Emission Rate by the end of 2013, and then at least

a 6% reduction in the Annual CO₂ Emission Rate each year compared to the Annual CO₂ Emission Rate of the previous year, through the year 2050.

(a) The Department shall have such powers as necessary to achieve the annual 6% reduction in Annual CO₂ Emission Rate, including the powers to create permit provisions, conditions, enforceable agreements with emission sources, as well as the power to enforce, through administrative or judicial means, any reductions imposed on or agreed to by a source of carbon dioxide emissions.

(b) The Department shall certify the rate of reduction of the Annual CO₂ Emission Rate each year and make the information used in determining the reduction in that Rate publicly available. The information made available to the public shall include the data compiled by individual source, source categories, and the methodology used by the Department to compile both any components of as well as the total reduction in the Annual CO₂ Emission Rate.

(c) If the Department determines that the rate of reduction for a particular year does not meet the required 6% reduction, the Department shall announce and undertake such further actions, including the imposition of greater reductions in emissions of carbon dioxide, so that the total reductions in carbon dioxide emissions will return to the rate imposed by this regulation within 12 months.

5. To the extent that any rule in this section conflicts with any other rule in effect, the more stringent rule, favoring full disclosure of emissions and protection of the atmosphere, governs.