

Clean Power Plan

The Effect on Pennsylvania's Energy Outlook



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Presentation Outline

1. Clean Power Plan (CPP) Summary
2. Projected Nationwide Emission Outlook
3. Timeline and Objectives of CPP
4. Pennsylvania's Energy Portfolio
5. Potential Strategies for Pennsylvania

Project Summary



The recently introduced Clean Power Plan (CPP) provides states the independence to determine strategies to reduce their carbon dioxide emissions unique to the needs of the state itself. This project will take an in-depth look at the Clean Power Plan and analyze potential strategies for Pennsylvania to implement in order to reach their targets in reducing carbon emissions.

Hypothesis



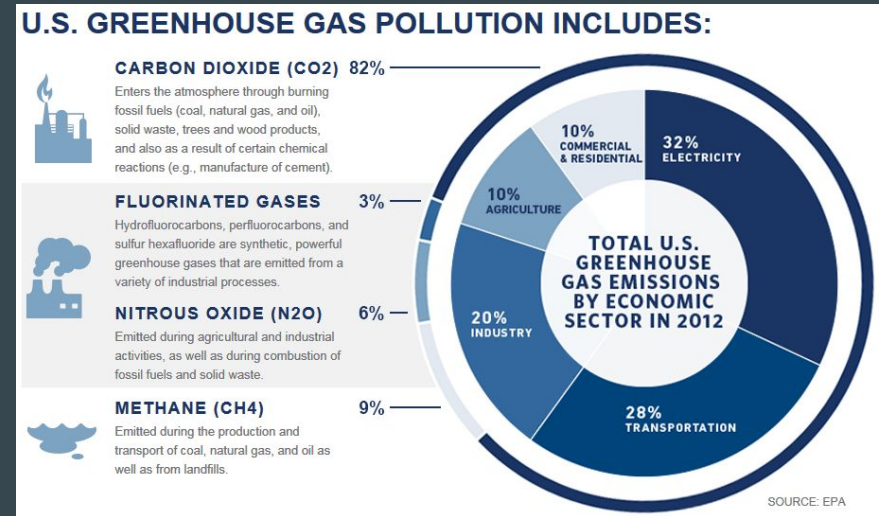
In order to comply with the Clean Power Plan, the state of Pennsylvania should join the Regional Greenhouse Gas Initiative cap and trade program in order to help decrease statewide CO₂ emissions.

Gantt Chart

	Task	W1	W2	W3	W4	W5
1	Research CPP					
1.1	Emissions Targets					
1.2	Plan Building Blocks					
1.3	Emission Reduction Process					
1.4	Policy Feedback					
2	Pennsylvania Energy Mix					
2.1	Outline PA Energy Outlook					
2.2	State Comparison					
2.3	Potential Emission Strategies					
3	Pennsylvania Outlook					
3.1	Advantages to Each Strategy					
3.2	Proposed Energy Plan					
3.3	Ideas for Improvement					
4	Presentation					
4.1	Create Presentation					
4.2	Practice Presentation					
4.3	Present Draft Presentation					
4.4	Make Presentation Adjustments					
4.5	Present Final Presentation					

The Basics

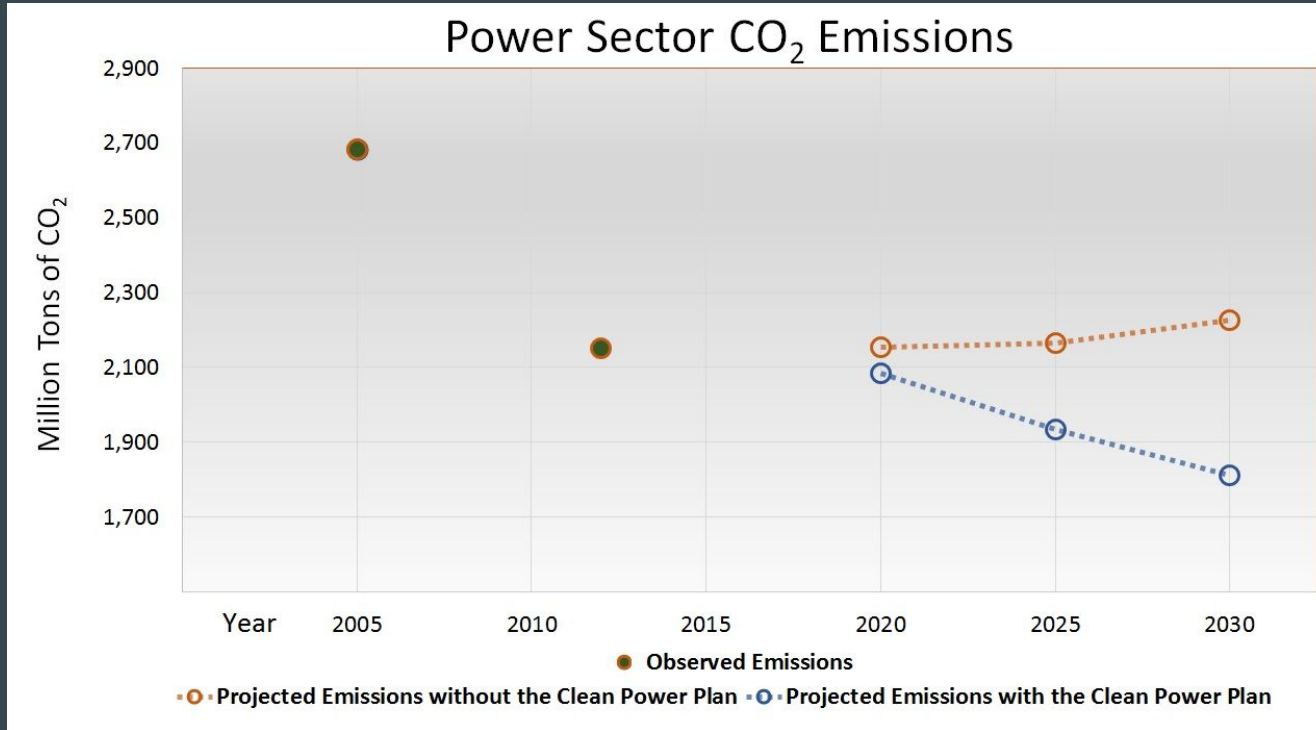
- On August 3, 2015 the Obama Administration and the EPA announced the Clean Power Plan (CPP). This plan aims to reduce national carbon emissions from power plants in order to combat climate change.
- When Obama first came in office, the administration tried a variety of plans including a cap-and-trade bill. These ideas died in Congress.
- The CPP works by requiring states to make individual cuts to reach a country-wide goal.



Why Clean Power?

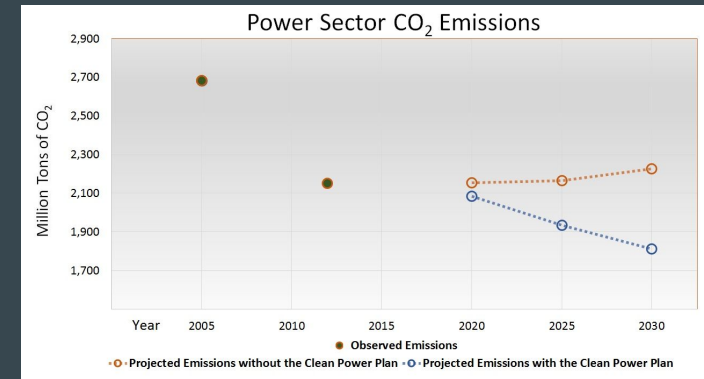
1. Protect the Health of American Citizens
 - a. Prevent up to 3,600 premature deaths
 - b. 1,700 heart attacks
 - c. 90,000 pediatric asthma attacks
2. Save the Average American Money
 - a. Nearly \$85 a year reduction in energy bills in 2030
 - b. Save enough energy to power 30 million homes
 - c. Save consumers \$155 billion from 2020-2030
3. Boost Our Economy
 - a. 30% more renewable energy generation in 2030
 - b. Creating tens of thousands of jobs
 - c. Continuing to lower cost of renewable energy technology

Projected Emissions



Projected Emissions

- Reduce plant emissions from existing power plants by 32% from 2005 - 2030. This is equivalent to 550 million metric tons of carbon dioxide.
- CPP covers large electric generating units (EGUs) selling power to a distribution system - including boilers, combustion turbines, integrated gasification combined cycle, etc. that:
 - a. are capable of combusting 250 million BTUs per house
 - b. combust fossil fuel for 10% or more of total heat input
 - c. sells over 219,000 MWh/yr and 1/3 of its potential is electrical output
 - d. was in operation or began construction as of January 8, 2014



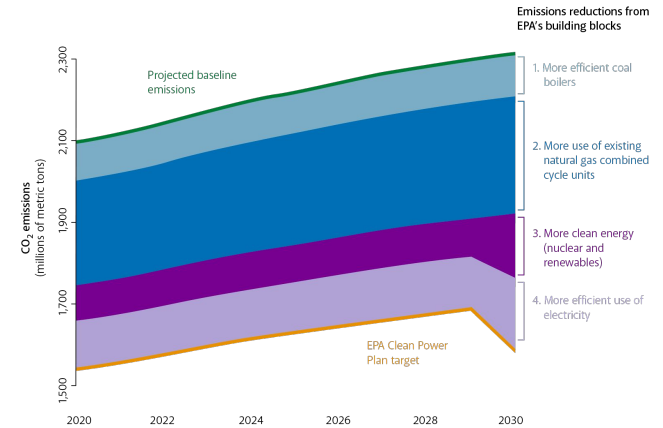
The Timeline

Sept. 2016	<ul style="list-style-type: none"> • State Plans due ...or... • Demonstration of progress
Sept. 2018	<ul style="list-style-type: none"> • Final State Plans due
Jan. 2022	<ul style="list-style-type: none"> • First Compliance Year begins
2022-2024	<ul style="list-style-type: none"> • First Interim Compliance Period
2025-2027	<ul style="list-style-type: none"> • Second Interim Compliance Period
2028-2029	<ul style="list-style-type: none"> • Third Interim Compliance Period
2030	<ul style="list-style-type: none"> • Final Compliance Year
...and beyond	<ul style="list-style-type: none"> • States must continue to hold at 2030, biennial reports to EPA

Building Blocks

- Block 1: Improved efficiency at power plants
 - a. Power plants make heat rate improvements to reduce the amount of carbon dioxide they emit per MWh
 - b. Equates to 2.1 - 4.3 percent improvement, previously placed at 6 percent in original draft
- Block 2: Shifting to lower-emitting natural gas
 - a. Assuming that natural gas can be used at 75 percent of “net summer capacity”
 - b. Initially, 70% “nameplate capacity” was used which gave unrealistic projections
- Block 3: Shifting to zero-emitting renewables
 - a. Takes recent reductions in the cost of technology as well as future projections into account
 - b. Does not include existing nuclear/renewable energy sources as original draft did

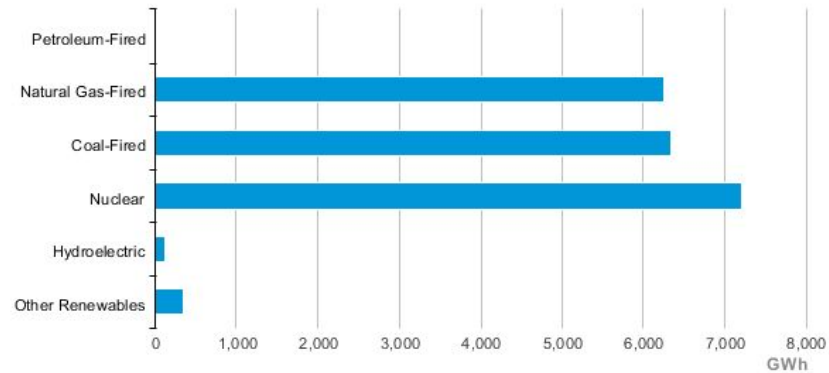
Figure 2. Possible Futures for CO₂ Emissions from the US Electricity Sector
How EPA's building blocks stack up



Source: Based on the Energy Information Agency's Annual Energy Outlook 2014 Reference Case projection of electricity production. See more at <http://common-resources.org/2014/epas-building-blocks/>.

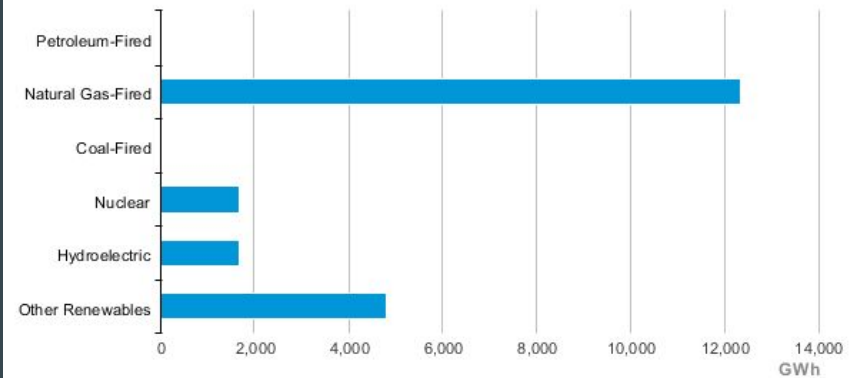
Recognizing States Differences

Pennsylvania Net Electricity Generation by Source, Aug. 2015



 Source: Energy Information Administration, Electric Power Monthly

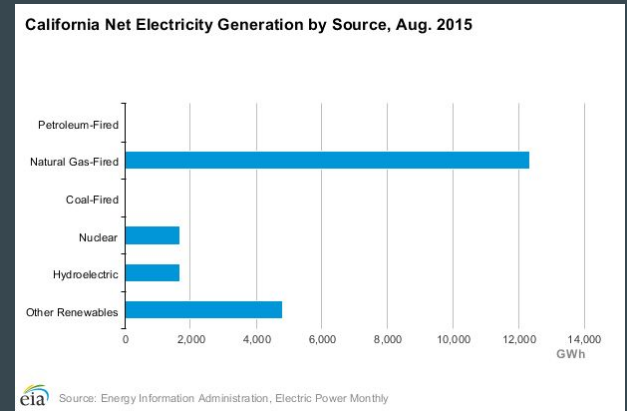
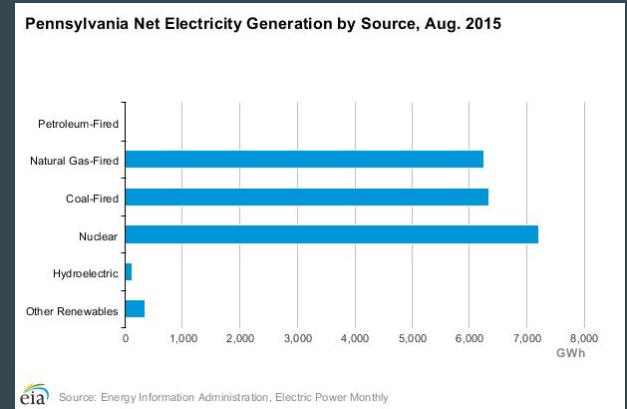
California Net Electricity Generation by Source, Aug. 2015



 Source: Energy Information Administration, Electric Power Monthly

Recognizing State Differences

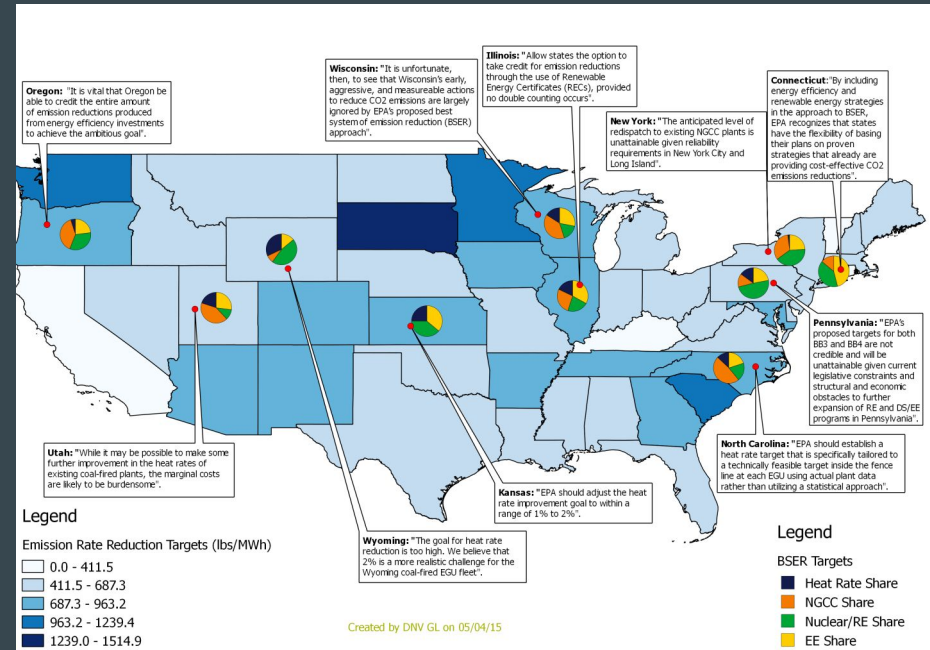
- Every state has a different goal based upon its own unique energy mix.
- Not all states are starting at the same starting point, and this levels the playing field.
- States are given the independence to develop their own emissions-reduction plan as long as they reach their goal by the deadline
- Multi-state approaches, including emissions trading, are allowed





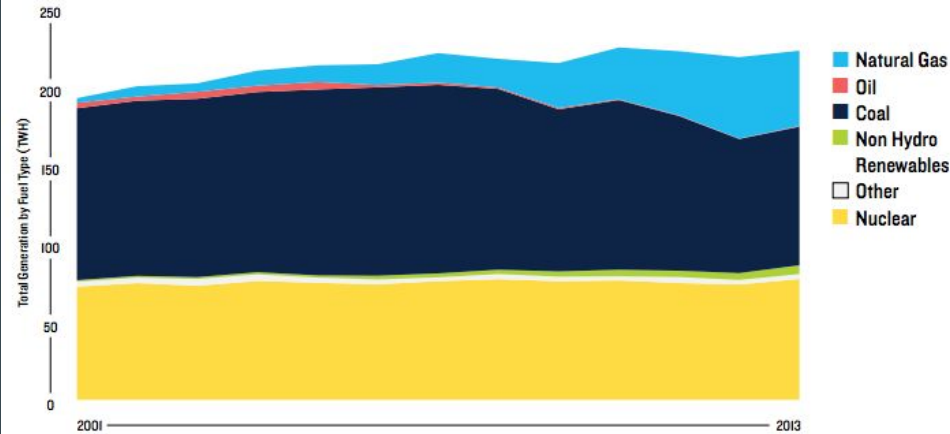
State Responses

- 24 states are suing to stop the plan
- The main concerns:
 - It is unlawful for the federal government to control state power grids
 - The targets listed in the building blocks are too steep and unrealistic
 - Costs to make these changes
- In the states opposing the rule, 61% of the public supports CPP
 - Only three states had a majority opposing the bill (WV, WY, & ND)



Pennsylvania's Energy Mix

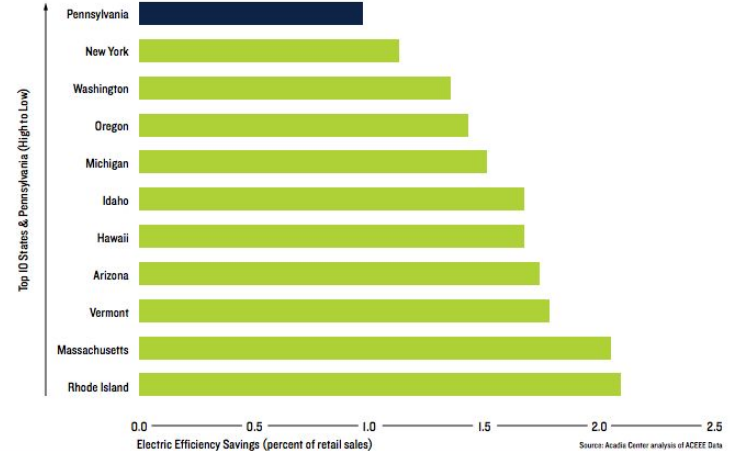
FIGURE 1. PENNSYLVANIA'S ELECTRICITY GENERATION SOURCES (2001-2013)



Source: Energy Information Administration

FIGURE 3. PENNSYLVANIA'S ENERGY EFFICIENCY

Comparison to the 10 states with the highest energy efficiency rates. Pennsylvania ranked 16th as of 2013.



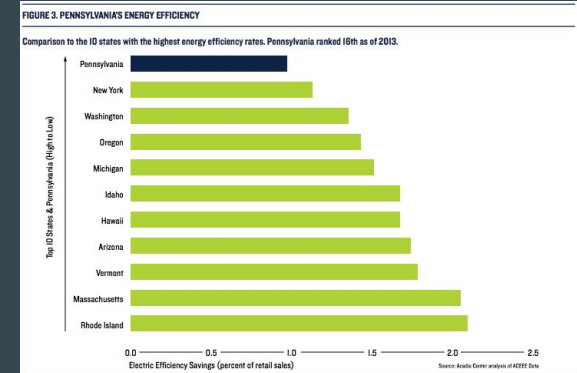
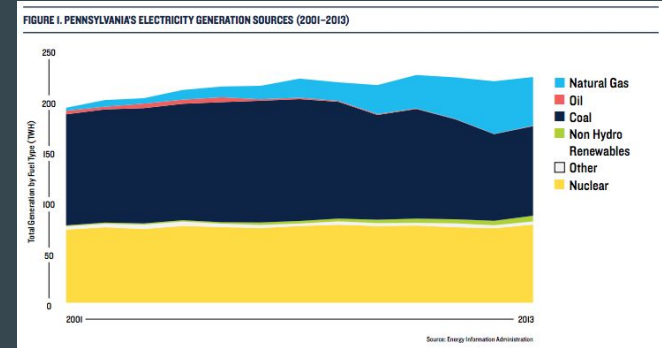
Source: Acadia Center analysis of ACEEE Data



Pennsylvania's Energy Mix

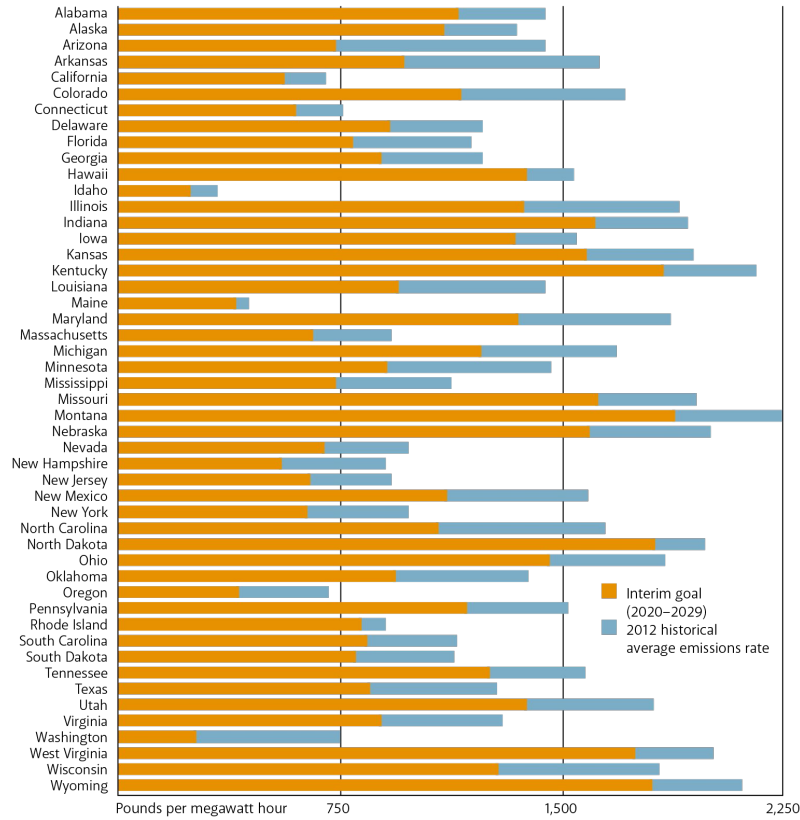
- Second-largest natural gas producer thanks to recent exploitation of Marcellus Shale (2014)
- Fourth-largest coal-producing state, and only state producing anthracite coal (2013)
- Second in the nation in electricity generation from nuclear power (2014)
- Renewables represent 4% of net electricity generation. Wind power is the leading source of renewable energy followed by hydroelectric and biomass power plants.

Source: National Resources Defense Council (NRDC), EIA



Pennsylvania's Power Strategy

Figure 1. EPA Clean Power Plan Emissions Rate Reduction Targets



Source: US Environmental Protection Agency, Office of Air and Radiation. 2014. Goal Computation Technical Support Document, Appendices 3 and 5. Washington, DC.

Pennsylvania's Power Strategy

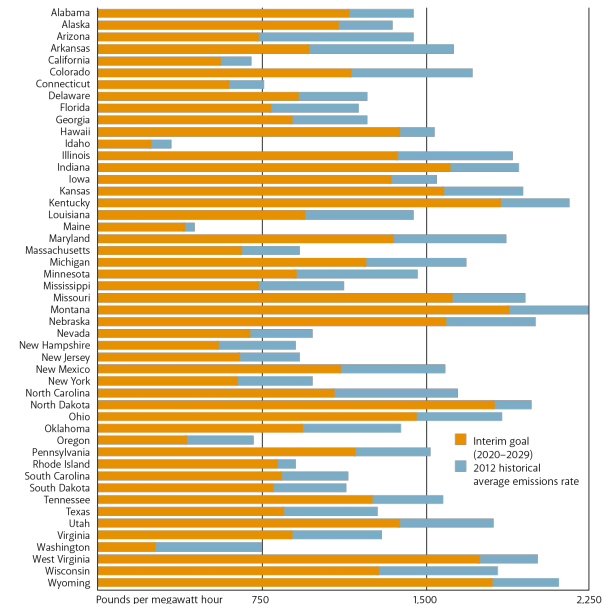
Potential Solutions:

Option 1: Carbon Tax

- Calls for the implementation of a region-wide compliance strategy
- Allows the EPA to set a price on carbon
 - States will be deemed in compliance as long as they require power plants to pay carbon costs
- Costs could potentially be returned to states or consumers to counteract increased energy costs
- Costs may also be used for compliance

Source: Kleinman Energy @ UPenn

Figure 1. EPA Clean Power Plan Emissions Rate Reduction Targets



Source: US Environmental Protection Agency, Office of Air and Radiation, 2014. Goal Computation Technical Support Document, Appendices 3 and 5. Washington, DC.

Carbon Tax

Advantages

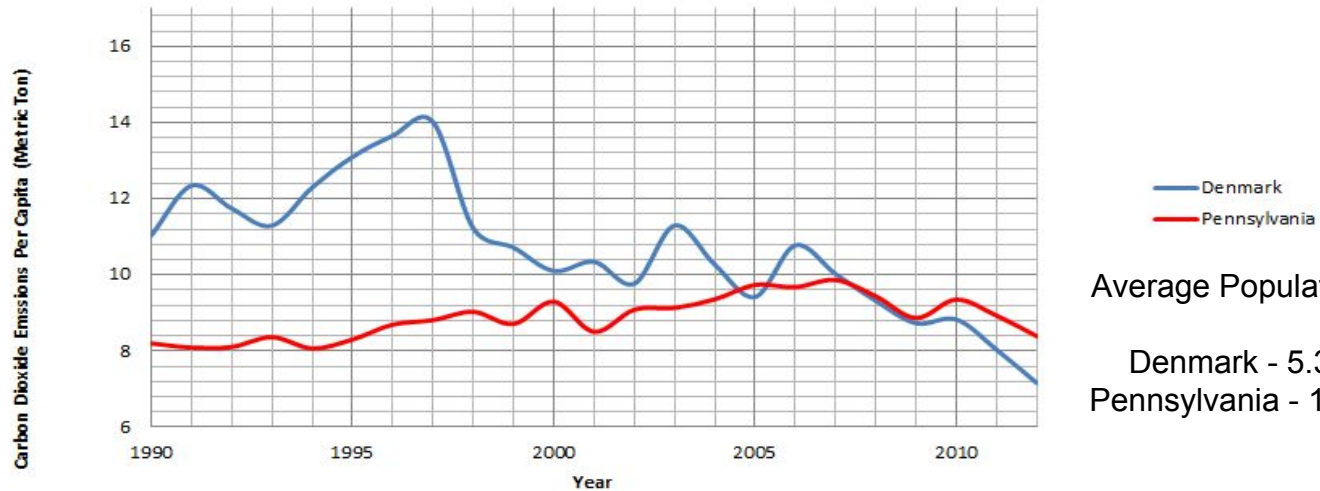
- Encourages alternative energy sources
- Raises revenue
- Short term reduction of emissions from smaller firms unable to afford tax

Disadvantages

- No incentive for complying for proposed plan → large firms may simply choose to pay tax
- Difficult to administer and understand most effective tax prices
- Firms may hide emissions

Carbon Tax Success – Denmark Case Study

Per Capita Carbon Dioxide Emissions Since 1990

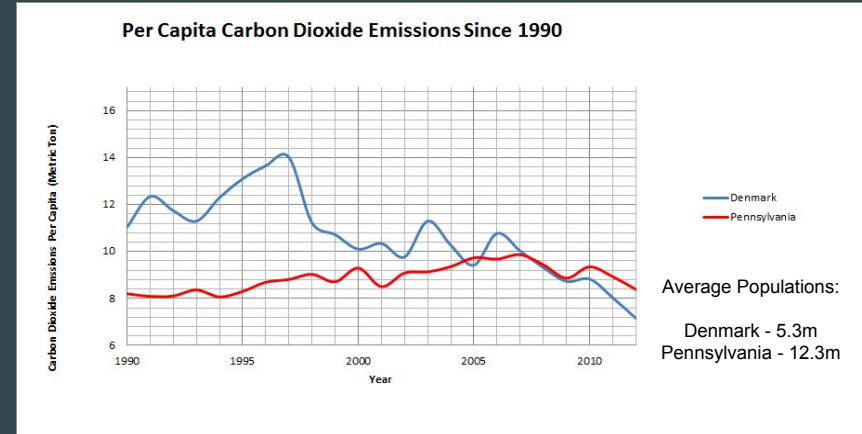


Average Populations:

Denmark - 5.3m
 Pennsylvania - 12.3m

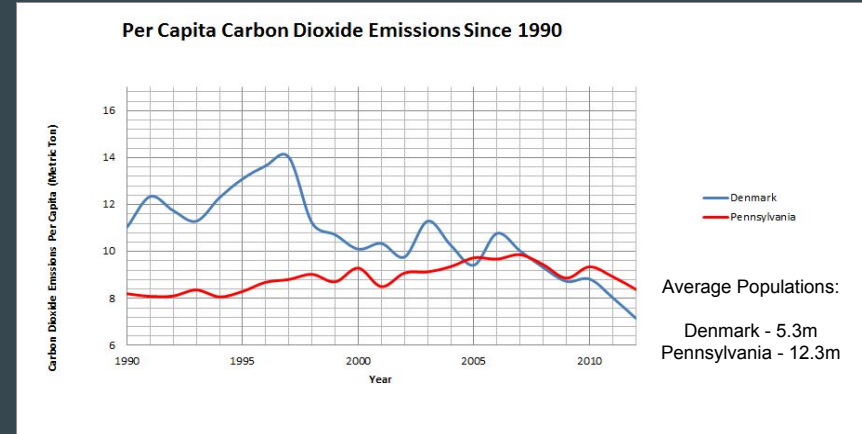
Carbon Tax Success – Denmark Case Study

- Implemented in 1991
- Goal was to reduce emissions from 1988 levels by 20%
- Upon implementation, households were taxed
 - \$7.50 per ton
- Industry taxes followed in 1993
 - \$14.30 per ton



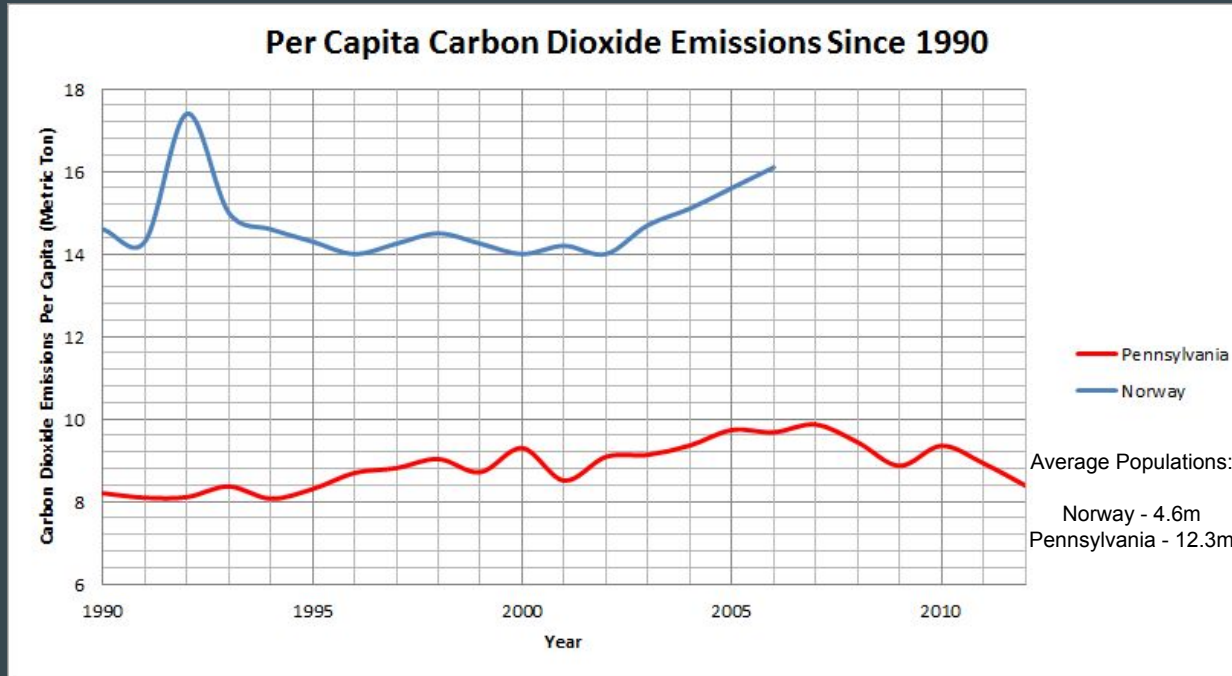
Carbon Tax – Denmark Case Study

- 25% reduction of emissions from 1988 to 2005
- “...if emission reduction is the goal, then a carbon tax is a tax you want to impose but never collect.” - NY Times
- 40% of the revenue is used as environmental subsidy
- 60% of revenue is returned to industry



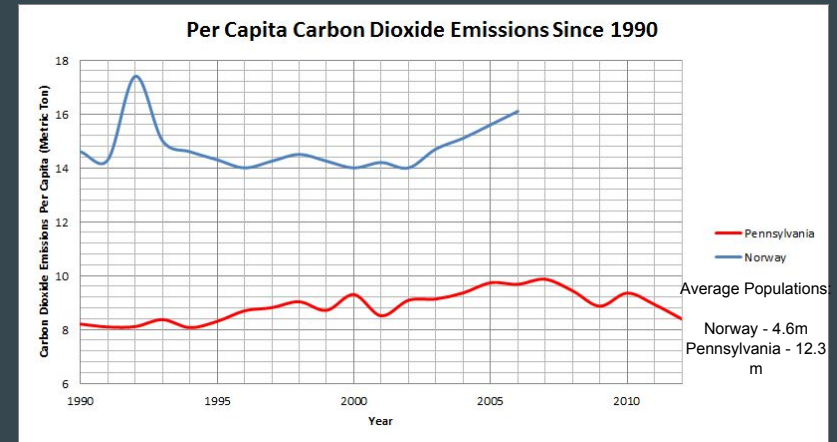
Based on these percentages and using 2008 as an example year, \$350 million was offered as an environmental subsidy and \$550 million was given back to industry for the purpose of efficiency and innovation.

Carbon Tax Failure – Norway Case Study



Carbon Tax Failure – Norway Case Study

- Implemented in 1991
- Highest tax was \$51 per ton (1999) with an average of \$21 per ton
- 10% increase in emissions from 1990 to 2006
- A research paper from Norway research department estimates that the tax has reduced emissions by 5-10% no-tax levels
- No incentive to reduce emissions

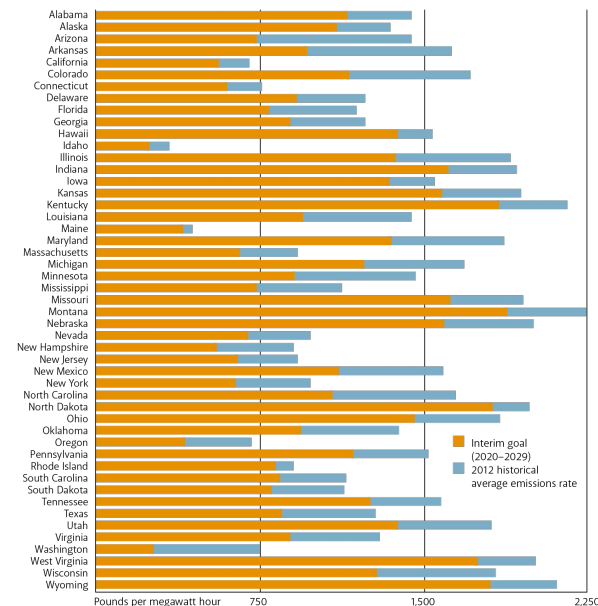


Pennsylvania's Power Strategy

Option 2: State Plans with Regional Conformity

- States develop individual plans they can “link” with nearby states so that credits/allowances from the region of states can be traded
- This ensures that each individual state will reach their expected results while also given companies the ability to trade with others in the same regional grid

Figure 1. EPA Clean Power Plan Emissions Rate Reduction Targets



Source: US Environmental Protection Agency, Office of Air and Radiation, 2014. Goal Computation Technical Support Document, Appendices 3 and 5. Washington, DC.

Cap and Trade Program

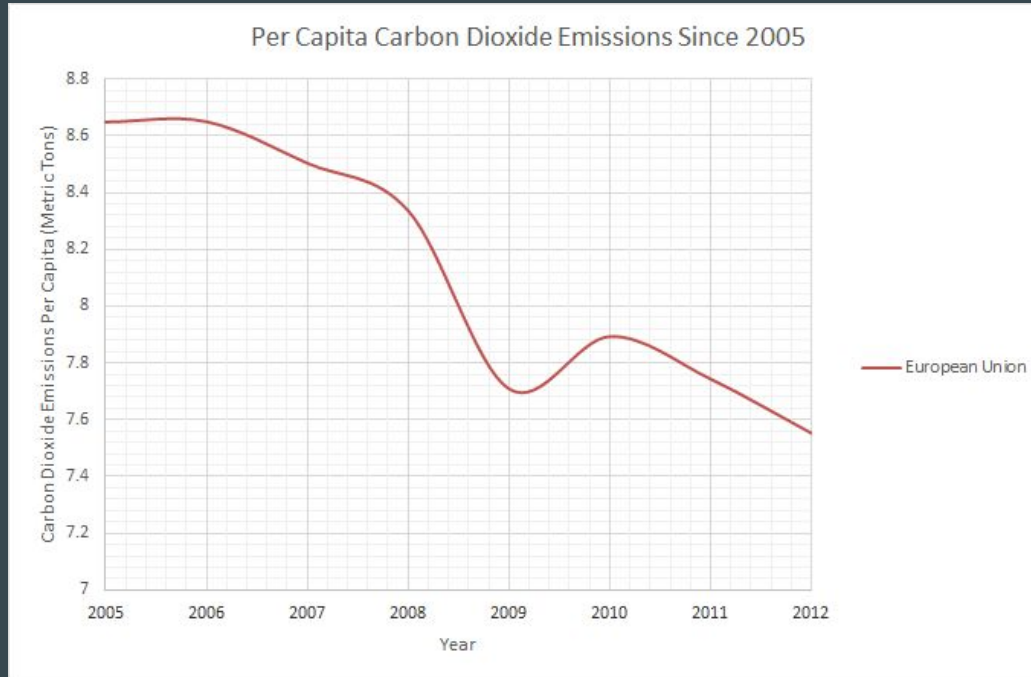
Advantages

- Allows companies to purchase carbon allowances
- Profits from these sales can be invested in renewables
- Limit carbon emissions

Disadvantages

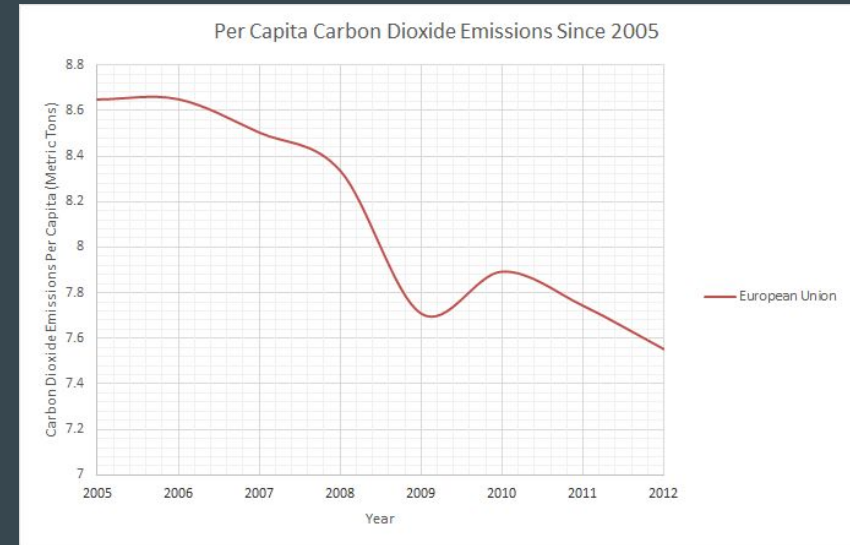
- Can cause dependency on fossil fuels
- Success is difficult across a large region with different governments
- Cost of compliance can be detrimental to smaller companies
- Cost can be passed to consumers

Cap and Trade Success - EU ETS



Cap and Trade Success - EU ETS

- Emissions from affected sectors should decrease by 21% from 2005 - 2020
- Emissions included are CO₂ and NO_x
- 15 of 28 member states are predicted to meet the 2020 goal
- Free allocation of allowances based on benchmarks
- Amount of allocated allowances decreases each year



Current Progress - EU ETS

- Since 2005 the emissions have dropped by 10% in the EU
- In 2013 €3.6 billion of revenue was distributed to member states from the program
- €3 billion of that distributed revenue was invested into renewable energy

EU ETS: Development in phases

2005-2007: 1st trading period used for 'learning by doing.' EU ETS successfully established as the world's biggest carbon market. However, the number of allowances, based on estimated needs, turns out to be excessive; consequently the price of first-period allowances falls to zero in 2007.

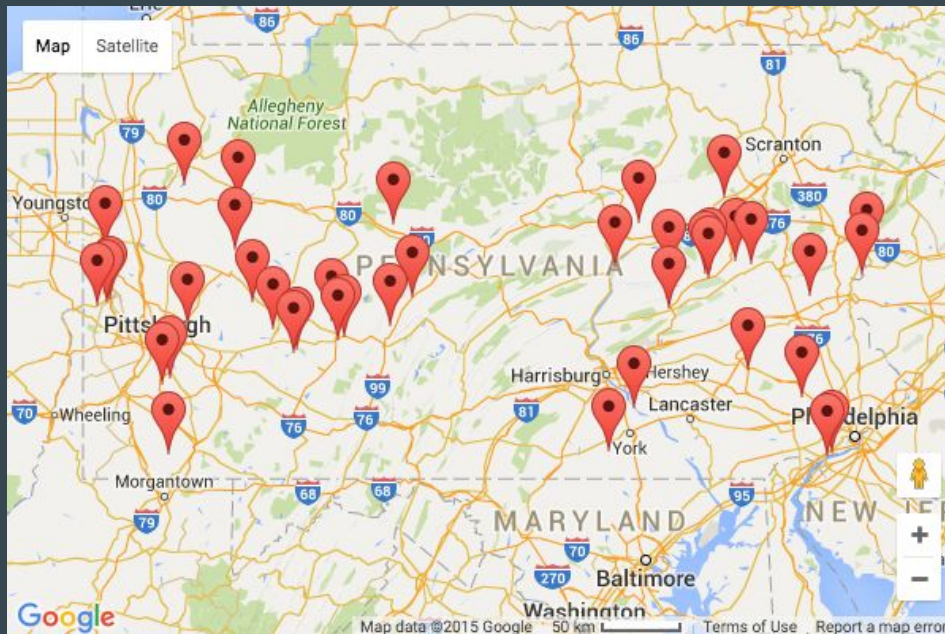
2008-2012: 2nd trading period. Iceland, Norway and Liechtenstein join (1.1.2008). The number of allowances is reduced by 6.5% for the period, but the economic downturn cuts emissions, and thus demand, by even more. This leads to a surplus of unused allowances and credits which weighs on carbon price. Aviation brought into the system (1.1.2012).

2013-2020: 3rd trading period. Major reform takes effect (1.1.2013). Biggest changes are the introduction of an EU-wide cap on emissions (reduced by 1.74% each year) and a progressive shift towards auctioning of allowances in place of cost-free allocation. Croatia joins the ETS (1.1.2013).

2021-2028: 4th trading period.

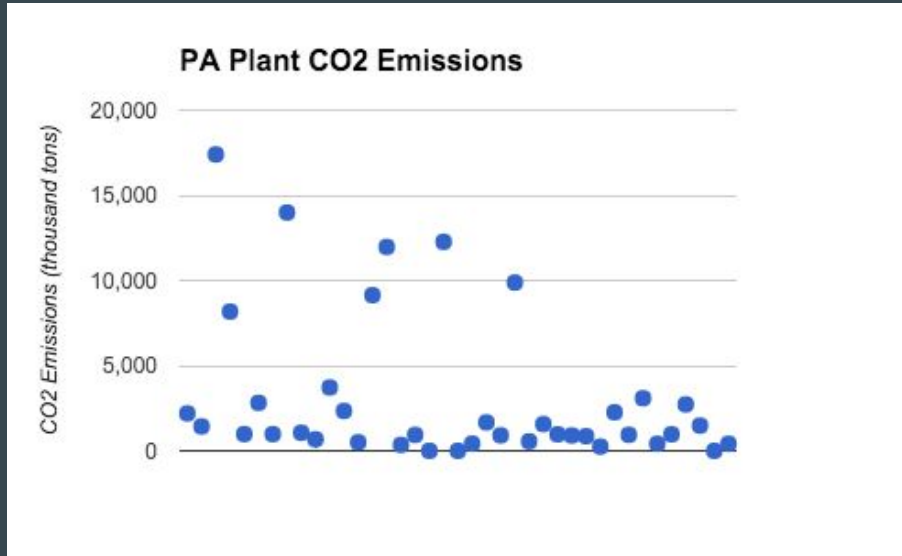


Coal Plants in Pennsylvania



- Total of 78 coal-fired generating units at 40 different locations
- Total capacity of 20,475 MW
- This totals to 41.5% of the state's electricity generating capacity
- Closest one to State College:
 - American Eagle Paper Power Plant in Tyrone, PA

Plant CO₂ Emissions

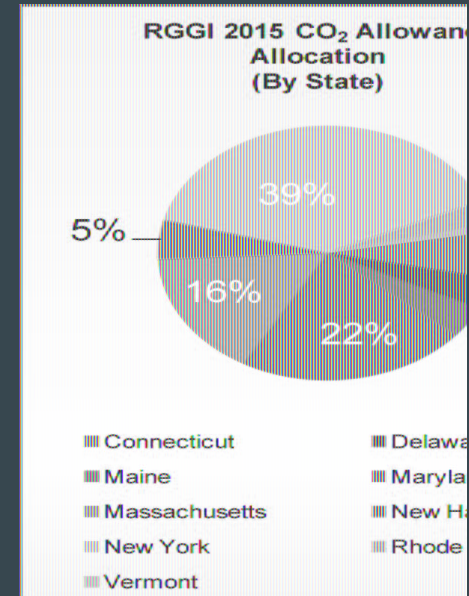


- Total 137,100 thousand tons
- Average per plant: 3,109 thousand tons
- Largest Plant: Bruce Mansfield Power Station owned by FirstEnergy (17,400,000 tons)
- Data from 2005 - 2006, no data for five plants

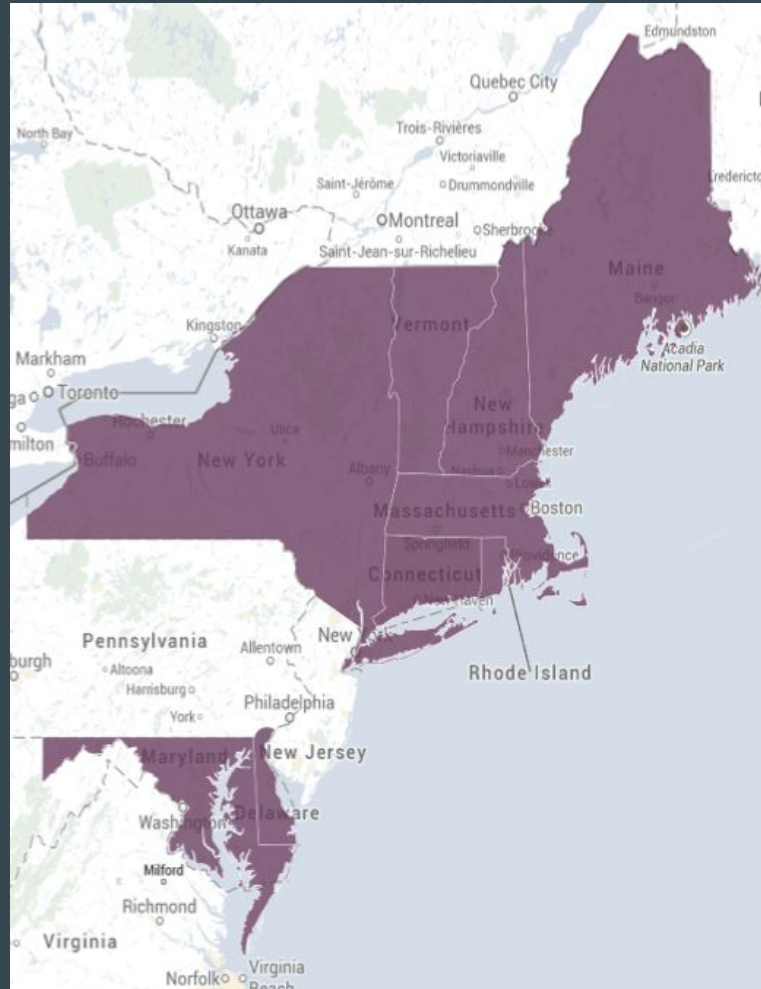
State Plans With Regional Conformity

RGGI (Regional Greenhouse Gas Initiative)

- Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont are current participants
- 2015- Regional Cap of 88.7 Million short tons of CO₂
- Cap reduces by 2.5 % each year from 2015 -2020
- Cap is only for electric power plants
- Companies can purchase allowances from any state



RGGI



PENNSTATE



Source: RGGI

Pennsylvania State Proposal

In order to comply with the CPP emissions goals PA must find a way to decrease carbon emissions.

Join RGGI

Power plants generating greater than 25 MWh/year subject to program

Introduce an additional 130 million tons of allowance into RGGI program to account for a 2.5% decrease in total carbon emissions from PA power plants for a total of 218.7 million allowances. Total amount of allowances decreases by 2.5% each year

Would meet CPP compliance of 2030 with a regional decrease in emissions of ~ 35%

Allowances



Pricing

Most recent auction (#30) - December 2nd, 2015 | Price Per Allowance: \$7.50 | 15,374,274 Allowances Sold

Price at Auction 1 \$3.07

Lowest price was \$1.86 at Auction 6, , 7, 8, 9, & 10

Projected Price by 2030 of \$12.50 per allowance

Source: RGGI

Future Research

The Kleinman Center for Energy Policy recommended a variety of other solutions as well. They include:

- Leveraging Compliance Investments
 - Using funds from private sources, public sources, or compliance costs to invest in carbon reduction strategies. A “green bank” would be created to support financing strategies to leverage investments.
- Regional Energy Programs
 - Examining the energy profiles of states in the region to see how a regional plan would affect their emissions. This would give a better idea of if plans such as the regional cap and trade program would be beneficial to neighboring states.

Questions?



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