Department of Natural Resources and Environmental Control

Regulation 1147 – CO₂ Budget Trading Program

Technical Support Document

September 2008
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I. INTRODUCTION

Purpose of the Regulations

Regulation 1147 - Carbon Dioxide (CO2) Budget Trading Program regulations (the “DE CO2 Budget Trading Program,” or, “the regulations”) establishes Delaware’s portion of a multi-state Carbon Dioxide (CO2) Budget Trading Program. The Budget Trading Program, also known as a cap-and-trade program was developed by the Regional Greenhouse Gas Initiative, (RGGI – pronounced “reggie”), which is a cooperative effort amongst Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont. The purpose of RGGI is to reduce emissions of greenhouse gases, particularly CO2 from burning fossil fuels to generate electricity. CO2 is a greenhouse gas that contributes to global warming.

Between 2009 and 2015 the regional emissions of CO2 from Electric Generating Units (EGUs) with a maximum nameplate rating of equal to or greater than 25 megawatts that are located in a RGGI state will be, collectively, capped at current levels. Beginning in 2015 the cap will be reduced incrementally to achieve a 10 percent reduction by 2019. Under the cap-and-trade program one allowance will be issued for each ton of CO2 emissions allowed by the cap. Each subject EGU will be required to have enough allowances to cover its reported emissions for their total CO2 emissions during the three-year control period. The EGUs may buy or sell allowances, but individual EGU emissions shall not exceed the amount of allowances it possesses.

This document provides background information regarding the development of Delaware’s CO2 Budget Trading Program - Regulation 1147.

Background

The burning of fossil fuels to generate electricity is a major contributor to the warming of the earth’s climate. Fossil fuel burning electric generating units emit large amounts of CO2, the principal greenhouse gas. The national electricity generation sector accounts for 33% of greenhouse gas emissions, the highest proportion of United States’ greenhouse gas emissions.1 The electricity generation sector accounts for

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approximately 34% of total CO₂ emissions in Delaware.² See Figure 2 – Delaware’s Carbon Dioxide Emissions by Sector.

![Relative CO2 Emissions](image)

**Figure 2.** Delaware’s Carbon Dioxide Emissions by Sector. Based on 2002 emissions.

Given the significant contribution of the electric generation sector to climate change, in April 2003, New York Governor George Pataki wrote to the governors of 11 Northeastern and mid-Atlantic states to invite their participation in developing a regional cap and trade program to limit power plant carbon dioxide emissions. By July 2003, Governor Pataki had received positive responses from the governors of eight states—including Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, Rhode Island, and Vermont—indicating that their representatives would participate actively in this effort, which became known as the Regional Greenhouse Gas Initiative (RGGI). After the RGGI discussions were underway, representatives from the Secretariat of the Eastern Canadian Provinces and the Province of New Brunswick, together with representatives from the states of Maryland and Pennsylvania, joined the process as observers.

Ten states became signatories to the RGGI Memorandum of Understanding (MOU) and decided to propose, as a first step, implementation of a CO₂ constraint on fossil fuel-fired electricity generation and the development of a cap-and-trade program for the trading of CO₂ emissions allowances, a limited authorization to emit CO₂.³ As of

³ The MOU was signed by the Governors of the participating states and outlines the program in detail, including the framework for a Model Rule. The states made substantial revisions to the draft model rule in response to public comments. As a result, an amendment to the MOU was agreed to and signed by the heads of the energy regulatory and environmental agencies in each participating state. The MOU and amendments are available at [http://www.rggi.org/agreement.htm](http://www.rggi.org/agreement.htm).
September 2008, the following comprise the ten signatory RGGI states: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.

Context of Regulations within Regional Process

RGGI is an ongoing effort, to reduce CO₂ emissions. The RGGI cap-and-trade program aims to initially stabilize and then reduce CO₂ emissions from large fossil fuel-fired electricity generating units in the region. To begin, the RGGI program sets a cap of 188.1 million tons of CO₂ emissions for the ten-state RGGI region, based in large part on emissions from affected sources. States are given allocations from the RGGI cap based on their CO₂ emissions stated in the MOU. Then, between 2015 and 2018, the RGGI cap is reduced by 10%, and in the process, each state will receive 2.5% fewer CO₂ allowances annually relative to their initial allocation.

The regional cap for RGGI and Delaware’s allocations are detailed below in Table 1 – RGGI CO₂ Budget 2009-2018.

<table>
<thead>
<tr>
<th>Year</th>
<th>Regional Annual CO₂ Cap</th>
<th>Delaware’s Annual Allowances⁵</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-2014</td>
<td>188,076,976</td>
<td>7,559,787</td>
</tr>
<tr>
<td>2015</td>
<td>183,375,052</td>
<td>7,370,792</td>
</tr>
<tr>
<td>2016</td>
<td>178,673,127</td>
<td>7,181,798</td>
</tr>
<tr>
<td>2017</td>
<td>173,971,203</td>
<td>6,992,803</td>
</tr>
<tr>
<td>2018 and beyond</td>
<td>169,269,278</td>
<td>6,803,808</td>
</tr>
</tbody>
</table>

RGGI’s phased approach to reducing emissions, with initially modest emissions reductions, is intended to provide market signals and regulatory certainty so that electricity generators begin planning for, and investing in, lower-carbon alternatives throughout the region. It is also designed to avoid creating dramatic wholesale electricity price impacts and related retail electricity rate impacts.

Reducing Global CO₂ Emissions

According to the Intergovernmental Panel on Climate Change (IPCC), the industrialized countries must reduce their greenhouse emissions to well below 1990 levels if global atmospheric concentrations of CO₂ are to be stabilized at acceptable levels. In concrete terms, global greenhouse gas emissions must be stabilized at 450 parts per million (ppm) CO₂ equivalent (CO₂-eq). Based on IPCC analyses, this would require that

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⁴ The initial regional cap of 188.1 million tons of CO₂ is approximately 4% above average regional emissions during the period 2000-2002. See Appendix I of this document for further information on 2000-2002 emissions in Delaware.

⁵ One allowance is equal to emission of one ton of CO₂.
greenhouse gas emissions are reduced 25-40% below 1990 levels by 2020 and 80-95% below 1990 levels by 2050. Failure to do so could push annual global mean surface temperature past pre-industrial levels by more than 2.0 - 2.4 degrees Celsius (3.6 - 4.3 degrees Fahrenheit), considered the risk threshold for triggering the most catastrophic climate scenarios.  

Some debate continues among IPCC contributors about whether the world has already exceeded this threshold. Even at early stabilization levels of 450 ppm CO2-eq, average temperatures are projected to increase between 0.6°C and 4.0°C (1.1°F - 7.2°F) in this century. The larger the temperature change, the greater the risks to the environment and human health.  

Meeting Delaware’s Greenhouse Gas Reduction Goals  

The DE CO2 Budget Trading Program is a first step toward mitigating some of the environmental and health impacts of climate change in Delaware. Climate change poses a threat to Delaware’s air quality, surface and subsurface drinking water supplies, marine and freshwater fisheries, salt and freshwater wetlands, river and stream impoundment infrastructure, forest species and wildlife habitats. These impacts are discussed in detail later in this document.

II. OVERVIEW OF THE REGULATION  

RGGI Model Rule  

The DE CO2 Budget Trading Program is based on the RGGI Model Rule, which was developed to provide guidance and consistency to states that signed the RGGI Memorandum of Understanding (MOU) as they implement the program detailed in the MOU. The MOU states that “Each of the Signatory States commits to propose the Program substantially as reflected in the Model Rule.” The Model Rule provides

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9 The MOU was signed by the Governors of the participating states and outlines the program in detail, including the framework for a Model Rule. The states made substantial revisions to the draft model rule in response to public comments. As a result, an amendment to the MOU was agreed to and signed by the heads of the energy regulatory and environmental agencies in each participating state. The MOU and amendments are available at http://www.rggi.org/agreement.htm.

10 The RGGI Model Rule does not supplant any state regulatory or legislative efforts, but instead facilitates them by including the types of provisions necessary to implement RGGI. The RGGI
states flexibility in adopting provisions regarding applicability and source exemptions, allowance allocations and allowance set-asides, and permitting. With the exception of these portions of the Model Rule where states are provided with discretion, the applicable regulatory agencies in the region intend to propose rules that are materially consistent with the Model Rule. This consistency is required to provide for participation in a regional allowance trading program and Delaware believes this trading program is the best means to regulate CO2 emissions from EGUs at this time.

The initial template for the Model Rule was based on EPA’s Part 96 rule\(^{11}\), which was used as the starting point for provisions addressing the basic administrative functioning of the cap and trade program (e.g., process for establishing authorized account representatives, compliance certification, allowance tracking system, and allowance transfers).

The Model Rule was developed by the RGGI Staff Working Group, comprised of staff members from the environmental and energy regulatory agencies in each signatory state. This effort was supported by an extensive regional stakeholder process that engaged the regulated community, environmental nonprofits, and other organizations with technical expertise in the design of cap and trade programs.

**Delaware’s CO2 Budget Trading Program - Regulation 1147**

The DE CO2 Budget Trading Program – Regulation 1147 (“regulation”) affects coal, oil, and gas-fired electric generating units (“sources”) with a nameplate capacity of at least 25 megawatts. The MOU requires each member state to auction at least 25% of its annual CO2 allowances to create a fund to support energy efficiency projects, and to either auction or allocate the remainder of its allowances. Sources will need to purchase and/or be allocated an allowance for each ton of CO2 they emit annually. Allocating allowances to support consumer benefits leads to lowering of electricity demand, reducing the overall compliance costs of the RGGI program and its impact on electricity ratepayers.

2008 Delaware legislation dictates the extent Delaware allowances will be auctioned and allocated, and how funds from the auctioning of allowances will be distributed. Beginning with 2009 CO2 allowances, the Department will auction 60% of allowances available to Delaware and allocate 40% to generators in proportion to their average annual emissions from 2000-2002. The percentage of allowances auctioned by the Department shall increase by 8% per year, such that 100% of Delaware’s allowances for 2014 shall be auctioned in accordance with Title 7, Chapter 60. The proceeds of the auction or auctions will be used to promote the purposes of the energy efficiency

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\(^{11}\) 40 CFR Part 96 – NOX Budget Trading Program and CAIR, NOX, and SO2 Trading Programs for State Implementation Plans. See [http://www.access.gpo.gov/nara/cfr/waisidx_06/40cfr96 06.html](http://www.access.gpo.gov/nara/cfr/waisidx_06/40cfr96 06.html).
and clean technology account and for administrative costs associated with the CO$_2$
Budget Trading Program.

Proposed Regulation 1147 is divided into eleven sections. Below is a summary of the
requirements outlined in the regulation.

1. **Applicability**

   a. **General.** Any fossil fuel-fired unit serving an electric generator with a
      nameplate capacity of 25 megawatts and greater is subject to the
      program.

      The size threshold is based upon an analysis of several data bases
      covering the RGGI region’s units, including EIA, E-grid and state specific
      information. The 25 MWe de minimis captures about 98% of the total
      generating output in the region. The remaining 2% is generated by
      hundreds of known units and thousands of units that are not contained in
      any state or federal data bases. Further, the majority of these smaller units
      do not currently have any applicable permitting requirements under either
      the NOx budget or acid rain programs. The 25 MWe de minimis therefore
      captures the units that generate almost all of the region’s electricity,
      recognizing that, launching a new program to regulate carbon should
      focus first on the major greenhouse gas contributors. This focus also
      facilitates program administration, understanding, consistency and
      certainty for the states, the regulated community and the public.
      (See § 1.2.1)

   b. **“Behind the Meter” Exemption.** If a unit supplies less than 10% of its
      electrical output to the grid, then the proposed regulation provides for it to
      apply to be exempted from the program. Any units that avail themselves
      of this exemption will be required to report the amount of their annual
      electricity generation to the applicable state, and retain records for at least
      ten years. Any exempt unit whose electrical output exceeds 10% in any
      year subsequent to receiving the exemption will be subject to the RGGI
      program and its applicable requirements (once in, always in concept).
      (See § 1.2.2)

   c. **50% Biomass Exemption.** If a source burns biomass for more than 50%
      of its total fuel, then it would not be subject to the program.
      (See Definition of “fossil fuel – fired” § 1.4)

2. **Source Compliance Requirements**

   a. **Start Date.** January 1, 2009 (See § 1.5.3.3)
b. **Permit Requirement.** Each unit must have a permit that requires the source comply with the requirements of the program. (See § 3.1)

c. **Allowance Account Representatives.** Each source must designate one and only one Account Representative and one and only one Alternative Representative. (See § 2.1, 2.2 & 2.3)

Regulation 1147 requires each CO₂ budget unit to have a CO₂ authorized account representative (AAR) who shall be responsible for, among other things, complying with the CO₂ budget permit requirements, the monitoring requirements, the allowance provisions, and the recordkeeping and reporting requirements. The owner and/or operator of the unit may also designate an alternate CO₂ AAR to perform the above duties.

The CO₂ Budget Trading Program was designed to allow for the use of agents that can make electronic submissions on behalf of the AAR and Alternate AAR. If the CO₂ budget source is also subject to the Acid Rain Program, then for a CO₂ Budget Trading Program compliance account, this natural person shall be the same person as the alternate designated representative under the Acid Rain Program.

d. **Allowance “True-up”**. Each source must cover its emissions with the CO₂ allowances at the CO₂ allowance transfer deadline, which falls on March 1 after the control period ends. (See § 1.5.3; & § 6.5)

The **control period** is a three-year period unless extended by a “stage two trigger event” which occurs if the average allowance price exceeds $10 (2005$ + 2% per year) on a 12-month rolling average basis.

Multi-year compliance periods were employed to provide regulated facilities more flexibility to adjust to variations in electricity demand (driven by meteorology and load growth), fuel price spikes, clean unit outages, etc. A longer compliance period may also lead to resource (administrative) savings for the regulated facilities and for implementing Delaware’s program. This design component was included in lieu of allowance borrowing, as it allows for de facto borrowing within a three-year compliance period. (See Definition at § 1.4)

e. **Limit on Use of Offsets at True-Up.** A source may cover up to 3.3 % of its emissions with CO₂ offset allowances unless:

1. the 12–month rolling average spot price for allowances is $7 or more, in which case 5.0 % of a source’s emissions can be covered with offsets; or
2. the 12–month rolling average spot price for allowances exceeds $10 for two consecutive 12 – month periods, in which case 10.0% of a source’s emissions can be covered with offsets. (See § 6.5.1.3)

f. Compliance Certification. Each Account Representative must file a compliance certification at the end of each compliance period (referred to as a “control period” in the regulation). (See § 4)

g. Emission Monitoring, Reporting and Record keeping. Each source must monitor its emissions consistent with existing practice under federal rules, and file quarterly emissions reports with the Department. Records must be maintained for ten (10) years by the source for inspection by the Department. (See § 8)

3. State Allowance Budget. Specified for each allocation year. (See § 5.1)

4. Allowance Allocations.

a. Timing of Allocations. No later than January 1, 2009, the Department will determine the allowance allocations for the years 2009, 2010, 2011 and 2012. By January 1 of each succeeding year, the Department will determine the allowance allocations for the year that begins three years hence. (See § 5.2)

b. Allocating Allowances. RGGI takes an innovative approach to how states allocate allowances to regulated sources. Historically, cap and trade programs have allocated allowances directly to regulated emissions sources. Under RGGI, instead of giving allowances directly to electric generators for free, states would sell a significant portion or all allowances through a regional auction or otherwise.

RGGI takes this approach because in a competitive wholesale market electric generators pass through the market value of free allowances to the price they bid into the market. The RGGI program proposes to use this allowance value to provide incentives for end use energy efficiency and other measures, thus lowering the impact of the program on electricity consumers.

In the RGGI MOU participating states have agreed to allocate a 25% minimum of allowances to support consumer benefit programs. Allocating allowances to support consumer benefits leads to lowering of electricity demand, reducing the overall compliance costs of the RGGI program and its impact on electricity ratepayers.
The regulation provides for allowance allocations in accordance with Title 7, Chapter 60 which requires the Department to auction 60% of allowances available to Delaware and allocate 40% to generators in proportion to their average annual emissions from 2000-2002. The percentage of allowances auctioned by the Department shall increase by 8% per year, such that 100% of Delaware's allowances for 2014 shall be auctioned.

Note that the Department has established one set-aside account. A Limited Industrial set-aside account was established for those sources that are anticipated to qualify as meeting the "Behind-the-meter" generation of less than 10% and request a permit condition restricting generation to the grid. (See § 5.3)

c. **Administration of Allowance Accounts.** The Department, or its agent, will establish compliance accounts for each unit, as well as "general accounts" for individuals other than authorized account representatives for units covered by the program. (See § 6)

d. **Administer Emissions and Allowance Tracking.** The Department or its agent will establish an emissions and allowance tracking system that will receive emissions data, allowance allocations, and receive and effectuate allowance transfers reported by the sources. (See § 7)

5. **Early Reduction Allowances.**

Early reductions allowances (ERAs) will be issued for actions taken at units subject to the program on or after December 20, 2005, that results in an improvement in the efficiency (heat rate) of the unit and result in an absolute reduction in CO$_2$ emissions. Like offset allowances, these allowances would be issued in addition to the state budget.

ERAs are awarded directly to the CO$_2$ budget source, are not included in the auction, and are in addition to the cap. To be eligible to receive ERAs, a CO$_2$ budget source must submit an ERA application no later than May 1, 2009 demonstrating the following:

- An absolute reduction in the mass of CO$_2$ emitted during the early reduction period (the three years 2006, 2007, and 2008), relative to the baseline period (the three years 2003, 2004, 2005 – the three years immediately preceding the early reduction period)
- A reduction in the average CO$_2$ emissions rate resulting from electric energy output and useful thermal energy output for all the CO$_2$ Budget Units at the CO$_2$ budget source during the early reduction period relative to the baseline period
- Facility shutdowns are not eligible for ERAs. (See § 5.3.3)
6. **Penalty Provisions.**

   If at the end of a control period, a source has failed to cover all of its emissions with allowances, the Department will deduct up to 3 times the deficit from the source’s future allocations. This is in addition to any state specific penalties that may apply to the violation. (See § 6.5.4)

7. **Severability.**

   If one part of the regulation is held invalid, the remainder of the regulation would stand. (See § 1.7)

8. **Offset Provisions.**

   The emissions offset provisions of the regulation provide compliance flexibility by awarding CO₂ offset allowances to projects outside the capped sector that reduce and/or sequester emissions of greenhouse gases. CO₂ offset allowances may be used to satisfy a limited fraction of a source’s compliance obligation. Initially, the use of CO₂ offset allowances is constrained to 3.3% of a unit’s total compliance obligation during a control period, though this may be expanded to 5% and 10% if a stage one or stage-two trigger event occurs, respectively.

   In order to ensure that the CO₂ offset allowances awarded represent CO₂ equivalent emissions reductions or carbon sequestration that are real, additional, verifiable, enforceable, and permanent, highly prescriptive standards were developed for specific project categories.

   a. **Procedure for Offset Project Applications.** Eligible offset projects may be located in any participating state, or any other state or U.S. jurisdiction in which a cooperating regulatory agency has entered into a MOU with the participating states to provide oversight support related to CO₂ emissions offset projects in that state or U.S. jurisdiction. Offset project applications will be submitted to the appropriate regulatory agency in the state where the project occurs. Applications for projects not located in any RGGI signatory state will be submitted to any one RGGI signatory state.

   Eligible offset projects must go through a two-step application process and must be verified after both steps by an accredited independent verifier. The first step is a consistency determination, whereby the applicable regulatory agency would determine whether a project meets the eligibility criteria. The second step is the submittal of an annual monitoring and verification report, which requires the applicant to demonstrate the precise amount of greenhouse gas emissions reduced or sequestered before offset allowances are awarded. (See § 10.4)
b. **Specific Offset Standards.** The initial list of project categories was selected with consideration of expected offset supply within the borders of RGGI MOU signatory states; the relative ease of developing standards; and, the likelihood of mandatory greenhouse gas regulations for that sector. The participating states intend to develop methodologies for evaluating new categories of offset projects.

1. **Landfill Methane Standards.** (See § 10.5.1)
2. **SF6 Emissions Reductions.** (See § 10.5.2)
3. **Sequestration through Afforestation.** (See § 10.5.3)
4. **Fossil Fuel Energy Efficiency.** (See § 10.5.4)
5. **Agricultural Methane Capture.** (See § 10.5.5)

9. **Auction Provisions.**

The auction will be carried out to achieve the following objectives to the extent practicable: achieve fully transparent and efficient pricing of allowances; promote a liquid allowance market by making entry and trading as easy and low-cost as possible; be open to participation for bidding by any individual or entity that meets reasonable minimum financial requirements; monitor for and guard against the exercise of market power and market manipulation; be held as frequently as is needed to achieve design objectives; avoid interference with existing over-the-counter allowance markets; align well with wholesale energy and capacity markets; and be designed to not act as a barrier to efficient investment in existing or new electricity generating sources.

Delaware has agreed to specific design elements of the auction. These include: reserve price, auction structure and format, allowance sale schedule, participation, unsold allowances, notice of auctions, monitoring, and auction results.

a. **Auction Structure and Format:** Allowances will be made available for sale on a quarterly basis in lot sizes of 1,000 allowances. The initial auction will offer allowances through a single-round, uniform-price, sealed-bid auction format. While the goal is to maintain a consistent auction format, flexibility will be retained to transition to a multiple-round, ascending-price auction format if necessary to address evolving market conditions. (See § 11.5)
b. **Allowance Sale Schedule:** Allowances will be identified with a vintage corresponding to the allowance’s respective allocation year. All allowances made available for auction by the Department, for a respective compliance period, will be offered for sale prior to the end of that compliance period. Future allowance vintages will be made available for sale in a quantity up to 50-percent of their respective annual allocation, and such offerings may be for allowances extending up to four allocation years into the future. (See § 11.5.4)

c. **Participation:** All market participants will be eligible to participate in the initial auction, provided they meet applicable qualification requirements, which will include provision of financial security. Flexibility will be retained to limit participant eligibility in subsequent auctions. Auction rules will establish a total limit for the number of allowances that entities (e.g., an organization and its affiliates and/or agents) may purchase in a single auction, equivalent to 25-percent of the allowances offered for sale in any single auction. (See § 11.7)

d. **Reserve Price.** Reserve Price represents the price below which no allowances will be sold at the auction. Its use is important for mitigating the potential for auction prices to clear significantly below current market prices, due to tacit or explicit collusion, weak competition, or to maintain a minimum rate of progress in reducing emissions below business as usual. The Department will disclose the Reserve Price before every auction. (See § 11.5.6)

e. **Unsold Allowances:** Any unsold allowances will be made available for sale in future auctions in which a reserve price based on the current market price is being used. In 2012, as part of the first program review envisioned in the December 2005 RGGI Memorandum of Understanding, a decision will be made by the participating states as to whether to retire any unsold allowances from the first compliance period, or to offer these allowances for sale in subsequent auctions during the second compliance period. (See § 11.5.7)

f. **Notice of Auctions:** A public notice of auction will be provided at least 45 days prior to each auction. Such notification will be posted on a publicly available RGGI auction web site. Each auction notice will provide at a minimum: the date, time, and location of the auction, the categories of eligible bidders, any requirements established for qualified participants, the quantity of allowances to be auctioned, and all other relevant information and procedures necessary for prospective bidders to participate in such auction. (See §11.9).

g. **Monitoring:** The participating states will retain a professional independent market monitor to monitor auctions and subsequent market activity. The
independent monitor will observe the conduct of the auction qualification process and the conduct of the auction itself. Based on such monitoring, the independent monitor will provide the participating states with a timely report of whether the auction was conducted in accordance with the regulations established by participating states and the noticed procedures and requirements that apply to qualified auction participants. (See § 11.11)

h. **Auction Results:** Upon approval by the participating states of the auction outcome and upon payment in full by successful bidders to the respective participating states, the Department shall transfer the corresponding CO₂ allowances to each successful bidder's applicable account in the CO₂ allowance tracking system. The Department will retain full regulatory authority for transferring allowances from its respective state account to winning bidders, contingent on approval of auction results and financial settlement.

Within a reasonable period of time following each auction, the Department shall publish on the RGGI auction website the auction clearing price and the total amount of allowances sold in such auction. (See § 11.11)

10. **Miscellaneous Provisions.**

a. **Definitions.** (See § 1.4)

b. **Banking.** The regulation provides for the banking of allowances with no restrictions. Banking provides facilities with the ability to carry over unused allowances from a current compliance period into future compliance periods. Therefore, banking should provide allowance price stability while providing an incentive to hedge future year emissions uncertainty. (See § 6.6)

c. **Price Triggers.** The MOU and regulation include allowance price triggers, which provide additional compliance flexibility and price dampening in the event of higher allowance prices in two distinct stages.

A stage-one trigger event occurs if the twelve-month rolling average CO₂ allowance price is equal to or greater than the stage one trigger price. The stage-one trigger price is set at $7 in 2005 dollars, and will be adjusted up or down each year according to the consumer price index. In the event that a stage-one trigger event occurs, CO₂ budget units will be able to expand their use of CO₂ offset allowances from 3.3% of their compliance obligation to 5% of their compliance obligation (see “Offsets” below).

A stage-two trigger event occurs if the twelve-month rolling average CO₂ allowance price is equal to or greater than the stage-two trigger price. The stage-two trigger price is set at $10 in 2005 dollars, and will be adjusted
up or down each year according to the consumer price index plus two percent.

If a stage-two trigger event occurs:
- CO₂ budget units will be able to use CO₂ offset allowances to satisfy 10% of their compliance obligation;
- The compliance period will be extended to four years; and,
- CO₂ offset allowances may be awarded for the permanent retirement of greenhouse gas allowances or credits that have been issued pursuant to any mandatory carbon constraining program outside the United States that places a specific tonnage limit on greenhouse gas emissions, or greenhouse gas emissions reduction credits certified pursuant to the United Nations Framework Convention on Climate Change (UNFCCC) or protocols adopted through the UNFCCC process.

The price trigger provisions include a 14-month market settling period, which commences at the start of each new compliance period. The twelve-month rolling averages used to calculate the stage one and stage two trigger events cannot include the 14-month market settling period. Therefore, the earliest that either trigger event can occur is 26 months after the commencement of a compliance period.

Calculations of trigger prices, and determinations as to whether or not a Stage-one or stage-two trigger event has occurred, will be performed by the applicable regulatory agency, in consultation with the applicable regulatory agencies in other signatory states. (See Definitions at § 1.4)

III. COMPARISON OF THE REGULATIONS TO FEDERAL STANDARDS

No federal regulation currently exists for the control of CO₂ emissions from the burning of fossil fuels for electricity. These Delaware regulations, as a part of the larger RGGI regional process, would be among the first regulations of their kind in the country.
IV. AFFECTED SOURCES\textsuperscript{12}

These regulations affect fossil fuel-fired generating units at the following plants:

<table>
<thead>
<tr>
<th>Table 2 – Delaware Electric Generators &gt; 25 MW</th>
</tr>
</thead>
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<td>Valero Refinery</td>
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V. GREENHOUSE GASES

Atmospheric gases including CO\textsubscript{2}, methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6) are called greenhouse gases (GHGs) because they trap the sun’s energy in the atmosphere close to the earth’s surface as heat, similar to the glass panels of a greenhouse. They are emitted through a combination of human activities and natural processes as described below.

Carbon Dioxide

CO\textsubscript{2} is a gas emitted through the burning of fossil fuels such as oil, natural gas, and coal, and through the burning of solid waste, trees, and wood products. It is also cycled through natural systems. Carbon dioxide is produced naturally through the eruption of volcanoes and respiration of animals. Plants use CO\textsubscript{2} in photosynthesis, converting energy from the sun into living matter such as leaves and branches. In addition, the oceans at their surface release CO\textsubscript{2} to the atmosphere and store CO\textsubscript{2} from the atmosphere.\textsuperscript{13}

Since the Industrial Revolution in the 1700’s, human beings have caused a significant increase in CO\textsubscript{2} levels in the atmosphere. The National Oceanic and Atmospheric

\textsuperscript{12} DNREC Air Quality Emissions Inventory Data.
Administration (NOAA) has indicated global CO₂ levels to be approximately 36% higher in 2005 than in pre-industrial times.¹⁴

**Methane**

Methane (CH₄) is emitted from the burning of fossil fuels as well as biomass, the cultivation of rice, the raising of livestock, and the management of waste. It also comes from natural sources such as wetlands, termites, oceans, permafrost, and wildfires.

**Nitrous Oxide**

Nitrous oxide (N₂O) also has human and natural sources. It is produced through the combustion of fossil fuels, animal manure management, sewage treatment, and agricultural soil management. Natural sources include wet tropical forests and biological materials in soil and water.

**Fluorinated Gases**

Fluorinated gases include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). These are emitted during industrial processes such as aluminum production, semiconductor manufacturing, magnesium production and processing, and electric power transmission.¹⁵

**VI. ENVIRONMENTAL & HEALTH IMPACTS OF CLIMATE CHANGE**

**Summary**

According to the International Panel on Climate Change (IPCC) in its 2007 Assessment Report, the evidence for human-influenced global climate change is “unequivocal.”¹⁶ Delaware’s natural environments and its citizens are at great risk. Due to its small size, the whole state of Delaware is considered coastal, making it highly vulnerable to increased sea level rise.¹⁷ Delaware has a rich coastal environment that includes tidal flats, salt marshes, and beaches, all of which serve important ecological, recreational, and economic functions. These resources all are at substantial risk not only from

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¹⁴ National Oceanic and Atmospheric Administration (NOAA), Earth Systems Research Laboratory, as quoted by the U.S. Environmental Protection Agency (EPA), [http://www.epa.gov/climatechange/science/recentac.html#ref](http://www.epa.gov/climatechange/science/recentac.html#ref), accessed 12/10/07.


continued climate change, but also from other problems such as pollution, overdevelopment, and wetlands loss, among other things.

The IPCC models suggest, though, the possibility of mitigating some of the impacts of climate change. By reducing atmospheric levels of greenhouse gases, the world may see sea levels rise 1.5 feet rather than 3 feet. The risks of deterioration of the Greenland ice sheet, the melting of which influences sea levels as far away as Delaware, may be reduced significantly. Likewise, by reducing levels of greenhouse gases, the number of days of extreme heat stress may increase only slightly.\(^\text{18}\)

**Risk from Greenhouse Gas Emissions in Delaware**

All Delawareans are at risk of economic and health impacts from greenhouse gas emissions in the State. Global warming not only poses a serious threat to the health of the planet, it also puts Delawarean’s own health at risk. Rising temperatures will most likely lead to more air pollution and other serious threats to lung health. With rising temperatures, there will be many more smoggy days. While ozone - the main ingredient in smog - high up in the atmosphere actually protects Delaware’s citizens from the sun's ultraviolet rays, ozone down near the ground is very dangerous to lung health and can lead to wheezing and coughing, increased risk of asthma attacks, and more visits to the hospital for breathing problems.\(^\text{19}\)

Particularly threatened, though, are the residents who live in the coastal areas at the greatest risk of flooding (see “Delaware Coastal Areas Vulnerable to Sea-Level Rise,” Figure 2). Delaware’s coastal population increased by 30 percent from 1980 to 2008. The Delaware Bay watershed is one of the ten most densely populated coastal watersheds in the nation.\(^\text{20}\)

**Delaware Coastal Areas Vulnerable to Sea-Level Rise**

The coast of Delaware is perhaps the state’s most vital resource. Its 381 miles of shoreline, including the 24 miles that front the Atlantic Ocean, provides economic benefits from tourism, coveted high-value space for commercial and residential development, and many forms of recreation, including boating, fishing, and beach-going.

Delaware’s coastline also is an important ecological resource—providing habitat for a variety of plants, animals, insects, migratory birds, and a multitude of other terrestrial and aquatic wildlife. Delaware’s shoreline includes barrier beaches, inland bays, small islands, and highly productive estuaries, marshes, and tidal flats.

\(^{18}\) IPCC. 2008.
Historical data indicates that sea level has been rising in Delaware since the last Ice Age. Recent sediment analysis and historical tidal gauge records in the area show a rising sea level trend of about 3 mm per year, or about one foot over the last 100 years. If these trends continue into the future, Delaware’s coastal resources and communities could be at risk.

Potential effects from sea-level rise include inundation of wetlands and other low-lying lands, erosion of beaches, intensified flooding, and increased salinity of rivers, bays, and groundwater tables. Also, as sea level rises, storm surge becomes more of a threat to property located along the coast. Although sea level rise itself is too gradual to create severe flooding problems for property located along the Delaware coast, sea level rise can be a contributing factor to property damage when coupled with storm surge. Coastal property and property located within tidal floodplains is particularly susceptible to increased damage from coastal storms and associated storm surge.

Historical and Current Sea Level Rise

There is no doubt that sea level is rising both worldwide and along parts of Delaware’s coastline. The majority of sea level rise comes from thermal expansion of the ocean’s waters—an effect of global warming. The melting of glaciers and ice caps also contributes a significant amount to sea level rise, with somewhat smaller contributions coming from the melting of the Greenland and Antarctic Ice Sheet.

In Delaware, there also is an effect from local land “subsidence.” Here, sea level rises relative to the land, as the land slowly drops due to the after-effects of the last Ice Age. While thermal expansion is currently the main contributor to global sea level rise, contributions from the melting of glaciers and ice sheets will eventually become the dominant factor as temperatures continue to rise.

Scientific measurements and data indicate that the total 20th-century global sea level rise was about 17 mm, or 6.7 inches. Between 1961 and 2003, global sea level rose at an average rate of 1.8 mm per year. At the later part of the century, between 1993 and 2003, the rate was much higher—about 3.1 mm per year (see the IPCC’s most recent report on climate change for further details).

The sea level in Delaware is rising as well. Research has shown that the sea level in
Delaware has been rising for the last 12,000 to 14,000 years, or since the last ice age. Sediment analysis along the Delaware coastline indicates that sea level rise in Delaware has averaged about 0.9 mm per year over the past 1200 years, while tide gauge data shows a rise of about 3.3 mm per year over the past 100 years (see Nikitina et al., 2000; USEPA, 1997). Moreover, the most recent estimates from the U.S. EPA indicate that sea level has been rising 0.08-0.12 inches per year (2.0-3.0 mm per year) along most of the U.S. Atlantic and Gulf coasts. Based on past and current estimates, scientists are now concerned that the rate of sea level rise may be accelerated in the future.

**Future Sea Level Rise**

The Intergovernmental Panel on Climate Change (IPCC) has projected global average sea level rise estimates for the end of the 21st century based on a number of different emission scenarios. Under the low greenhouse gas emission scenario, sea level is expected to rise between 7 and 15 inches by 2100; under the high emission scenario, sea level is expected to rise between 10 and 23 inches by 2100.

These estimates mean that continued sea level rise in Delaware could be a concern, although there is considerable uncertainty and disagreement among researchers regarding the rate of future sea level rise in Delaware. Also, according to the IPCC, current model projections indicate substantial variability in future sea level rise between different locations. This means that some locations could experience sea-level rise higher than the global average projection, while others could actually have a fall in sea level. However, using the historical data for Delaware mentioned above, and given the fact that overall global temperatures and sea level are predicted to continue to rise worldwide, it is likely that sea level in Delaware will continue to rise at a rate at least equal to that already seen—about 3 mm per year, or 12 to 13 inches total over the next 100 years.

The regions shaded red on the map above are some of the areas that could experience flooding at high tide if global warming causes the sea level to rise 2 feet in the next 100 years, as the IPCC estimates. Tidal variations and land subsidence (the gradual settling or sinking of the land) would, along with global warming, contribute to the effect shown.

Delaware’s coastline includes barrier beaches, inland bays and productive estuaries, freshwater and salt marshes, tidal flats, and several islands that dot the coast. Delaware Bay is the chief spawning ground for the horseshoe crab and a nursery for many coastal fisheries. Similarly, additional salt water and sediment could intrude into the habitats of fish and wildlife of the Bay. This would lead to additional loss of marshes and other

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wildlife habitats. As in many estuaries, the Delaware Inland Bays are already affected by shoreline erosion. Rising sea levels will further erode shores along the bay.22

Accelerated sea level rise due to global warming is expected to increase the frequency and magnitude of storms such as the 100-year storm, resulting in increased flood damage. Sea level rise also has the potential to exacerbate the damaging effects of coastal storms by increasing the severity of flooding in coastal communities, particularly during storm surges.

**Air and Weather**

If greenhouse gas emissions are not sufficiently reduced, average summer temperatures in Delaware, based on the IPCC’s global models, would increase by about 4°C (7°F) by the year 2100 and the number of days with temperatures greater than 90°F would be likely to quadruple, with 25 or more 100°F days.23 The progress that Delaware has made in reducing smog and other air pollution could be reversed with these temperature increases. Increased temperatures from global warming, along with strong ultra-violet radiation (sunlight), stable air masses, and the presence of volatile organic compounds (VOCs) and NOx, enhance the formation of ground-level ozone. Increased concentrations of ground-level ozone promote respiratory illness in children, the elderly, and those with pre-existing illnesses.

More intense and prolonged periods of summertime heat can result in increased mortality and heat illnesses, especially in cities that experience the heat island effect. The term “heat island” refers to urban air and surface temperatures that are higher than nearby rural areas. Many U.S. cities and suburbs have air temperatures up to 5°C (10°F) warmer than the surrounding natural land cover.24 The U.S. EPA reports that a one degree Fahrenheit (1°F) increase in average temperature could more than double heat related fatalities in cities like New York from 300 to 700 per year.25 Similar effects could be seen in other large cities such as Baltimore and Washington, DC.

Average winter temperatures in Delaware, based on the IPCC models, would increase by approximately 4°C (8°F) by the end of the century. Precipitation during the winter and spring is likely to increase 10-15%, coming mostly in heavy rainfall events, but the summers and falls are likely to be drier as increased evaporation depletes soil moisture.26

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23 Ibid.
Water Quality

The region’s public water supply would be stressed by changes in temperature and precipitation. Approximately two-thirds of Delaware’s 850 thousand citizens obtain water from the Delaware River Basin and other surface water sources. The amount of water available from these sources can be highly variable, for example, drought conditions occurred in Delaware in 1999 and 2002. Residential development and increased population in communities surrounding water supply areas is placing additional strain on the water supply, and predicted extended periods of drought from climate change would place additional stress on the system.

Most of Delaware drains to either Delaware Bay or Chesapeake Bay. The state relies heavily on a relatively shallow groundwater system for industrial and municipal water supply. Climate change could increase summer evaporation and thus reduce summertime recharge of aquifers, although some of this loss could be offset by increases in winter recharge if winter precipitation increases. Many of Delaware’s aquifers are contaminated by industrial pollutants. Although the effects of climate change on the movement of pollutants are not well understood, changes in infiltration rates could affect the rate at which pollutants migrate throughout an aquifer. Increased precipitation could contribute to groundwater contamination by increasing the inflow of contaminants into the state’s aquifers.27

Forests

According to the Chief of the USDA Forest Service, climate change is already impacting the nation’s forests. For example, the annual fire season is coming earlier and lasting longer each year, with fires burning hotter and bigger.

Warmer winters are affecting water supplies as mountain snowpacks become thinner and melt earlier in the spring, reducing water availability to many regions in the summer. Insects, pests and disease also are spreading faster and causing increasing problems for forest managers.

Delaware’s forests are also at risk. Delaware’s 375,000 acres of forests are under continuous stress from urban development. Delaware’s forests cover 35 percent of the land area in the State—less than any other state in the region. Delaware’s Forest Service manages three state forests totaling over 15,000 acres; Blackbird Forest near Smyrna, Taber Forest near Harrington, and Redden Forest near Georgetown (see map right). According to a 2006 analysis by the Delaware Forest Service, approximately 3,000

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acres (or one percent of the State’s total forest land) have been cleared for development each year during the last five years.\textsuperscript{28} This development of forest lands is not sustainable in the long run. In addition to these direct pressures, climate change could further impact the health of Delaware’s native forest species.

According to the Northeast Climate Impacts Assessment (NCIA), while gradual shifts in climate over the past 120,000 have not caused any climate-driven extinction of tree species in the Northeast, the projected rate of human-induced warming is now too fast for most species to adapt.\textsuperscript{29} Trees with slower response times and narrow habitat requirements are particularly susceptible as their suitable habitat shifts northward.

A report by the US Global Change Research Program (2008) indicates that, as temperatures rise, Delaware’s northern oak/pine forests are expected to transform into a more mixed forest type characteristic of the area south of Virginia.\textsuperscript{30}

Moreover, the US Environmental Protection Agency (1997) estimates that the extent and density of forested areas in Delaware could decline by as much as 10-20 percent because of climate change impacts. US Shifts in species composition are not the only projected stress on Delaware’s natural forest habitat.

Warmer temperatures and reduced summer precipitation may increase the risk of forest fires and alter trees’ resistance to insects and other pests. Warmer climate might also allow invasive species to establish themselves in areas that were once too cold or unsuitable. Also, changes in Delaware’s tree species composition could bring changes to the state’s other forest wildlife, especially if natural habitat quality declines.

Furthermore, on another level, changes in forests and other ecosystems may impact peoples’ quality of life and well being in ways that are very difficult to quantify.

\textbf{Animal and Plant Life Cycles}

Climate change will affect phenology, the timing of biological functions in relationship to climatic events. In wildlife, migration, breeding/spawning, hibernation, estivation, and the natural range of species are all likely to change in response to a shift in the climate, especially when flowering and fruiting in plants they feed upon also are changed. Some plants need low winter temperatures in order to reach optimal production of flowers and fruit during the growing season and may be impacted by increased temperatures.


\textsuperscript{29} Northeast Climate Impacts Assessment (NECIA), \textit{Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions}, released July 11, 2007.

In many cases, though, biological activities are ultimately triggered by non-climatic signals, such as day length, at the same time that temperature affects many natural processes. This combination would potentially result in wildlife populations attempting to reproduce or migrate at unfavorable times.\textsuperscript{31}

Temperature also affects the range of a species; butterfly species in Europe and North America have already shifted their ranges northward. Some climate change models predict that the range of birds, such as Maryland’s Baltimore Oriole, may shrink or disappear from their natural region.\textsuperscript{32}

In addition, severe weather effects besides coastal flooding and storm surges can harm fish and wildlife populations; for example, unpredictable and irregular droughts, tornadoes, and ice storms can stress wildlife and their habitats to a degree from which some species may not be able to recover.

Delaware’s coastal waters are critical for many commercial species, game species such as deer, and migratory birds, including bobwhite quail. The Delaware estuary is an important habitat for migratory shorebirds, waterfowl, migratory songbirds, fish, and other coastal species such as horseshoe crabs. Approximately 35% of the Delaware estuary’s rare species live in or depend on wetland habitats, and 70-90% of the state’s commercial fish and shellfish species either live entirely in estuarine habitats or use them as nursery grounds. Delaware Bay has the second largest concentration of migratory shorebirds in the Western Hemisphere, with approximately 1.5 million shorebirds passing through the bay area each spring.\textsuperscript{33}

\section*{Agriculture}

Agriculture is Delaware’s largest industry. According to 2005 data from the USDA, agriculture in the state is well over a billion-dollar industry, with most of it coming from livestock, mainly broiler chickens ($844 million). The major crops in Delaware are corn ($36 million), soybeans ($28 million), and wheat ($10 million), along with vegetables for the fresh market ($29 million).

Because agricultural production is closely tied to climate and water supply, farmers throughout the Northeast, including Delaware, will face increasing uncertainty and risk as they adapt to changes in the region’s climate.


\textsuperscript{33} United States Environmental Protection Agency (EPA), Office of Policy, \textit{“Climate Change and Delaware,”} EPA 230-F-97–008h, September 1997.
To date, analysis shows that aggregate U.S. food production will not be harmed by climate change in the short-run, though there may be significant regional changes. In fact, according to the Intergovernmental Panel on Climate Change’s (IPCC) most recent report, “moderate climate change” will likely increase yields of North American crops such as corn, rice, soybeans, and wheat by 5 to 20 percent over the next few decades.

If this projection holds true for Delaware, this could be good news for farmers who farm these crops. However, there are a number of negative impacts from climate change that the Delaware agricultural industry should be aware of—including summer heat stress, drought, and increased pest-related damage. While farmers in the Northeast may benefit from warmer temperatures and extended growing periods, “many traditional farm operations in the region will become unsustainable without adaptation strategies that could be quite costly.” 34

According to the U.S. Environmental Protection Agency, the effects of climate change could cause major crop yields in Delaware to decline by as much as 32 percent or to rise by as much as 24 percent. Crop productivity is tied to a host of factors, including temperature, water supply, the weather, competition from weeds and pests, and even atmospheric carbon dioxide concentrations. With continued climate change, many of these factors may alter productivity in Delaware, altering productivity. For example, according to the Northeast Climate Impacts Assessment (NCIA), warmer weather is projected to increase the growing season in the Northeast by four to six weeks by the end of the century.

While this will benefit farmers who grow crops that require longer growing seasons, rising temperatures also will cause hardship for farmers who grow crops that require significant periods of frost and winter chill for optimum flowering, fruit set, and seed development.

Increases in temperatures, drought, and/or CO₂ levels are expected to affect yields of these and other crops. Increased CO₂ levels tend to lead to greater agricultural yields in some crops. In contrast, increased temperatures and drought tend to impact processes such as pollination and grain set. At temperatures above 33ºC (91ºF), these processes begin to fail.35 Increased temperatures in Delaware also will cause problems as all crops will face increased risk of summer heat stress and drought. Crops like corn, wheat, and oats—all of which are grown in Delaware—tend to have lower yields as summer temperatures rise (NCIA, 2007).

Rising temperatures and drought are likely to increase irrigation demands in Delaware as dry soil and transpiration (the evaporation from the leaves of a plant’s pores) increase.

More frequent irrigation, in turn, will increase demands on the state’s water supply. And although climate change is predicted to bring more frequent and stronger rainstorms, the rain that these “heavy precipitation” events bring can further jeopardize farmers’ profits by ruining crop fields and soils and disrupting spring planting (NCIA, 2007).

Rising temperatures also are projected to escalate weed and pest-related problems for farmers, requiring additional use of herbicides and pesticides. One particular concern to regional agriculture is that warmer temperatures will extend the ranges and voracity of certain weed species, perhaps encouraging the spread of southern invasive weeds that currently cause major crop loss into northern areas (NCIA, 2007).

Dairy farmers would also be impacted since milk production is maximized under cooler conditions ranging from 41 to 68 degrees Fahrenheit.36 Chicken farming is also a major industry in Delaware, and impacts would include increased energy costs for cooling the housing for chickens.

Insect- and Animal-Borne Disease

Increased temperature and precipitation levels produce conditions favorable for the introduction and spread of vector-borne illnesses such as Lyme Disease, Equine Encephalitis, West Nile Virus, and other diseases spread by mosquitoes, ticks, and wild rodents.37 West Nile Virus and Equine Encephalitis are already present in mosquitoes in Delaware.

VII. SECONDARY IMPACTS OF REGULATIONS

Leakage

“Emissions leakage” is the concept that there could be a shift of electricity generation from sources subject to a RGGI cap-and-trade program to higher emitting sources not subject to RGGI that results in a net increase in carbon dioxide (CO2) emissions. The implementation of a carbon cap on power plants is expected to increase the cost of electricity generation in the RGGI region. In a competitive power market, this may have the effect of shifting generation in the larger region to uncontrolled, and presumably cheaper, fossil fuel-fired generation not subject to a carbon cap.

Because RGGI is being implemented in a competitive generation market, the addition of a carbon compliance cost that applies to only a subset of electric generators in the market could lead to a shift in the dispatch of electric generators and changes in flows of energy on the transmission system in response to this CO2 price signal. The concept of emissions leakage is, therefore, specific to a scenario where a larger national

program does not exist and a regional program is being implemented that does not fully cover the respective regional wholesale electricity markets.

RGGI has considered leakage to be a serious concern and, in response, established an Imports and Emissions Leakage Working Group in December 2005. In March 2007, the group drafted a preliminary report for the RGGI Agency Heads. The report, entitled “Potential Emissions Leakage and the Regional Greenhouse Gas Initiative (RGGI): Evaluating Market Dynamics, Monitoring Options, and Possible Mitigation Mechanisms,” reviewed the leakage issue and potential solutions. The report recommended modifications to existing generation attribute tracking systems in the RGGI region in order to monitor emissions leakage. It also evaluated diverse policy options for addressing potential emissions leakage. These included policies to reduce electricity demand, a carbon procurement adder, a carbon procurement emissions rate, an emissions portfolio standard, and a load-based emissions cap.38

In March 2008, the working group provided to the commissioners and secretaries of the environmental and energy agencies in the RGGI states an update on the March 2007 report. Included in the report was documentation of the group’s work with the three independent system operators (ISO) for the RGGI region: the New England, PJM, and New York ISOs. To help to address leakage, all three ISOs are working to add emissions and leakage tracking measures to their generation tracking systems. Implementation of these measures is expected by the end of 2008. The working group recommends policy options for reducing electricity demand as another means of reducing potential leakage. Finally, a federal CO2 cap-and-trade program, an increasing prospect, would fully eliminate the problem of leakage.39

VIII. ECONOMIC ANALYSIS

Expected Costs to the Regulated Entity & the General Public from the Regulations

The regulations establish the DE CO2 Budget Trading Program with which all fossil fuel-fired generators of at least 25 Megawatts must comply. There are no costs to generators for additional pollution prevention equipment to reduce CO2 emissions since current technology has not reached this level of development. Instead, generators must purchase, either through auction, or the secondary market, one allowance for each ton of CO2 emitted for each three-year period, beginning 2009. The revenue generated by


the auction and/or sale of allowances shall be directed to public benefit purposes in accordance with Title 7, Chapter 60. The funds will then be used to support energy efficiency, directly mitigate electricity ratepayer impacts, promote renewable or non-carbon emitting energy technologies, stimulate or reward investment in the development of innovative carbon emissions abatement technologies with significant carbon reduction potential, and administer these regulations.

This economic impact analysis primarily focuses on an estimate of the overall costs to implement these regulations. In this regard, a number of economic analyses have been considered, including economic evaluation of auction platforms and auction percentages by private consultants.

The original nine RGGI states (Maryland was not a participant at that time) jointly hired a consulting firm, ICF, to use its Integrated Planning Model (IPM) to project the economic impacts of RGGI under a variety of scenarios. The scenarios differ in factors such as national market prices for fossil fuels, growth in electricity demand, whether or not a federal cap on emissions comes into being, and how much funding is made available for electric efficiency programs. The IPM model produced results for wholesale electric rates, which DNREC used as input to REMI to determine regional macroeconomic impacts and also translated into retail rates and customer bill impacts. These results are available on the RGGI website, at http://rggi.org/documents.htm, in the summary documents section.

The macroeconomic impacts of RGGI are projected to be generally quite small in terms of impacts on employment, income, and gross regional product – generally one-tenth to one-hundredth of one percent reductions throughout the program duration. Under the scenario including a federal and Canadian carbon policy, the regional macroeconomic impacts were shown to be positive because electric generation in the northeast region is comparatively less coal intensive.

The retail electric price impacts were calculated for two of the later years,40 2015 and 2021 (the 2021 numbers reflect RGGI’s requirement to cut emissions 10% from the baseline levels). For the baseline RGGI package scenario, which includes no increased spending for efficiency programs, residential and commercial bills, averaged over the RGGI region, are projected to rise 0.3% in 2015 and 0.6% in 2021; and industrial bills 0.7% and 1.2%.

However, the rate impacts can be greatly mitigated by selling or auctioning the RGGI allowances and using the funds to expand spending on energy efficiency programs. Although electric rates rise, projections estimate that a doubling of efficiency programs enabled by RGGI auction proceeds will cause consumption to fall, resulting in bills that are lower on average across all customers compared to business as usual (i.e., no RGGI). After considering these energy efficiency savings, average residential customer

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40 “The Impact of Energy Efficiency Measures Integrated with the RGGI Policy on Residential, Commercial, and Industrial Customer Consumption and Bills” (Revision 12/08/07), MA Division of Energy Resources.
bills are estimated to decrease by 7% in 2015 and 12% in 2021. For commercial customers, bills are estimated to decrease by 4% in 2015 and 7% in 2021, and for industrial customers the bill reductions are estimated to be 2% in 2015 and 3% in 2021. Those customers that participate in the energy efficiency programs would expect greater overall cost reductions. A macro-economic impact study of the Program was also conducted at the direction of the RGGI state agencies through the Massachusetts Division of Energy Resources to estimate the potential impact of the Program on the economies of participating states. The study used a computer model called the Regional Economic Models, Inc. (REMI) model. The study concluded that the economic impacts of RGGI on the economies of the participating states, including Delaware, were very small and generally positive.

If both the U.S. and Canadian governments implement national caps on CO\textsubscript{2} emissions, customers in RGGI states will experience greater increases in electric rates than they would under RGGI alone. These greater increases in electric rates for the RGGI states would result because:

- Natural gas demand and prices would rise more under a US and Canadian CO\textsubscript{2} cap scenario than they would with only a northeast regional CO\textsubscript{2} policy; and
- The national caps prevent the "leakage" of low-priced coal-fired power into the RGGI MOU signatory states from other states or provinces because under the national cap scenario all areas would also be subject to the same price impacts as a result of the carbon cap.

However, under this scenario the entire nation experiences higher electric costs and the RGGI MOU signatory states would actually benefit economically relative to other regions due to their lower dependence on coal-fired power relative to the rest of the country.

The impacts of RGGI should also be considered in the context of other factors affecting electricity rates and bills, particularly the Forward Capacity Market (FCM) being run by the PJM ISO that will provide increased payments to generators that bring new capacity online. While the effects of the FCM are uncertain, reasonable expectations are that it will have far greater impacts than will RGGI.

IX. Alternatives Considered

DNREC examined the alternative of an emission rate based program for CO\textsubscript{2} to the cap-and-trade structure of the CO\textsubscript{2} Budget Trading Program that could conceivably be used to achieve equivalent emissions reductions. This alternative is a command-and-control regulatory structure which DNREC concluded is less cost-effective and more difficult for sources to implement than the CO\textsubscript{2} Budget Trading Program. The Department also determined that an emission rate program would be no more protective of the public health and the environment.

DNREC also considered a number of variations of the emissions cap-and-trade construct that could share many or most of the features of the CO₂ Budget Trading Program as proposed. These alternatives included: (1) a Delaware only trading program; (2) allocating allowances to generators at no cost; and (3) applicability to smaller sources.

In carrying out its statutory obligation to assess all relevant factors in developing an appropriate control program that is most cost-effective, the DNREC determined that emissions cap-and-trade programs are the most appropriate programs for the control of CO₂ emissions from the subject sources.

X. Reasons for Delaware to Implement the CO₂ Budget Trading Program

DNREC has chosen to propose and develop Regulation 1147 - CO₂ Budget Trading Program, a cap-and-trade program in response to the Governor’s commitment to the Regional Greenhouse Gas Initiative and as Delaware’s initial effort to address reductions in greenhouse gas emissions in Delaware. In summary, DNREC believes that implementing the CO₂ Budget Trading Program will provide the following benefits to Delaware:

- **Reduce the long-term costs of addressing climate change.** By acting now, Delaware may be able to avoid more disruptive measures later.42

- **Capture environmental co-benefits.** Reducing carbon emissions from the electric generators could lead to reductions in the emissions of other pollutants associated with fossil fuel-based electricity generation (e.g., NOₓ, SO₂, and Mercury). Additional co-benefits could be realized through the offsets component of the program, which would provide incentives for: afforestation, improved agricultural manure management, and reduced consumption of natural gas, propane, and home heating oil. The auction of allowances will generate revenue that can be used to benefit the environment and energy planning (e.g., through investments in energy efficiency and clean energy technologies).

- **Drive new technology.** By establishing a cost for emitting CO₂, the CO₂ Budget Trading Program will provide a market incentive for developing and deploying technologies that improve the fuel efficiency of electric generation, generate electricity from non-carbon emitting resources (e.g., wind and solar power), and reduce CO₂ emissions from combustion sources.

- **Promote expanded energy efficiency.** The offsets provisions provide incentives for end-use efficiency improvements. In addition, auction proceeds could be used for other energy efficiency programs in Delaware.

42 Note that when ranked against the nations of the world, RGGI MOU-signatory states represent one of the ten largest sources of carbon dioxide emissions from energy use.
- **Stimulate economic development.** The CO₂ Budget Trading Program will encourage growth of clean energy technologies in the region. This stimulus will be applied indirectly by establishing a cost for carbon emissions, and directly through programs funded by the auctioning of CO₂ allowances.
APPENDIX I: EMISSIONS IN DELAWARE, 2000-2002


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