MEMORANDUM

TO: EC4 GREENHOUSE GAS EMISSIONS REDUCTION STUDY TECHNICAL COMMITTEE
FROM: EC4 GREENHOUSE GAS EMISSIONS REDUCTION STUDY PROJECT TEAM
RE: CONSUMPTION VERSUS GENERATION METHODOLOGY
DATE: FEBRUARY 2, 2016

The purpose of this memo is to provide context and information regarding an emissions accounting methodology for the EC4 GHG Emissions Reduction Study ("the Study").

Background

The Resilient Rhode Island Act ("the Act") established the Executive Climate Change Coordinating Council ("EC4") and charged the EC4 with developing a plan to meet targets for greenhouse gas emissions reductions. The EC4 is commissioning a Rhode Island Greenhouse Gas Emissions Reduction Study ("the Study") to inform the development of this plan. The EC4 has retained Northeast States for Coordinated Air Use Management ("NESCAUM") to develop the Study. The EC4 established a Project Team to oversee management of the Study development composed of staff from the Rhode Island Department of Environmental Management ("DEM"), the Rhode Island Office of Energy Resources ("OER"), the Rhode Island Department of Transportation ("DOT") and the Rhode Island Division of Planning ("DOP"). Finally, the EC4 established a Technical Committee to participate in the development of the Study and provide feedback on key draft work products and deliverables. The Technical Committee consists of a targeted group of climate and energy stakeholders with subject matter expertise and experience in their respective areas.

GHG Emissions Accounting Methodologies

The Act establishes a schedule of GHG emissions reduction targets for Rhode Island. As scenarios and strategies are evaluated to achieve said targets, there are two options for accounting for GHG emissions from the electric power sector: a "generation-based" or "consumption-based" methodology.

"Generation-based" accounting considers all GHG emissions emitted by fossil fuel electricity generation occurring within the state. "Consumption-based" accounting considers GHG emissions associated with electricity used within the state. Because electricity in New England is provided through a regional transmission grid, the cross-border export and import of electricity is common. Therefore, an individual state's "generation-based" GHG emissions is often different from that same state's "consumption-based" emissions.

Considerations Regarding Accounting Methodologies

The EC4 Project Team provides the attached informational memo prepared by NESCAUM, the EC4's hired consultant, which details the strengths and drawbacks of the two approaches as well as additional context regarding other neighboring state approaches and consistency with existing regional emissions programs and goals. A summary of the main points is provided below:

- Generation-Based Accounting: This method is fairly straightforward to calculate, but does not account for the cross-border effects of electricity imports and exports. It may not fully capture

GHG emissions reductions achieved through the state's energy efficiency programs or give credit for renewable energy obtained from out-of-state sources.

- Consumption-Based Accounting: This method more realistically comports with the regional nature of New England's electric grid and is consistent with the approaches taken by neighboring states. It can be a more informative metric for state-level policymaking because many policy instruments available to states have more influence on electricity consumption than electricity generation. This approach could be viewed as failing to count GHG increases within the state associated with electricity generation for out-of-state sale if these emissions were not being accounted for by other states.

- Other State Approaches: Massachusetts is required by law to use a consumption-based accounting, and since it currently imports a quarter of the power it uses, Massachusetts is accounting for electricity exported by neighboring states. Connecticut also appears likely to pursue a consumption-based approach to be consistent with Massachusetts.

- RGGI Program and NEG/ECP Goals: Rhode Island participates in the Regional Greenhouse Gas Initiative ("RGGI") and has committed to GHG emissions reduction goals set by the New England Governors/Eastern Canadian Premiers ("NEG/ECP"). The RGGI program and the NEG/ECP goals are designed and implemented on a regional basis where the state-specific location of power plants is not a salient feature in achieving their goals and requirements.

EC4 GHG Study Approach

The EC4 Project Team recommends the use of a "consumption-based" accounting methodology for electric power sector GHG emissions in the Rhode Island Greenhouse Gas Emissions Reduction Study. This approach is a more direct accounting of actual GHG emissions associated with electricity use in Rhode Island and is consistent with the approaches of our neighboring states.

MEMORANDUM

To: EC4 Greenhouse Gas Emissions Reduction Study Project Team

From: Paul Miller, NESCAUM

Date: January 25, 2016

Re: *In-state electricity generation vs. consumption GHG accounting approaches*

Issue Statement

In assessing Rhode Island's greenhouse gas (GHG) mitigation scenarios to achieve the state's ultimate goal of an 80% reduction in GHG emissions from 1990 levels by 2050, the state is considering two options in accounting for GHG emissions from the electric power sector. The first option is to account for all GHG emissions emitted by fossil fuel electricity generation occurring within the state (generation-based). The second option is to account for GHG emissions associated with electricity used within the state (consumption-based). Neither method is a "full life cycle" approach, in that both approaches are based on GHG emissions emitted by combustion of the fuel used to generate electricity, but not in the production of the fuel being used (*e.g.*, methane leakage in a gas production field). This memorandum presents an overview of the two GHG accounting approaches, including their strengths and drawbacks, and places them in the regional context of what neighboring states and the broader region are pursuing.

I. Alternative methods for electricity GHG accounting in Rhode Island

A. Generation-based

Generation-based accounting of GHG emissions from the electricity sector is the summation of GHGs emitted directly from the combustion of fuels at power plants (*i.e.*, "at the stack") located within Rhode Island's borders. For fossil fuel combustion, the GHG emissions are mainly carbon dioxide (CO_2), but methane (CH_4) and nitrous oxide (N_2O) may also be co-emitted. Total emissions are expressed as "carbon dioxide equivalent" (CO_2e) that account for the global warming potential of the non-CO_2 GHGs, but CO_2 comprises the vast majority of fossil fuel combustion GHGs.

B. Consumption-based

Consumption-based accounting of GHG emissions accounts for GHG emissions associated with electricity consumed, rather than generated, within Rhode Island. The approach also tabulates "at the stack" GHG emissions, but includes generation sources located outside of Rhode Island if they provide electricity imported to and consumed in Rhode Island. One approach to quantifying consumption-based emissions for Rhode Island would be to use annual state-level electricity consumption (in megawatt-hours, MWh) and multiply the in-state MWh consumption by the average CO_2 emission factor for the New England regional transmission grid (e.g., CO_2

emissions in lb/MWh) that serves Rhode Island and the other New England states. Under this approach, GHG emissions from all fossil fuel combustion sources generating electricity in the New England region are distributed proportionally across the New England states according to each state's electricity consumption.

II. Strengths and drawbacks of each approach

A. Generation-based

Strengths: Generation-based accounting is the traditional emissions inventory approach and is straightforward to do. It is a relatively simple tabulation of GHG emissions occurring at the stack of power plants located in the state, which is already currently reported annually by the largest sources to the U.S. EPA's Greenhouse Gas Reporting Program.[1] For smaller sources, standard emission factors based on fuel consumed and type of combustion source can be used to estimate GHG emissions.

Drawbacks: Electricity in Rhode Island is provided through a regional transmission grid operated by ISO-New England, so GHG emissions from electricity use within Rhode Island are a reflection of the generation sources across (as well as outside of) the ISO-New England grid, and not solely attributable to generation sources within the state. Because of the regional nature of the grid, a generation-based approach would not account for "leakage" where fossil fuel generation could shift out-of-state, with the electricity then imported back into Rhode Island for consumption. It may also not fully capture GHG emission reductions achieved through in-state energy efficiency programs, or give appropriate credit for electricity obtained from renewable energy sources located out-of-state, some of which may be supported by existing Rhode Island statutes and/or regional-based energy policies.

B. Consumption-based

Strengths: A consumption-based approach for electricity is a more direct accounting of actual GHG emissions associated with electricity use within Rhode Island and more realistically comports with how electricity is generated and distributed across a regional, multi-state grid.

A consumption-based GHG approach can be a more informative metric for purposes of state-level policymaking because many (though not all) policy instruments available to states have more influence on electricity demand, i.e., consumption. For example, energy efficiency and demand-side management programs are state-level policies that influence consumption by in-state consumers and businesses. In contrast, most policies which influence the type, location, and scale of generation (e.g., air quality standards, interstate transmission, reliability requirements) are federal or regional policies. Even renewable energy policies, which are state-

[1] Facilities that emit 25,000 metric tons or more per year of GHGs are required to submit annual reports to EPA. Additional information available at: http://www.epa.gov/ghgreporting/learn-about-greenhouse-gas-reporting-program-ghgrp.

based, are effectively implemented at a regional level (market for RECs is New England-wide). In recognition of this, Rhode Island has recommended in its *Energy 2035: Rhode Island Energy Plan* that from a state emission perspective, policy makers should strongly consider in any separate carbon reduction efforts to use consumption-based emissions for the electricity sector.[2]

The consumption-based approach also highlights where states need to coordinate and collaborate on policymaking, is more consistent with approaches of neighboring states, and will allow for more regionally consistent and accurate accounting for GHG emissions and emission reductions.

Drawbacks: To the extent that Rhode Island is a net exporter of electricity to other states in some years, a consumption-based approach could be viewed as failing to count GHG increases within the state associated with electricity generation for out-of-state sale.

III. Regional context: Considerations in choosing between a generation-based and consumption-based approach

In considering whether to take a generation-based or consumption-based approach to electricity sector GHG emissions, it is important to consider consistency of methods and goals with neighboring states and broader regional programs. As required by state law,[3] Massachusetts is already pursuing a consumption-based GHG accounting approach in its state GHG mitigation planning effort. Massachusetts currently imports a quarter of the power it uses, therefore counting only in-state generation would underestimate emissions from in-state electricity use. Connecticut appears likely to also pursue a consumption-based approach in order to be consistent with Massachusetts. As in Rhode Island, both these neighboring states have similar 2050 80% GHG mitigation targets set by state law.

A harmonized regional approach among the three states, which collectively account for about 77% of annual electricity consumption in the ISO-New England control area,[4] would avoid inconsistent accounting of GHG emissions. As a practical effect, a harmonized and consistent consumption-based approach brings GHG emissions associated with cross-border electricity exports and imports within the sphere of all three states' GHG mitigation requirements, which are virtually equivalent by 2050. On the other hand, if Rhode Island followed a generation-based

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[2] Rhode Island Division of Planning, *Energy 2035: Rhode Island State Energy Plan*, State Guide Plan Element Report #50 (Oct. 8, 2015), p. 150.

[3] Massachusetts Global Warming Solutions Act (GWSA) of 2008, Chap. 298. The GWSA provides that statewide GHG emissions shall include "total annual emissions of greenhouse gases in the commonwealth, including all emissions of greenhouse gases from the generation of electricity delivered to and consumed in the commonwealth … whether the electricity is generated in the commonwealth or imported[.]" Note that in recent years, Massachusetts has imported about a quarter of its electricity from outside the state, which would include generation sources in Rhode Island.

[4] ISO-New England, *Energy, Load, and Demand Reports, Net Energy and Peak Load by Source* (Dec. 9, 2015), available at http://www.iso-ne.com/isoexpress/web/reports/load-and-demand/-/tree/net-ener-peak-load.

approach, potential issues could arise. For instance, consider a scenario where new fossil-fuel generation is built in neighboring Connecticut and Massachusetts and the generated electricity exported to Rhode Island. Neither Connecticut nor Massachusetts would count the emissions in their consumption-based approaches, and Rhode Island would not count the emissions with an in-state generation-based approach.

Rhode Island is also part of the Regional Greenhouse Gas Initiative (RGGI) that caps electricity sector GHG emissions from nine participating Mid-Atlantic and Northeast states. The RGGI program is also likely to serve as Rhode Island's compliance mechanism for the federal Clean Power Plan. While natural gas generation is leading to an increase in GHG emissions within Rhode Island, total GHG emissions among the participating RGGI states are decreasing as higher emitting coal- and oil-fired power plants retire or reduce production levels elsewhere in the RGGI region. To the extent the region is collectively constraining power plant GHG emissions over time and RGGI is amenable to becoming a federally-enforceable program, the state-specific location of a power plant is not a salient feature in achieving the regional GHG reduction requirements.

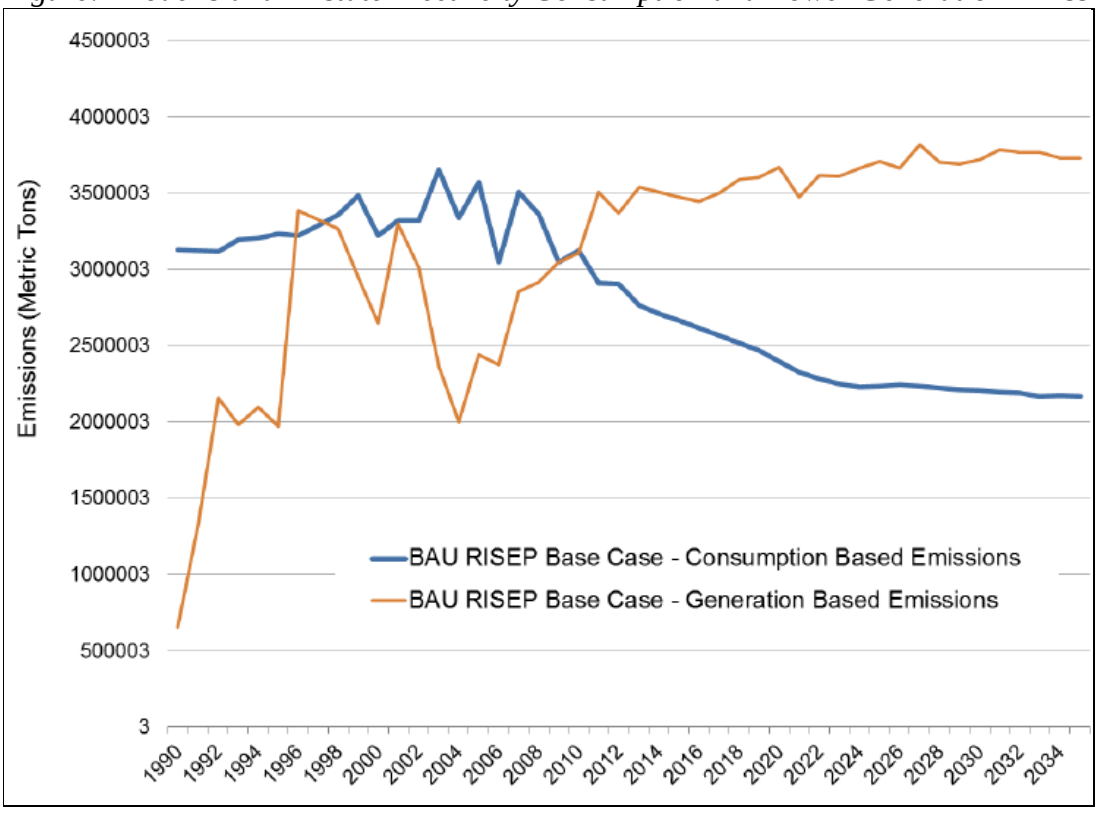
Finally, Rhode Island is part of the New England Governors/Eastern Canadian Premiers Resolution 39-1[5] that sets a 2030 regional 35%-45% GHG reduction marker range below 1990 emissions on the way to a 2050 regional target of 75%-85% GHG reduction below 2001 levels. This resolution, signed in August 2015, sets a regional marker that is not state- or province-specific, which is consistent with the science of climate change. Emissions of GHGs contribute to a global problem, and the specific location of a GHG reduction is less relevant than achieving a collective reduction in GHG emissions, wherever it may occur. With Rhode Island part of this broader regional coalition having common GHG mitigation targets, and in recognition that GHGs have global impacts no matter where emitted, there can be greater opportunities for GHG reductions within a multi-jurisdictional effort that would be captured by an electricity consumption-based GHG accounting approach but not by a state-specific generation-based approach.

[5] Conference of New England Governors and Eastern Canadian Premiers, Resolution 39-1: Resolution Concerning Climate Change, 39th Annual Conference of New England Governors and Eastern Canadian Premiers, St. John's, Newfoundland and Labrador, signed August 31, 2015, available at http://www.coneg.org/Data/Sites/1/media/39-1-climate-change.pdf.

Attachment: Comparison of Rhode Island CO_2 emission trends based on in-state electricity consumption and in-state electricity generation

The figure below illustrates a comparison of electricity sector GHG emissions in Rhode Island using an in-state consumption-based approach and an in-state generation-based approach. This figure is from a 2013 report to the Rhode Island Office of Energy Resources prepared by ENE.[6] Generation-based emissions data come from the U.S. Energy Information Administration (EIA) State Energy Data System (SEDS) and EIA Annual Energy Outlook AEO forecasts. Consumption-based emissions are based on EIA AEO data that are adjusted to incorporate projected in-state electricity consumption reductions from Rhode Island energy efficiency programs not captured in the EIA AEO data.

Figure: Rhode Island In-state Electricity Consumption and Power Generation Emissions



The chart shows much greater variability in the in-state electricity generation-based CO_2 emissions trend versus the in-state electricity consumption-based trend. Since 1990, four large natural gas power plants within Rhode Island either started commercial operation or repowered. These were:

[6] *From* ENE, "Rhode Island State Energy Plan Business-as-Usual Forecast," October 2013, p. 28 (Figure 8-9).

- Units at the 560 MW Ocean State Power in Burrillville began operations between 1990 and 1991
- The 450 MW Dominion Manchester Street Power Station in Providence repowered in 1995
- The 265 MW Tiverton Power began commercial power operations in 2000
- The 550 MW Rhode Island State Energy Center began commercial operations in November 2002

The chart, however, indicates that the increased natural gas generation capacity within the state since 1990 did not result in a relatively stable increase in CO_2 emissions from the electricity sector, as compared to in-state electricity consumption. The large inter-annual changes with in-state generation CO_2 emissions likely instead reflect the regional nature of the transmission grid serving Rhode Island, with in-state generation varying according to overall market conditions for electricity generators across the regional transmission grid. Specifically, actual dispatch of natural gas units varies significantly from generation capacity over short time frames, depending on prices offered by the grid operator for each marginal unit of electricity at different points in time. This suggests that using in-state electricity consumption to track GHG trends is a more meaningful metric for informing policymakers about progress towards meeting long-term Rhode Island's GHG mitigation targets than emissions from in-state generation, which only reflects the role that Rhode Island's natural gas plants play in the short-term economics of how electricity is dispatched and paid for in the region.