Rhode Island GHG Emissions Reduction Study

Meeting No. 3
Providence, RI

May 9, 2016

Overview of Today's Meeting

1. Objective of Technology and Policy Task
2. Compile Technologies/Practices for inclusion in RI GHG Reduction Study
   - Key questions to address
   - Proposed lists of GHG-reducing technologies/practices (by sector) and policies to promote them
   - Criteria for evaluating GHG-reducing technology/practices
   - Discussion Q & A and comments
3. Next steps & meetings
4. Public comment

Objective of Task

- Develop complete list of technologies, changes in consumer and business practices, and enabling policies which can reduce (energy and non-energy) GHG emissions by 2050

- Gather input from EC4 Project Team and Technical Committee on initial list

- Narrow down list to technologies/practices for possible inclusion in LEAP scenarios

Key Questions to Address

- What are the GHG-reducing technologies and practices which can be deployed to meet Rhode Island's goals for 2035 and 2050?
- What types of policies and programs could be implemented to encourage greater deployment of GHG-reducing technologies and practices?
- In addition to GHG mitigation potential, what other criteria can be used to help evaluate technologies and practices for reducing GHG emissions for inclusion in scenarios?

GHG-Reducing Technologies/Practices and Policies, By Sector

Greenhouse Gas Reduction Technology/Policy Combinations for Transportation and Land Use

Technologies and Practices for Reducing GHGs	Policy Approaches
Reductions in VMT • Smart Growth practices – *Increased density of new development, closer proximity to transit, improved street connectivity* – *Improved infrastructure for multi-modal travel (i.e., bicycles, walking)* – *Increased telecommuting and ridesharing* • Ridesharing • Increased bike lanes and infrastructure • Increased public transit service levels and ridership • Expanding public transit – *Bus rapid transit, expansion of commuter rail* • Enhancing public transit infrastructure	• Investments in public transit (e.g., regional rail, subway, bus rapid transit) • Transit-oriented development • Infrastructure investments for multi-modal travel (bicycling, pedestrian) • Price or taxes on fuel, congestion, or parking • Planning zoning for increased density and mixed use development • Reductions in free parking • Incentives for ridesharing and telecommuting • Revise local, county, and state development review process
Vehicle efficiency • Improving fuel efficiency • Improving aerodynamics and weight reduction • Fuel economy improvements (light-duty, medium and heavy-duty/freight)	• Light-duty vehicle fuel economy standards • Medium- and heavy-duty vehicle fuel economy standards • Trucking and freight strategy • Feebates

Greenhouse Gas Reduction Technology/Policy Combinations for Transportation and Land Use cont.

Technologies and Practices for Reducing GHGs	Policy Approaches
Zero and low emission vehicles • Advanced vehicles – *Battery Electric Vehicles, Plug-in Hybrid Electric Vehicles, Hydrogen Fuel Cells, E85 vehicles* • Biofuel buses • Electric buses • Electrify commuter rail • CNG for Medium/Heavy Duty (e.g., On-road Freight) • Diesel retrofits	• Multi-state Zero Emission Vehicle program • Direct purchase incentives • Support and incentives for charging/fueling infrastructure for advanced vehicles
Aviation/marine • Aircraft operational changes when landing, taxiing, and idling at gate • Electrification of airport ground equipment • Biofuels • Alternative marine power at port docks	• Caps on airport and seaport emissions • GHG standards for aircraft and marine vessels

Greenhouse Gas Reduction Technology/Policy Combinations for Transportation and Land Use (con't.)

Technologies and Practices for Reducing GHGs	Policy Approaches
Low-carbon fuels • Cellulosic ethanol and diesel • Other drop-in synthetic biofuels • Low-carbon fueling delivery and infrastructure – *Electric vehicle, CNG, E85, and hydrogen fueling infrastructure*	• Fuel performance standard • Incentives for biofuel production • Direct support for distribution infrastructure
Forestry and Agriculture • Forest Best Management Practices (BMPs) • Reforestation • Urban/suburban tree planting and tree retention strategies • Improved agricultural practices – *Organic farming, nutrient reductions, no-till and improved residue management* • Wetlands restoration for "blue" carbon • Conversion of marginal agriculture to forests	• Forest management practices • Grants or incentives for tree planting retention/programs • Technical assistance through agricultural extension • Incorporating carbon into ecological restoration activities

Greenhouse Gas Reduction Technology/Policy Combinations for Electric Power Sector

Technologies and Practices for Reducing GHGs	Policy Approaches
Renewable Energy • Utility-scale and distributed renewable technologies - *Rooftop solar PV* - *Onshore wind* - *Offshore wind* - *Hydroelectric* - *Geothermal* - *Tidal* • Landfill gas • Biomass	• State energy procurement standards • Direct rebate programs • On-bill financing • Leveraging private financing • Renewable Portfolio Standards • Feed-in tariffs • Workforce training and development • Production tax credits • Net metering • Joint procurement/long-term contracts
Other Low or Zero Carbon Generation • Large hydropower • Nuclear power • Carbon capture and storage • Advanced waste-to-energy	• Production tax credits • Support of research and development • Streamlining of siting and permitting • Support for related legal and regulatory requirements (e.g., waste disposal, liability issues) • Technical assistance

Greenhouse Gas Reduction Technology/Policy Combinations for Electric Power Sector cont.

Technologies and Practices for Reducing GHGs	Policy Approaches
Infrastructure & Operations • Renewable energy storage (e.g., advanced batteries, compression) • Utility-scale and distributed energy storage • Smart meters • Demand response programs • Advanced natural gas combined cycle turbines • Volt/VAR optimization	• Streamlined siting and permitting of new generation • Performance standards (emission or output-based) • Grid modernization • Incentives for energy storage R&D • Incentives for demand optimization (direct load control capability) • Rate design • Regional agreements on energy infrastructure (e.g., for transmission/delivery infrastructure) • Reforming regulatory model and incentives for regulated utilities

Greenhouse Gas Reduction Technology/Policy Combinations for Buildings and Facilities Sector

Technologies and Practices for Reducing GHGs	Policy Approaches
Energy Efficiency • High efficiency lighting, HVAC, and water heating • Deep envelope retrofits for existing buildings – *Insulation/windows/envelope improvements* • Expanded combined heat and power • All cost-effective energy efficiency in residential/commercial (electricity, gas, oil) • Fuel-switching (e.g., oil to natural gas, diesel to biodiesel) • District heating/cooling • Advanced building codes for new buildings • Advanced appliance standards • Compact footprints for new construction • Building and energy management systems	• Energy efficiency portfolio standards • Expand Least-Cost Procurement mandate to unregulated fuels (e.g., heating oil and LPG) • Advanced building codes • Electricity capacity market mechanisms • Performance standards (e.g., appliance and lighting standards) • Incentives for demand response • Combined heat & power incentives • Tax credits • Public/private financing, e.g., energy savings performance contracts, Property Assessed Clean Energy (PACE) programs • Workforce training and development

Greenhouse Gas Reduction Technology/Policy Combinations for Buildings and Facilities Sector cont.

Technologies and Practices for Reducing GHGs	Policy Approaches
Renewable and Low-Carbon Thermal • Ground source heat pumps • Air source heat pumps • Solar thermal • Biomass pellet stoves • Biogas and biofuels	• Incentives for residential and commercial solar/renewable thermal • Technical support (e.g., training for HVAC installers) • Blending standards (e.g., biodiesel blending) • Production tax credits • Other requirements for utilities/regulated fuels (e.g., requiring electric utilities to promote reductions in use of fossil fuels for heating)

Greenhouse Gas Reduction Technology/Policy Combinations for Industry, Waste, and Other Sector

Technologies and Practices for Reducing GHGs	Policy Approaches
• Industry-specific or GHG-specific initiatives (e.g., reducing F-gas emissions - SF_6, HCFCs) • All cost-effective energy efficiency in industrial processes (e.g., high-efficiency motor drives) • Combined heat and power • Fuel-switching (e.g., oil to natural gas, diesel to biodiesel)	• Performance standards • Industrial process incentives
• Reductions in natural gas leaks	• Continue support for National Grid's leak-prone pipe replacement program
• Landfill gas-to-energy • Advanced waste-to-energy (i.e., gasification, pyrolysis)	• Tax incentives • Technical assistance
• Increasing recycling, reuse, and waste avoidance • Diversion of organics to composting and anaerobic digestion • Increased source reduction and recycling	• "Pay-as-you-Throw" program • Funding for local recycling programs • Technical assistance • Education and outreach
• Methane capture at Publicly-Owned Treatment Works (POTWs)	• Technical assistance

Performance Criteria for GHG-reducing Technologies and Practices

Performance Criteria for Technologies/Practices and Policies

- To provide additional insights on the comprehensive list of technologies/practices and policies potentially included in modeling scenarios, we are evaluating the following:
  - Results of similar long-range GHG mitigation planning efforts (e.g., MA, CA, UK) for "lessons learned"
  - How well options score against key performance criteria

Role of Performance Criteria for Technologies/Practices and Policies

- We will develop and share a spreadsheet scoring the performance criteria against technologies and practices, populated using existing literature and expert judgment:
  - Quantitative: GHG reduction potential, cost-effectiveness
  - Qualitative/ordinal rankings: ease of implementation, technical feasibility
- Scoring will provide additional insights on pros, cons, and trade-offs associated with technologies and practices, beyond their GHG-reduction potential

Key Performance Criteria for Technologies/Practices and Policies (1)

- Potential magnitude of GHG emission reductions in Rhode Island
- Cost-effectiveness
- Potential for co-benefits
- Potential economic development impacts in RI

Key Performance Criteria for Technologies/Practices and Policies (2)

- Technical feasibility
- Ease of implementation and administration
- Requirements for coordination and complementary policies
- Primary modeling approach

Discussion Q & A and Comments

- Questions and comments?
- Can also email written comments to Pam Sherrill, meeting facilitator, sherrill6@cox.net; May 23 requested deadline
- Send technical questions to Paul Miller, NESCAUM, pmiller@nescaum.org

Next Steps & Meetings

Recap of current and next steps

- Today's meeting presented GHG-reducing technologies/practices and policies relevant to RI GHG mitigation
- June 13th – take input on scenario combinations for lowering reference case GHGs
- Late summer date tbd – present initial scenario analyses

June 13th Meeting on Task 2: Defining Scenarios for LEAP

- What combinations of technologies/practices should be included in 3-5 scenarios to be analyzed using LEAP?

- What are implications of the selected technologies/practices for Rhode Island's economy and energy mix over the near- and long-term?

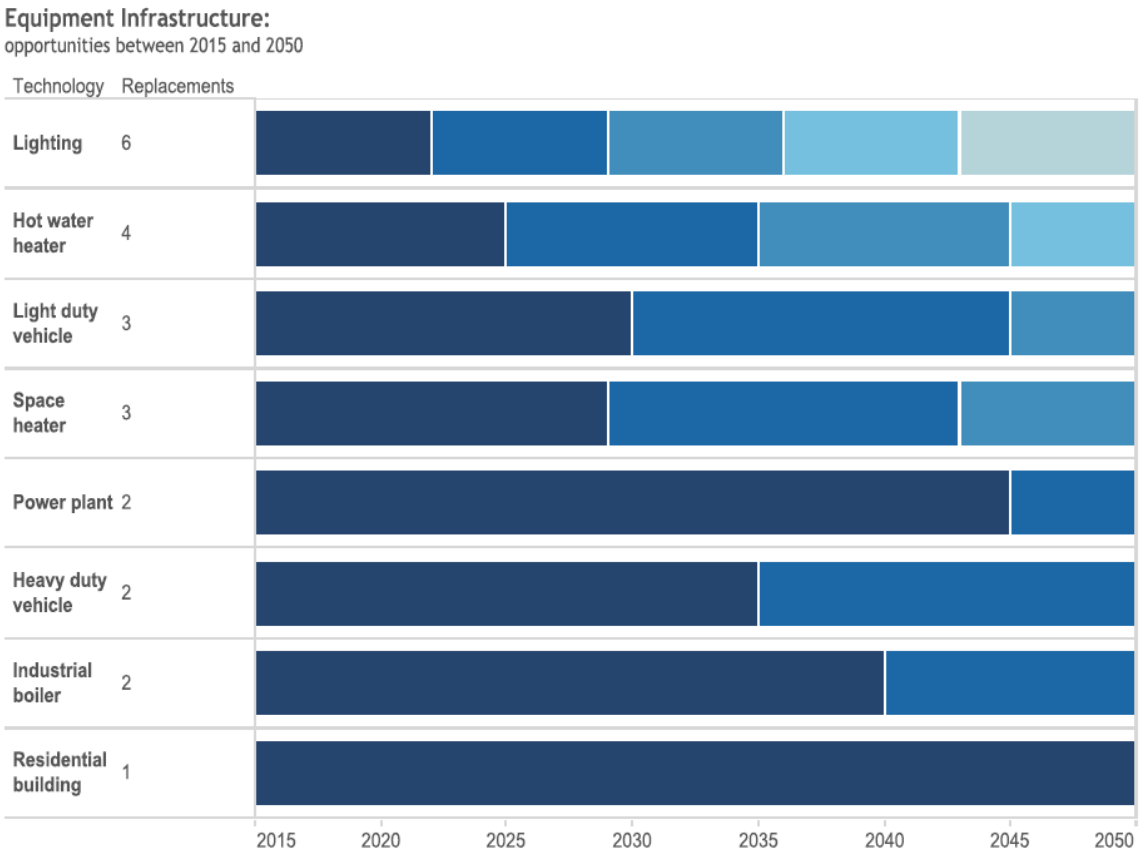
Review Process

- Draft scenarios to be distributed ~1 week prior to June 13th meeting
- Discussion Q & A at meeting, with feedback on initial scenarios
- 1 week comment period after June 13th meeting for additional input on initial scenarios

Public Comment

Challenges to Decarbonization: Lifetimes of Energy Infrastructure

Figure 26. Lifetimes Until Replacement for Key Equipment and Infrastructure



(Source: Williams et al., 2015)