



REMI Economic Analysis of RGGI IPM Potential Scenarios

Agenda

- REMI Macroeconomic Model Overview
- REMI Macroeconomic Analysis for RGGI Program Review
 - Analysis of IPM Potential Cap Scenarios
 - Draft REMI Assumptions
 - Draft REMI Analysis
 - Today present initial analysis for the 106 and 97 IPM potential cap scenarios

REMI Potential Scenario Analysis

- These projections are draft and may change as NESCAUM and the states make refinements and updates based on state review and stakeholder input.
- This analysis provides information for the overall program review process. The scenario specifications do not reflect a preference for or selection of any specific policy.

REMI Model Overview

- The REMI (Regional Economic Models, Inc.) Policy Insight + Model:
 - NESCAUM's REMI model is a 12-state economic and demographic forecasting model
 - Uses a regional REMI Reference Case
- REMI output includes estimates of:
 - Changes in gross regional product (\$);
 - Changes in employment (job-years); and
 - Changes in real personal (disposable) income (\$).

Analysis for RGGI Program Review

- The REMI model is being used to project the macroeconomic impacts of potential changes to the RGGI program as modeled in the IPM potential scenarios:
- This analysis is projecting the macroeconomic impacts of the *incremental* changes between the current RGGI program (REMI Reference Case) and potential changes to the RGGI program (IPM potential cap scenarios)
- These impacts are in addition to the macroeconomic benefits due to the current RGGI program

Draft REMI Assumptions

Inputs to REMI are developed using two sources of data which describe major economic impacts resulting from potential changes to the RGGI program:

- 1) States' Investments of RGGI Allowance Proceeds**
- 2) IPM Output on Electricity Market Changes**

Draft REMI Assumptions

1) States' Investments of RGGI Allowance Proceeds:

- States' investments generate *incremental* changes in regional economic activity (e.g., spending, prices, labor availability)
- REMI model quantifies changes in the 97 and 106 potential scenarios including the incremental investment of additional projected proceeds from 2012-2020
- Examples of proceed investments include: energy efficiency programs, GHG abatement projects, direct bill assistance

Draft REMI Assumptions

2) IPM Output on Electricity Market Changes:

- IPM outputs reflect incremental changes in the electricity market's response to RGGI which in turn influence regional economic activity
- IPM 106 and 97 potential cap scenarios model the RGGI program from 2012 to 2020
- Examples include: impacts on electric ratepayers and generators

Draft REMI Assumptions

Timing and Duration of Investment of RGGI Proceeds

- REMI model analyzes the impacts of potential changes to RGGI program (including incremental additional proceed investments) made in 2012-2020.
- Assumes a 1-year lag time between receipt and investment of RGGI proceeds (e.g., 2014 proceeds are invested in 2015).
- REMI model includes assumptions on projected benefits of proceeds invested through 2040 to incorporate the lifetime impacts of these investments made in 2012-2020.

Draft REMI Assumptions

Timing and Duration of Investment of RGGI Proceeds

- Energy savings benefits of states' investments in energy efficiency and similar programs are measured over their full lifetime.
- Lifetimes of benefits vary by type of program:
 - **Electric Energy Efficiency Measures:** Residential: 10 yrs; Commercial & Industrial: 13 yrs
 - **Fossil Fuel Energy Efficiency Measures:** 15 yrs
 - **Clean & Renewable Energy Measures:** 20 yrs
 - **GHG Abatement & Climate Change Programs:** 20 yrs

Draft REMI Assumptions

Timing and Duration of Investment of RGGI Proceeds

- This analysis does not make any projections for RGGI allowance prices or RGGI proceeds after 2020, nor does it analyze the impacts of investing RGGI proceeds generated after 2020.
- Projected fossil fuel prices post-2020 were made using the Annual Energy Outlook (AEO) 2012 “high oil price case” data
- Projected electricity prices post-2020 were extrapolated from IPM by using the AEO 2012 electricity price growth rate

Draft REMI Assumptions

Projected Proceed Investments

- REMI model quantifies incremental changes from 2012 to 2020 in the IPM potential scenarios including the incremental investment of additional projected proceeds:
 - Additional proceeds in 106 potential scenario compared to Reference Case: **\$377M**
 - Additional proceeds in 97 potential scenario compared to Reference Case: **\$1.8B**

Draft REMI Assumptions

Projected Proceed Investments

- For this analysis, each state provided draft assumptions for how proceeds from 2012-2020 could be invested.
- The following slides describe how proceeds were projected for the reference case, 106 and 97 potential cap scenarios and how investments were modeled for this analysis.

Draft Assumptions for Proceeds Investments

- Proceeds projections used the same assumptions as for the IPM modeling.
- For each scenario, annual proceeds were calculated by multiplying the estimated number of allowances purchased at auction by the projected CO₂ allowance price.
 - For the IPM reference case, assumed that the market purchased enough CO₂ allowances to meet demand based on emissions, minus the 47M banked allowances from first control period spread over the time horizon.
 - For the 106 and 97 IPM potential scenarios:
 - Assume in 2012 that the market purchases CO₂ allowances to meet demand based on emissions.
 - Assume the market is made aware of new policies in 2013 and purchases all allowances of the surplus of allowances remaining after the market meets demand based on emissions.
 - Post 2013, assume the market purchases all CO₂ allowances offered.

Draft Assumptions for Proceeds Investments

- Regional Investment of Proceeds (\$M Cumulative 2012-2020)

Scenario	Electric EE Investments	Fossil Fuel EE Investments	Total EE (Electric + Fuel EE)	Clean & Renewable Energy Investments	Direct Bill Assistance	GHG Abatement & Climate Change Abatement	Admin/ Other	Total
Total % of RGGI Spend:	46.37%	20.65%	67.02%	4.64%	11.83%	8.57%	7.95%	100.00%
Total Proceeds								
Reference Case Proceeds	\$ 718.65	\$ 320.09	\$ 1,038.74	\$71.88	\$ 183.30	\$132.82	\$123.23	\$1,549.97
106 Case Proceeds	\$ 893.51	\$ 397.97	\$ 1,291.48	\$ 89.38	\$ 227.90	\$ 165.14	\$ 153.21	\$ 1,927.11
97 Case Proceeds	\$ 1,558.13	\$ 694.00	\$ 2,252.13	\$ 155.86	\$ 397.42	\$ 287.98	\$ 267.18	\$ 3,360.55
Difference in Proceeds (Additional \$ Investments Total)								
106 Case & Reference	\$ 174.86	\$ 77.88	\$ 252.75	\$ 17.49	\$ 44.60	\$ 32.32	\$ 29.98	\$ 377.14
97 Case & Reference	\$ 839.48	\$ 373.91	\$ 1,213.39	\$ 83.97	\$ 214.12	\$ 155.15	\$ 143.95	\$ 1,810.58

Draft Assumptions for Proceeds Investments

- Regional percentage of RGGI proceed investments by category:

State	Electric EE Investments	Fossil Fuel EE Investments	Clean & Renewable Energy Investments	Direct Bill Assistance	GHG Abatement & Climate Change Abatement	Admin/ Other	Total
Connecticut	4.50%	0.00%	1.49%	0.00%	0.49%	0.00%	6.47%
Delaware	2.97%	0.46%	0.00%	0.23%	0.69%	0.23%	4.58%
Maine	2.88%	0.00%	0.00%	0.00%	0.00%	0.72%	3.60%
Maryland	10.44%	0.00%	2.38%	9.08%	\$1M	0.79%	22.70%
Massachusetts	16.14%	0.00%	0.00%	0.00%	0.00%	0.00%	16.14%
New Hampshire	2.43%	0.00%	0.00%	2.52%	0.00%	0.27%	5.22%
New York	6.23%	19.47%	0.00%	0.00%	7.40%	5.84%	38.93%
Rhode Island	0.76%	0.00%	0.76%	0.00%	0.00%	0.08%	1.61%
Vermont	0.00%	0.73%	0.00%	0.00%	0.00%	0.01%	0.74%
RGGI Total	46%	21%	5%	12%	9%	8%	100%

Draft Assumptions for Proceeds Investments

- States provided data on energy savings rates associated with each category of proceeds investment.
- The following table summarizes the savings rate that were used for the model for:
 - **Fossil Fuel Energy Efficiency**
 - **Electric Energy Efficiency**
 - **GHG Abatement & Climate Change Programs**
- Analysis was not able to develop an assumption for savings associated with the following investment category:
 - **Renewable and Clean Energy**

Draft Assumptions for Proceeds Investments

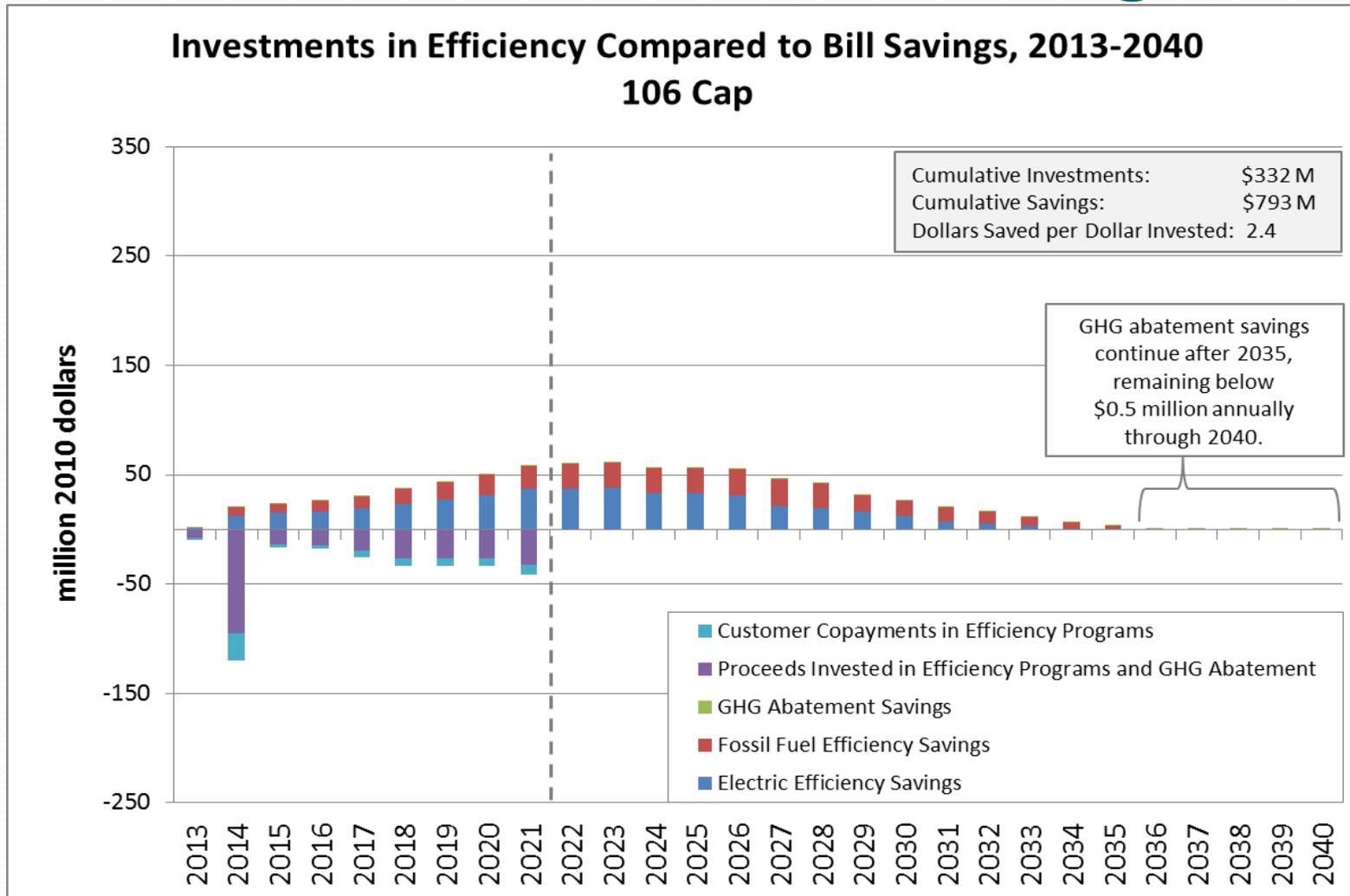
- **Energy Savings Rates Assumptions:**
(kWh or mmBTU saved per \$1 invested)

State	Electric EE Savings Rate (kWh/\$ invested)			Fossil Fuel EE Savings Rate (mmBTU/\$ invested)			GHG Abatement & Climate Change Programs	
	Residential	Commercial	Industrial	Residential	Commercial	Industrial	(kWh/\$ invested)	(mmBTU/\$ invested)
Connecticut	3.125	3.125	3.125	N/A	N/A	N/A	0	0
Delaware	2.53*	4.23*	4.23*	.015 **	.045**	.045**	.427**	.012**
Maine	2.53*	4.23*	4.23*	N/A	N/A	N/A	N/A	N/A
Maryland	2.53*	4.23*	4.23*	N/A	N/A	N/A	0	0
Massachusetts	2.39	3.15	3.15	N/A	N/A	N/A	N/A	N/A
New Hampshire	2.53*	4.23*	4.23*	N/A	N/A	N/A	N/A	N/A
New York	2.06	6.4	6.4	.015	.045	.045	.427	.012
Rhode Island	2.53*	4.23*	4.23*	.015 **	.045**	.045**	N/A	N/A
Vermont	N/A	N/A	N/A	.022	.139	.139	N/A	N/A

*Indicates a proxy averaging CT, DE, and NY rates

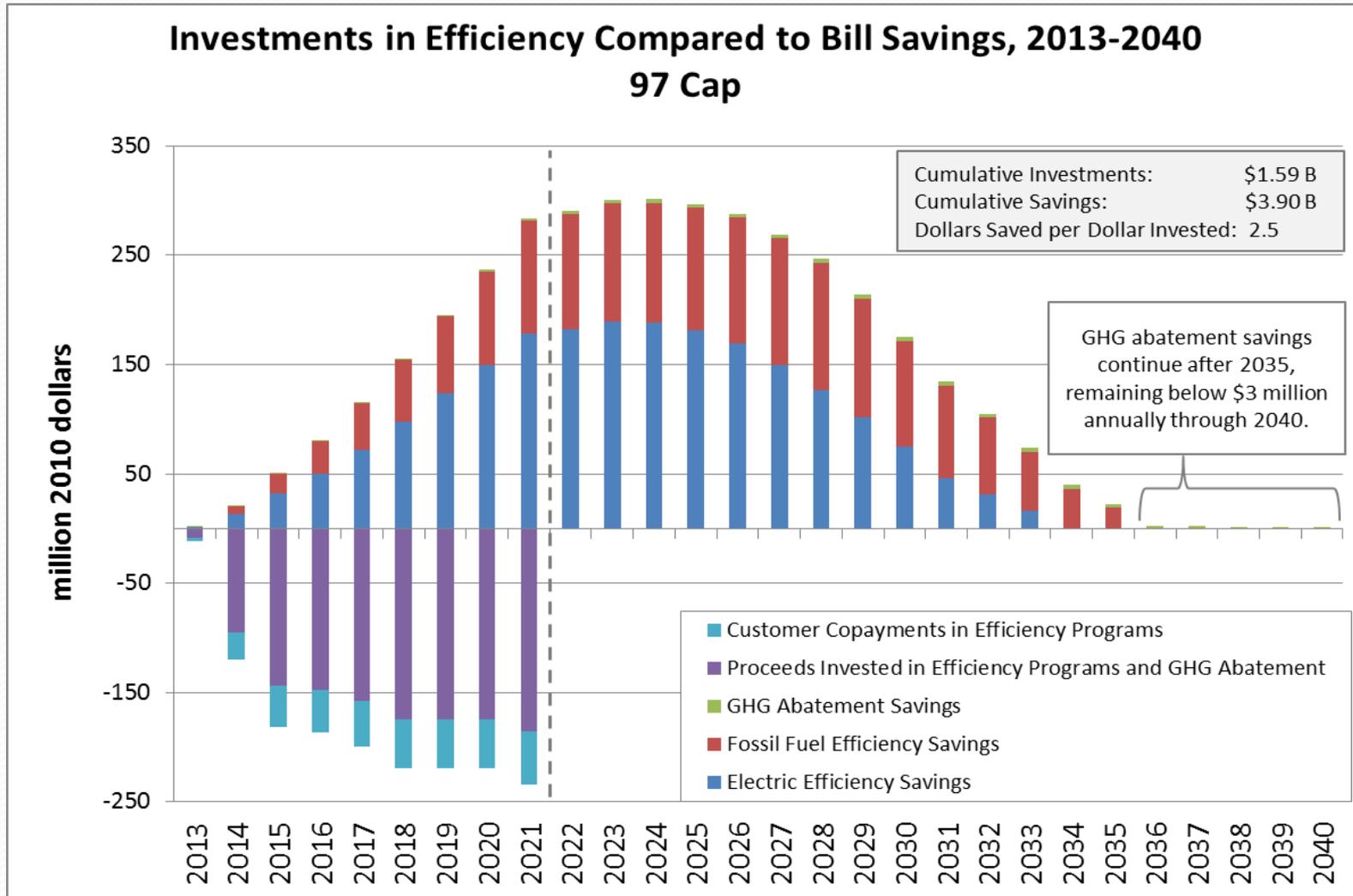
**Indicates a NY rate proxy

Proceed Investment & Bill Savings - 106



Note: Analysis was not able to develop an assumption for savings associated with the Clean and Renewable Energy investment category.

Proceed Investment & Bill Savings - 97



Note: Analysis was not able to develop an assumption for savings associated with the Clean and Renewable Energy investment category.

Draft REMI Assumptions

IPM Output on Electricity Market Changes

- REMI analysis uses data from the IPM model outputs (2012-2020), including incremental changes from the reference case to 106 and 97 potential cap scenarios in:
 - Projected power prices
 - Projected CO₂ allowance prices
 - Generation
 - Load
 - IPM Assumptions for load include an adjustment for the additional incremental proceeds investments in electric EE for each scenario based on state electric EE savings assumptions
 - Fuel Mix
 - Imports
 - Energy Costs: Overnight capital, retrofit, new build, fixed and variable O&M, fuel

Draft REMI Assumptions

IPM Output on Electricity Market Changes

- **Regional changes in electricity market outcomes**
 - **Impacts to Generators—net impacts equal sum of following components:**
 - Allowance purchases by generators with CO₂ emissions (-)
 - Impact of allowance price on generator revenues (+/-)
 - Avoided load effect (-)
 - Change in generation (imports, effect of EE) (-)
 - **Impacts to Ratepayers—net impacts equal sum of following components:**
 - Influence of allowance purchases on wholesale price (-)
 - Avoided load effect (+)
 - Avoided Energy and Capacity Costs from EE (+)
 - Avoided Distribution Costs from EE (+)

Draft REMI Assumptions

IPM Output on Electricity Market Changes

- **Regional changes in electricity market outcomes (*continued*)**
 - **Impacts to Shareholders of Generation Companies:**
 - Change in marginal generator income x 14% (population of 9 RGGI states as % of US total) (-)
 - **Other Economic Impacts:**
 - Changes in new capacity builds (-)
 - Changes in retrofits to existing capacity (-)

Summary of Regional Economic Impacts

- **Cumulative Increase in Benefits for the 106 Potential Cap Scenario (2012-2040):**
 - Gross State Product: + \$977M
 - Employment: + 11,809 job-years
 - Real Personal (Disposable) Income: + \$654M
- **Cumulative Increase in Benefits for the 97 Potential Cap Scenario (2012-2040):**
 - Gross State Product: + \$4.976B
 - Employment: + 60,849 job-years
 - Real Personal (Disposable) Income: + \$3.033B

Summary of Regional Economic Impacts

Summary of Regional Economic Impacts, 2012- 2040

Scenario	106 Cap	97 Cap
Cumulative Change in Gross State Product (Millions \$2010)	+ \$977	+ \$4,976
Percent Change from Business-As-Usual	+ 0.001%	+ 0.005%
Cumulative Change in Employment (Job-Years)	+ 11,809	+ 60,849
Percent Change from Business-As-Usual	+ 0.001%	+ 0.006%
Cumulative Change in Real Personal Income (Millions \$2010)	+ \$654	+ \$3,033
Percent Change from Business-As-Usual	+ 0.001%	+ 0.003%



Appendix

Draft Assumptions for Proceeds Investments

- **Electric EE Investment Assumptions:**
(CT, DE, ME, MD, MA, NH, NY, RI)
 - **Data By Customer Class (Residential/Commercial/Industrial):**
 - State-provided data: CT, DE, ME, MD, MA, NH, NY
 - Proxy data (Average of other 7 states' customer class rates): RI
 - **Data By End Use (e.g. Residential Lighting):**
 - State-provided data: CT, MA, NY
 - Proxy data (MA) : DE, ME, MD, NH, RI
 - **Customer Participant Costs:**
 - State-provided data : CT, DE, ME, MA, NY
 - Proxy data (MA) : MD, NH, RI

Draft Assumptions for Proceeds Investments

- **Fossil Fuel EE Assumptions:**

(DE, NY, RI, VT)

- **Data By Customer Class (Residential/Commercial/Industrial):**

- State-provided data: NY, VT
- Proxy data (NY) for: DE, RI

- **Data By End Use (e.g. Industrial Heating):**

- State-provided data: NY, VT
- Proxy data (NY) : DE, RI

- **Customer Participant Cost:**

- State-provided data: NY, VT
- Proxy data (NY) for: DE, RI

Draft Assumptions for Proceeds Investments

- **Clean & Renewable Energy:**

(CT, MD, RI)

- **Data by Program:**

- State-provided data and descriptions on potential programs for investments from: CT, MD
- Proxy data on investment distribution (CT) for: RI

- **Customer Participant Cost:**

- State-provided data from CT, MD
- Proxy data (CT) for RI

Draft Assumptions for Proceeds Investments

- **GHG Abatement & Climate Change Programs:**
(CT, DE, MD, NY)
 - **Data by Program:**
 - State-provided data and descriptions on potential programs for investments: CT, DE, MD, NY
 - Proxy for GHG Abatement Savings (NY) :DE
 - **Customer Participant Cost:**
 - State-provided data: CT, DE, MD, NY
- **Direct Bill Assistance *(DE, MD, NH)*:**
 - **Data by Program:**
 - State-provided data and descriptions on potential programs for investments: DE, MD, NH