

# **Refined Economic Impact Analysis for the Greenhouse Gas Emissions Reduction Act 2012 Plan—Appendices C through E**

*Prepared for*  
Maryland Department of the Environment

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## **Regional Economic Studies Institute**



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## Appendix C—Modeling Steps

### C.1 Energy

#### 3.1.1 Regional Greenhouse Gas Initiatives

##### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy.
  - a. **Regional Greenhouse Gas Initiatives**
    - i. 63—State Government Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Regional Greenhouse Gas Initiatives**
    - i. \$90,000 per year (per MDE)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Regional Greenhouse Gas Initiatives**
    - i. 100% - State Government Spending
4. Input costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

##### Operation Phase

1. Determine relevant REMI PI+ sectors.
  - a. **Regional Greenhouse Gas Initiatives**
    - i. X7809-Production Costs-Electric power generation, transmission, and distribution
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Regional Greenhouse Gas Initiatives**
    - i. Total allowances yearly by the state of Maryland for GHG—28,000,000 metric tons
    - ii. Cost of Allowance-\$1.86/allowance
    - iii. Number of Auctions to Date-17 auctions (4 per year, first year only one)
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Regional Greenhouse Gas Initiatives**
    - i. Proceeds From Auctions<sup>1</sup>—\$52,080,000
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).
  - a. **Regional Greenhouse Gas Initiatives**
    - i. X7809—\$12,254,118 [(\$52,080,000 total proceeds from auctions to date / 4.25 years)]=annual increase in production costs to electricity generation firms
5. Input cost/savings by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

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<sup>1</sup> "Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Auction 13." Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Welcome. 7 Sept. 2011. 11 Nov. 2011 <[http://www.rggi.org/market/co2\\_auctions/results/auction\\_13](http://www.rggi.org/market/co2_auctions/results/auction_13)>.

### 3.1.2 GHG Emission Reductions from Imported Power Investment Phase

No investment costs were specified by the agency for this policy.

#### Operation Phase

1. Determine relevant REMI PI+ sectors.
  - a. **GHG Emission Reductions from Imported Power**
    - i. X7809-Production Costs-Electric power generation, transmission, and distribution
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **GHG Emission Reductions from Imported Power**
    - i. 30% Energy is Imported from Outside of Maryland
    - ii. Target to be achieved by 2020—2.75 Million Metric Tons
    - iii. Number of years until Target—8 years
    - iv. Average Reductions per year—343,750 allowances annually
    - v. Average reduction per allowance—91.4 Metric Tons
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **GHG Emission Reductions from Imported Power**
    - i. Average GHG emissions associated with Electricity<sup>2</sup>—31.43 million metric tons
    - ii. Allowances Sold to Date<sup>3</sup>— 68,507,184
    - iii. Total Proceeds from Auctions to date<sup>4</sup>—\$169,600,423.80 total proceeds
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **GHG Emission Reductions from Imported Power**
    - i. \$2.48 [(\$169,600,423.80 total proceeds from auctions to date / 68,507,184 total carbon allowances sold to date)]=average cost of carbon allowances
    - ii. \$77,809,961.07 [(31,430,000 total carbon allowances sold \* \$2.48 per allowance for electricity)]=average carbon credits sold annually to firms
    - iii. 31,086,250 [(31,430,000 total carbon allowances sold—343,750 proposed annual reduction target)]=average annual carbon credit to be purchased under reductions
    - iv. \$76,958,953.30 [(31,086,250 average annual carbon credits purchased under reduction target \* \$2.48 average cost per carbon credit allowance)]=average cost to firm for carbon credits under new reduction target

<sup>2</sup> "Maryland Energy Consumption Data." ERedux Energy: Sustainable Geosocial Products and Services Network. 11 Nov. 2011. Maryland Energy Portal - Maryland's Carbon Footprint. 11 Nov. 2011  
<[http://www.eredux.com/states/state\\_detail.php?id=1129](http://www.eredux.com/states/state_detail.php?id=1129)>.

<sup>3</sup> "Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Auction 13." Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Welcome. 7 Sept. 2011. 11 Nov. 2011  
<[http://www.rggi.org/market/co2\\_auctions/results/auction\\_13](http://www.rggi.org/market/co2_auctions/results/auction_13)>.

<sup>4</sup> See note 3.

- v.  $X7809 - \$851,007.77 - [(\$77,809,961.07 \text{ current average annual carbon credit costs} - \$76,958,953.30 \text{ average carbon credit costs under target reduction policy})] = \text{reduction in costs to firms}$
5. Input savings by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.1.3 GHG New Source Performance Standard

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **GHG New Source Performance Standard**
    - i. 63—State Government Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **GHG New Source Performance Standard**
    - i. \$60,000 (per year provided by MDE)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **GHG New Source Performance Standard**
    - i. 100% for government administrative costs/responsibilities—\$60,000 per year
4. Input costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI PI+ sectors.
  - a. **GHG New Source Performance Standard**
    - i. X7809— Production Costs-Electric power generation, transmission, and distribution
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **GHG New Source Performance Standard**
    - i. Annual Reduction Target by 2020—4.48 million metric tons
    - ii. Number of years until Target—8 years
    - iii. Average Reductions per year—128,750 allowances annually
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **GHG New Source Performance Standard**
    - i. Average GHG emissions associated with Electricity<sup>5</sup>—31.43 million metric tons
    - ii. Allowances Sold to Date<sup>6</sup>— 68,507,184
    - iii. Total Proceeds from Auctions to date<sup>7</sup>—\$169,600,423.80 total proceeds

<sup>5</sup> "Maryland Energy Consumption Data." ERedux Energy: Sustainable Geosocial Products and Services Network. 11 Nov. 2011. Maryland Energy Portal - Maryland's Carbon Footprint. 11 Nov. 2011  
<[http://www.eredux.com/states/state\\_detail.php?id=1129](http://www.eredux.com/states/state_detail.php?id=1129)>.

<sup>6</sup> MD Proceeds by Auction. Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Welcome. Regional Greenhouse Gas Initiative CO2 Budget Trading Program, 2011. Web. 14 Nov. 2011.  
<[http://rggi.org/docs/MD\\_Proceeds\\_by\\_Auction.pdf](http://rggi.org/docs/MD_Proceeds_by_Auction.pdf)>.

4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **GHG New Source Performance Standard**
    - i. \$2.48 [(\$169,600,423.80 total proceeds from auctions to date / 68,507,184 total carbon allowances sold to date)]=average cost of carbon allowances
    - ii. \$77,809,961.07 [(31,430,000 total carbon allowances sold \*\$2.48 per allowance for electricity)]=average carbon credits sold annually to firms
    - iii. 30,825,000 [(31,430,000 total carbon allowances sold—605,000 proposed annual reduction target)]=average annual carbon credit to be purchased under reductions
    - iv. \$76,312,187.40 [(30,825,000 average annual carbon credits purchased under reduction target \* \$2.48 average cost per carbon credit allowance)]=average cost to firm for carbon credits under new reduction target
    - v. X7809—\$1,497,773.67 [(\$77,809,961.07 current average annual carbon credit costs - \$76,312,187.40 average carbon credit costs under target reduction policy)]=savings to firms from reductions
5. Input savings by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.1.4 Maximum Achievable Control Technology (MACT)

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Boiler Maximum Achievable Control Technology (MACT)**
    - i. 63—State Government Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Boiler Maximum Achievable Control Technology (MACT)**
    - i. \$40,000 (per year provided by MDE)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Boiler Maximum Achievable Control Technology (MACT)**
    - i. 100% for government administrative costs/responsibilities—\$40,000 per year
4. Input costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).

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<sup>7</sup> MD Proceeds by Auction. Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Welcome. Regional Greenhouse Gas Initiative CO2 Budget Trading Program, 2011. Web. 14 Nov. 2011. <[http://rggi.org/docs/MD\\_Proceeds\\_by\\_Auction.pdf](http://rggi.org/docs/MD_Proceeds_by_Auction.pdf)>.

- a. **Boiler Maximum Achievable Control Technology (MACT)**
  - i. X7809— Production Costs-Electric power generation, transmission, and distribution
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Boiler Maximum Achievable Control Technology (MACT)**
    - i. Target to 25 combined, 10 of single HAP
    - ii. Base Cost - \$200 for license + \$52.23 per ton
    - iii. Target by 2020—.10 million metric tons of CO2 emissions
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Boiler Maximum Achievable Control Technology (MACT)**
    - i. Number of Boilers (Nationally)<sup>8</sup>—13,500 boilers
    - ii. Number of Boilers in Maryland<sup>9</sup>—16
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **Boiler Maximum Achievable Control Technology (MACT)**
    - i. 12,500 [(10 million metric tons of CO2 emissions / 8 years)]=average reduction of CO2 emissions per year
    - ii. \$914,025,200.00 [(17.5 metric tons of HAPs \* \$52.23 per metric ton) + \$200.00 base fee]=average credit purchase annually from firms
    - iii. X7809—\$10,446,000.00 [(\$15,039,337.50 cost to purchase HAP not under rule) -[(17,500,000 average metric tons HAP output - 17,487,500 average output in metric tons from rule)] \* [(\$52.23 per metric ton)] + [(\$200.00 base fee)] \* [(16 boilers Maryland)]=average annual HAP credits to be purchased under new rule
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.1.5 Energy Efficiency in the Residential Sector

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **EMPOWER Maryland Empowering Finance Initiative**
    - i. 63—State Government Spending
    - ii. 98—Investment Spending (Residential)
  - b. **EMPOWER Maryland Residential Incentives**
    - i. 98—Investment Spending (Residential)

<sup>8</sup> "Maryland Energy Consumption Data." ERedux Energy: Sustainable Geosocial Products and Services Network. 11 Nov. 2011. Maryland Energy Portal - Maryland's Carbon Footprint. 11 Nov. 2011 <[http://www.eredux.com/states/state\\_detail.php?id=1129](http://www.eredux.com/states/state_detail.php?id=1129)>.

<sup>9</sup> Princeton Energy Resources International, LLC, and Exter Associates, Inc. "The Potential for Biomass Cofiring in Maryland." Maryland Powerplant Research Program. Mar. 2006. Maryland Department of Natural Resources (DNR). 11 Nov. 2011 <[http://esm.versar.com/pprp/bibliography/PPES\\_06\\_02/PPES\\_06\\_02.pdf](http://esm.versar.com/pprp/bibliography/PPES_06_02/PPES_06_02.pdf)>.

- c. MEA Home Performance Rebate Program**
    - i. 63—State Government Spending
    - ii. 98—Investment Spending (Residential)
  - d. DHCD Weatherization**
    - i. 98—Investment Spending (Residential)
  - e. Clean Energy Communities**
    - i. 63—State Government Spending
    - ii. 98—Investment Spending (Residential)
  - f. Maryland Home Energy Loan Program**
    - i. 98—Investment Spending (Residential)
  - g. Energy Workforce Training**
    - i. 98—Investment Spending (Residential)
  - h. State Energy Efficiency Appliance Rebate Program**
    - i. 63—State Government Spending
    - ii. 98—Investment Spending (Residential)
2. Determine overall cost of policy implementation for each program under the policy.
- a. EmPOWER Maryland Empowering Finance Initiative<sup>10</sup>**
    - i. 2010—\$44,104,681.87
    - ii. 2011—\$25,243,359.59
    - iii. 2012—\$32,753,320.79
    - iv. 2013—\$34,166,457.70
    - v. 2014—\$36,831,168.45
    - vi. 2015—\$37,422,974.39
    - vii. 2016—\$23,013,551.42
    - viii. 2017—\$23,013,551.42
    - ix. 2018—\$23,013,551.42
    - x. 2019—\$23,013,551.42
    - xi. 2020—\$23,013,551.42
  - b. EmPOWER Maryland Residential Incentives**
    - i. 2010—\$40,704,681.87
    - ii. 2011—\$25,243,359.59
    - iii. 2012—\$32,753,320.79
    - iv. 2013—\$34,166,457.70
    - v. 2014—\$36,831,168.45
    - vi. 2015—\$37,422,974.39
    - vii. 2016—\$23,013,551.42
    - viii. 2017—\$23,013,551.42
    - ix. 2018—\$23,013,551.42
    - x. 2019—\$23,013,551.42
    - xi. 2020—\$23,013,551.42
  - c. MEA Home Performance Rebate Program<sup>11</sup>**
    - i. 2010—\$42,204,681.87

<sup>10</sup> Program received ARRA funds in 2010.

<sup>11</sup> Program received ARRA funds in 2010.

- ii. 2011—\$25,243,359.59
- iii. 2012—\$32,753,320.79
- iv. 2013—\$34,166,457.70
- v. 2014—\$36,831,168.45
- vi. 2015—\$37,422,974.39
- vii. 2016—\$23,013,551.42
- viii. 2017—\$23,013,551.42
- ix. 2018—\$23,013,551.42
- x. 2019—\$23,013,551.42
- xi. 2020—\$23,013,551.42

**d. DHCD Weatherization**

- i. 2010—\$40,704,681.87
- ii. 2011—\$25,243,359.59
- iii. 2012—\$32,753,320.79
- iv. 2013—\$34,166,457.70
- v. 2014—\$36,831,168.45
- vi. 2015—\$37,422,974.39
- vii. 2016—\$23,013,551.42
- viii. 2017—\$23,013,551.42
- ix. 2018—\$23,013,551.42
- x. 2019—\$23,013,551.42
- xi. 2020—\$23,013,551.42

**e. Clean Energy Communities<sup>12</sup>**

- i. \$2010—\$45,504,681.87
- ii. 2011—\$26,843,359.59
- iii. 2012—\$32,753,320.79
- iv. 2013—\$34,166,457.70
- v. 2014—\$36,831,168.45
- vi. 2015—\$37,422,974.39
- vii. 2016—\$23,013,551.42
- viii. 2017—\$23,013,551.42
- ix. 2018—\$23,013,551.42
- x. 2019—\$23,013,551.42
- xi. 2020—\$23,013,551.42

**f. Maryland Home Energy Loan Program**

- i. 2010—\$40,704,681.87
- ii. 2011—\$25,243,359.59
- iii. 2012—\$32,753,320.79
- iv. 2013—\$34,166,457.70
- v. 2014—\$36,831,168.45
- vi. 2015—\$37,422,974.39
- vii. 2016—\$23,013,551.42
- viii. 2017—\$23,013,551.42

<sup>12</sup> Program received funding from 2010 through 2011.

- ix. 2018—\$23,013,551.42
- x. 2019—\$23,013,551.42
- xi. 2020—\$23,013,551.42
- g. Energy Workforce Training**
  - i. 2010—\$40,704,681.87
  - ii. 2011—\$25,243,359.59
  - iii. 2012—\$32,753,320.79
  - iv. 2013—\$34,166,457.70
  - v. 2014—\$36,831,168.45
  - vi. 2015—\$37,422,974.39
  - vii. 2016—\$23,013,551.42
  - viii. 2017—\$23,013,551.42
  - ix. 2018—\$23,013,551.42
  - x. 2019—\$23,013,551.42
  - xi. 2020—\$23,013,551.42
- h. State Energy Efficiency Appliance Rebate Program<sup>13</sup>**
  - i. 2010—\$45,804,681.87
  - ii. 2011—\$26,543,359.59
  - iii. 2012—\$32,753,320.79
  - iv. 2013—\$34,166,457.70
  - v. 2014—\$36,831,168.45
  - vi. 2015—\$37,422,974.39
  - vii. 2016—\$23,013,551.42
  - viii. 2017—\$23,013,551.42
  - ix. 2018—\$23,013,551.42
  - x. 2019—\$23,013,551.42
  - xi. 2020—\$23,013,551.42
- 3. Distribute inputs among identified REMI PI+ sectors.
  - a. EmPOWER Maryland Empowering Finance Initiative**
    - i. 92% from utilities compliance with EmPOWER (2010)
    - ii. 8% American Recovery and Reinvestment Act Funds (2010)
    - iii. 100% from utilities compliance with EmPOWER through subsequent years (2011-2020)
  - b. EmPOWER Maryland Residential Incentives**
    - i. 100% from utilities compliance with EmPOWER
  - c. MEA Home Performance Rebate Program**
    - i. 96% from utilities compliance with EmPOWER (2010)
    - ii. 4% American Recovery and Reinvestment Act Funds (2010)
    - iii. 100% from utilities compliance with EmPOWER through subsequent years (2011-2020)
  - d. DHCD Weatherization**
    - i. 100% from utilities compliance with EmPOWER

<sup>13</sup> Program received funding from 2010-2011.

- e. **Clean Energy Communities**
    - i. 88% from utilities compliance with EmPOWER (2010)
    - ii. 12% American Recovery and Reinvestment Act Funds (2010)
    - iii. 94% from utilities compliance with EmPOWER (2011)
    - iv. 6% American Recovery and Reinvestment Act Funds (2011)
    - v. 100% from utilities compliance with EmPOWER through subsequent years (2012-2020)
  - f. **Maryland Home Energy Loan Program**
    - i. 100% from utilities compliance with EmPOWER through subsequent years (2012-2020)
  - g. **Energy Workforce Training**
    - i. 100% from utilities compliance with EmPOWER through subsequent years (2012-2020)
  - h. **State Energy Efficiency Appliance Rebate Program**
    - i. 87% from utilities compliance with EmPOWER (2010)
    - ii. 13% American Recovery and Reinvestment Act Funds (2010)
    - iii. 95% from utilities compliance with EmPOWER (2011)
    - iv. 5% American Recovery and Reinvestment Act Funds (2011)
    - v. 100% from utilities compliance with EmPOWER through subsequent years (2012-2020)
- 4. Input costs by sector into REMI PI+ model and run impacts.
  - 5. Export impacts and analyze.

### Operation Phase

- 1. Determine relevant REMI PI+ sectors.
  - a. **EmPOWER Maryland Empowering Finance Initiative**
    - i. 640—Consumer Spending (electricity)
    - ii. 78—Consumption Reallocation (all categories)
  - b. **EmPOWER Maryland Residential Incentives**
    - i. 640—Consumer Spending (electricity)
    - ii. 78—Consumption Reallocation (all categories)
  - c. **MEA Home Performance Rebate Program**
    - i. 640—Consumer Spending (electricity)
    - ii. 78—Consumption Reallocation (all categories)
  - d. **DHCD Weatherization**
    - i. 640—Consumer Spending (electricity)
    - ii. 78—Consumption Reallocation (all categories)
  - e. **Clean Energy Communities**
    - i. 640—Consumer Spending (electricity)
    - ii. 78—Consumption Reallocation (all categories)
  - f. **Maryland Home Energy Loan Program**
    - i. 640—Consumer Spending (electricity)
    - ii. 78—Consumption Reallocation (all categories)
  - g. **Energy Workforce Training**
    - i. 78—Consumption Reallocation (all categories)



- a. **EMPOWER Maryland Empowering Finance Initiative**
  - b. **EMPOWER Maryland Residential Incentives**
  - c. **MEA Home Performance Rebate Program**
  - d. **DHCD Weatherization**
    - i. Number of Assist/Completions Yearly<sup>15</sup>=6,164
    - ii. Average Savings Yearly in Energy Bills<sup>16</sup>=\$437
  - e. **Clean Energy Communities**
  - f. **Maryland Home Energy Loan Program**
    - i. Loans Average of Those Possible Max<sup>17</sup>=\$11,250
    - ii. Total Homes Applied=36
    - iii. Replacement period=10 years
    - iv. Average Interest Rate on Loan=8.49%
    - v. Total Loan=\$12,205.125
    - vi. Total Owed every year on loan=\$1,220.51
    - vii. Annual Savings from Programmable Thermostat—\$150
    - viii. Annual Savings from Plugging Leaks—\$440
  - g. **Energy Workforce Training**
    - i. Total Trained to date=1,000 (assumed since 2009)
    - ii. Avg. Trained Yearly=333 (total trained to date/3 years since program initiated)
    - iii. Avg. Income of Green Job<sup>18</sup>=\$47,000
  - h. **State Energy Efficiency Appliance Rebate Program**
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
- a. **EMPOWER Maryland Empowering Finance Initiative**
    - i. 640—\$3,278,650 [(\$575 Average Annual Savings from Energy Efficiency Measures in Household \* 5,702 Applicants since 2009)]=Average Savings Associated from Program to All Applicants
    - ii. 78—\$3,278,650 [(Reallocation of savings across other consumption categories.)]
  - b. **EMPOWER Maryland Residential Incentives**
    - i. 640—\$3,225,175 [(\$575 Average Annual Savings from Energy Efficiency Measures in Households \* 5,609 Residential Applicants for MEA Grants since 2009)]=Average Savings Associated with Program Since 2009 for Residential Sector

<sup>15</sup> StateStat. Maryland StateStat Report. Department of Housing & Community Development, July 2011. Web. 11 Nov. 2011. <[http://www.statestat.maryland.gov/reports/20110825\\_DHCD\\_Template.pdf](http://www.statestat.maryland.gov/reports/20110825_DHCD_Template.pdf)>.

<sup>16</sup> Weatherization and Intergovernmental Program: Weatherization Assistance Program. EERE: EERE Server Maintenance. U.S. Department of Energy, 25 Apr. 2011. Web. 11 Nov. 2011. <<http://www1.eere.energy.gov/wip/wap.html>>.

<sup>17</sup> Maryland Home Energy Loan Program. Maryland Home Energy Loan Program. Maryland Clean Energy Centre, 2010. Web. 16 Nov. 2011. <<http://www.mcecloans.com/Module/Ext/ExtInfo.aspx?ModulePageAdmin=0fe789d7-d5fc-4297-9917-db58ccb8a660&&ModulePageVisitor=4b0b3b8a-4f4a-4192-98e8-4f0e35b75d90>>.

<sup>18</sup> 2009 County Business Patterns. Censtats Database. NAICS, 2009. Web. 11 Nov. 2011. <<http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl>>.

- ii. 78—\$3,225,175 [(Reallocation of savings across other consumption categories.)]
  - c. MEA Home Performance Rebate Program**
    - i. 640—\$1,500,000 [(From Strategy Write Up, Money Available for Grants)]
    - ii. 78—\$1,500,000 [(Reallocation of savings across other consumption categories.)]
  - d. DHCD Weatherization**
    - i. \$200.23 [(\$1,234,223 Cost Incurred for All Units to be Weatherized / 6,164 Units to be Completed Yearly)]=Average per Unit Cost of Weatherization
    - ii. \$236.77 [(\$437 Average Annual Savings from Weatherization - \$200.23 Cost per Unit of Weatherization)]=Average Annual Savings of Weatherization
    - iii. 640—\$1,459,445 [(\$236.77 Average Annual Savings of Weatherization per unit \* 6,164 Units to be treated)]=Average Savings Across All Households
    - iv. 78—\$1,459,445 [(Reallocation of savings across other consumption categories.)]
  - e. Clean Energy Communities**
    - i. 640—\$2,130,000 [(Grant Money Available per strategy write up)]
    - ii. 78—\$2,130,000 [(Reallocation of savings across other consumption categories.)]
  - f. Maryland Home Energy Loan Program**
    - i. \$1,220.51 [(\$12,205 Average Loan made through Program / 10 Year Payback period)] = Average Annual Loan Payment without Interest
    - ii. \$955 [(\$1,220.51 Average Annual Loan Payment Without Interest \* 8.49% Interest Rate Associated with Loan Program)]=Average Annual Interest Paid on Loans
    - iii. 432—\$34,385 [(\$955 Average Annual Interest Paid on Loans \* 36 Applicants for Program)]=Average Annual Revenue Received by Government from Loans
    - iv. 640—\$21,240 [(36 Applicants \* \$590 Overall Savings from Program Annually)]=Average Annual Savings to Households that Applied
    - v. 78—\$21,240 [(Reallocation of savings across other consumption categories.)]
  - g. Energy Workforce Training**
    - i. 78—\$15,666,666.67 [(333 Newly Trained Energy Workforce Labor Every Year \* \$47,000 Average Annual Income of Green Job)]=Average Additional Income to Households Annually
  - h. State Energy Efficiency Appliance Rebate Program**
    - i. 640— \$5,400,000 [(Allocated per Strategy Write Up)]
    - ii. 78—\$5,400,000 [(Reallocation of savings across other consumption categories.)]
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.1.6 Energy Efficiency in the Commercial and Industrial Sectors Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy.
  - a. **Maryland Save Energy Now**
    - i. 63—State Government Spending
  - b. **Jane E. Lawton Conservation Loan Program**
    - i. 63—State Government Spending
  - c. **Energy Efficiency and Conservation Block Grant Program**
    - i. 63—State Government Spending
  - d. **State Agencies Loan Program**
    - i. 63—State Government Spending
2. Determine overall cost of policy implementation for each program under the policy.<sup>19</sup>
  - a. **Maryland Save Energy Now**
    - i. 2010—\$0
    - ii. 2011—\$533,765
    - iii. 2012—\$533,765
    - iv. 2013—\$150,000
    - v. 2014—\$150,000
    - vi. 2015—\$150,000
    - vii. 2016—\$150,000
    - viii. 2017—\$150,000
    - ix. 2018—\$150,000
    - x. 2019—\$150,000
    - xi. 2020—\$150,000
  - b. **Jane E. Lawton Conservation Loan Program**
    - i. 2010—\$0
    - ii. 2011—\$1,335,000
    - iii. 2012—\$2,500,000
    - iv. 2013—\$2,500,000
    - v. 2014—\$2,500,000
    - vi. 2015—\$2,500,000
    - vii. 2016—\$2,500,000
    - viii. 2017—\$2,500,000
    - ix. 2018—\$2,500,000
    - x. 2019—\$2,500,000
    - xi. 2020—\$2,500,000
  - c. **Energy Efficiency and Conservation Block Grant Program**
    - i. 2010—\$3,190,000
    - ii. 2011—\$3,190,000
    - iii. 2012—\$3,190,000
  - d. **State Agencies Loan Program**
    - i. 2010—\$0

<sup>19</sup> Costs provided for this policy can be found in the *EmPOWERing Maryland: Clean Energy Programs FY2012* published by MEA. <http://energy.maryland.gov/documents/FY12ProgramBook.pdf>

- ii. 2011—\$2,500,000
  - iii. 2012—\$2,500,000
  - iv. 2013—\$2,500,000
  - v. 2014—\$2,500,000
  - vi. 2015—\$2,500,000
  - vii. 2016—\$2,500,000
  - viii. 2017—\$2,500,000
  - ix. 2018—\$2,500,000
  - x. 2019—\$2,500,000
  - xi. 2020—\$2,500,000
3. Distribute inputs among identified REMI PI+ sectors.
    - a. **Maryland Save Energy Now**
      - i. 100% for government administrative costs/responsibilities
    - b. **Jane E. Lawton Conservation Loan Program**
      - i. 100% for government administrative costs/responsibilities
    - c. **Energy Efficiency and Conservation Block Grant Program**
      - i. 100% for government administrative costs/responsibilities
    - d. **State Agencies Loan Program**
      - i. 100% for government administrative costs/responsibilities
  4. Input costs by sector into REMI PI+ model and run impacts.
  5. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Maryland Save Energy Now**
    - i. 80—Electricity (Industrial Sector) Fuel Costs, All Industrial Sectors
    - ii. 82—Electricity (Commercial Sector) Fuel Costs, All Commercial Sectors
  - b. **Jane E. Lawton Conservation Loan Program**
    - i. 80—Electricity (Industrial Sector) Fuel Costs, All Industrial Sectors
    - ii. 82—Electricity (Commercial Sector) Fuel Costs, All Commercial Sectors
  - c. **Energy Efficiency and Conservation Block Grant Program**
    - i. 80—Electricity (Industrial Sector) Fuel Costs, All Industrial Sectors
    - ii. 82—Electricity (Commercial Sector) Fuel Costs, All Commercial Sectors
  - d. **State Agencies Loan Program**
    - i. 80—Electricity (Industrial Sector) Fuel Costs, All Industrial Sectors
    - ii. 82—Electricity (Commercial Sector) Fuel Costs, All Commercial Sectors
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Maryland Save Energy Now**
  - b. **Jane E. Lawton Conservation Loan Program**
    - i. Total Energy Used by Government in 2009—1,500,000,000 kilowatts
  - c. **Energy Efficiency and Conservation Block Grant Program**
    - i. Potential Energy Reduction from Program—4,200,000 kilowatts
    - ii. Potential Energy Reduction from Program in Natural Gas (in kilowatts)—967,135 kilowatts

- iii. Potential Energy Reductions from Program in Oil (in gallons)—35,000 kilowatts
- d. State Agencies Loan Program**
  - i. Savings in kilowatts from program—11,000,000 kilowatts
- 3. Research savings data for each policy according to part of program to be affected by savings.
  - a. Maryland Save Energy Now**
  - b. Jane E. Lawton Conservation Loan Program**
  - c. Energy Efficiency and Conservation Block Grant Program**
  - d. State Agencies Loan Program**
- 4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).<sup>20</sup>
  - a. Maryland Save Energy Now**
    - i. \$128,605,000 [(Savings from 2010-2020 from this program)]
    - ii. 80—Annual Savings
      - 1. 2010—\$2,018,774
      - 2. 2011—\$4,067,822
      - 3. 2012—\$6,357,604
      - 4. 2013—\$9,170,329
      - 5. 2014—\$12,474,832
      - 6. 2015—\$15,752,591
      - 7. 2016—\$15,752,591
      - 8. 2017—\$15,752,591
      - 9. 2018—\$15,752,591
      - 10. 2019—\$15,752,591
      - 11. 2020—\$15,752,591
    - iii. 82—Annual Savings
      - 1. 2010—\$2,018,774
      - 2. 2011—\$4,067,822
      - 3. 2012—\$6,357,604
      - 4. 2013—\$9,170,329
      - 5. 2014—\$12,474,832
      - 6. 2015—\$15,752,591
      - 7. 2016—\$15,752,591
      - 8. 2017—\$15,752,591
      - 9. 2018—\$15,752,591
      - 10. 2019—\$15,752,591
      - 11. 2020—\$15,752,591
  - b. Jane E. Lawton Conservation Loan Program**
    - i. \$128,605,000 [(Savings from 2010-2020 from this program)]
    - ii. 80—Annual Savings
      - 1. 2010—\$2,018,774

<sup>20</sup> Reduction data provided by MEA from utilities for this program and an average was taken across the programs to determine the value of these programs.

2. 2011—\$4,067,822
  3. 2012—\$6,357,604
  4. 2013—\$9,170,329
  5. 2014—\$12,474,832
  6. 2015—\$15,752,591
  7. 2016—\$15,752,591
  8. 2017—\$15,752,591
  9. 2018—\$15,752,591
  10. 2019—\$15,752,591
  11. 2020—\$15,752,591
- iii. 82—Annual Savings
1. 2010—\$2,018,774
  2. 2011—\$4,067,822
  3. 2012—\$6,357,604
  4. 2013—\$9,170,329
  5. 2014—\$12,474,832
  6. 2015—\$15,752,591
  7. 2016—\$15,752,591
  8. 2017—\$15,752,591
  9. 2018—\$15,752,591
  10. 2019—\$15,752,591
  11. 2020—\$15,752,591
- c. Energy Efficiency and Conservation Block Grant Program**
- i. \$128,605,000 [(Savings from 2010-2020 from this program)]
  - ii. 80—Annual Savings
1. 2010—\$2,018,774
  2. 2011—\$4,067,822
  3. 2012—\$6,357,604
  4. 2013—\$9,170,329
  5. 2014—\$12,474,832
  6. 2015—\$15,752,591
  7. 2016—\$15,752,591
  8. 2017—\$15,752,591
  9. 2018—\$15,752,591
  10. 2019—\$15,752,591
  11. 2020—\$15,752,591
- iii. 82—Annual Savings
1. 2010—\$2,018,774
  2. 2011—\$4,067,822
  3. 2012—\$6,357,604
  4. 2013—\$9,170,329
  5. 2014—\$12,474,832
  6. 2015—\$15,752,591
  7. 2016—\$15,752,591
  8. 2017—\$15,752,591

9. 2018—\$15,752,591
10. 2019—\$15,752,591
11. 2020—\$15,752,591

**d. State Agencies Loan Program**

- i. \$128,605,000 [(Savings from 2010-2020 from this program)]
  - ii. 80—Annual Savings
    1. 2010—\$2,018,774
    2. 2011—\$4,067,822
    3. 2012—\$6,357,604
    4. 2013—\$9,170,329
    5. 2014—\$12,474,832
    6. 2015—\$15,752,591
    7. 2016—\$15,752,591
    8. 2017—\$15,752,591
    9. 2018—\$15,752,591
    10. 2019—\$15,752,591
    11. 2020—\$15,752,591
  - iii. 82—Annual Savings
    1. 2010—\$2,018,774
    2. 2011—\$4,067,822
    3. 2012—\$6,357,604
    4. 2013—\$9,170,329
    5. 2014—\$12,474,832
    6. 2015—\$15,752,591
    7. 2016—\$15,752,591
    8. 2017—\$15,752,591
    9. 2018—\$15,752,591
    10. 2019—\$15,752,591
    11. 2020—\$15,752,591
5. Input savings by sector into REMI PI+ model and run impacts.
  6. Export impacts and analyze.

**3.1.7 Energy Efficiency Appliances and Other Products**

**Investment Phase**

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. Energy Efficiency Appliances and Other Products**
    - i. 45—Residential Capital
2. Determine overall cost of policy implementation for each program under the policy.
  - a. Energy Efficiency Appliances and Other Products**
    - i. 2010—\$21,116,830
    - ii. 2011—\$20,901,270
    - iii. 2012—\$17,380,320
    - iv. 2013—\$18,140,110
    - v. 2014—\$23,300,840

- vi. 2015—\$19,872,100
- 3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Energy Efficiency Appliances and Other Products**
    - i. 100% spent by households to upgrade existing capital within the home
- 4. Input costs by sector into REMI PI+ model and run impacts.
- 5. Export impacts and analyze.

### Operation Phase

- 1. Determine relevant REMI PI+ sectors.
  - a. **Energy Efficiency Appliances and Other Products**
    - i. 640—Consumer Spending (electricity)
    - ii. 78—Consumption Reallocation (all categories)
- 2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Energy Efficiency Appliances and Other Products**
- 3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Energy Efficiency Appliances and Other Products**
    - i. Avg. purchase price of an incandescent bulb<sup>21</sup>—0.25
    - ii. Avg. purchase price of a CFL bulb<sup>22</sup>—5
    - iii. Lifetime of Incandescent Bulb<sup>23</sup>—1,000 hours
    - iv. Lifetime of a CFL Bulb<sup>24</sup>—8,000 hours
    - v. Price per hour of Incandescent bulb<sup>25</sup>—0.00025
    - vi. Price per hour of CFL Bulb<sup>26</sup>—0.000625
    - vii. Number of replacements in 7 years - Incandescent<sup>27</sup>—7
    - viii. Number of replacements in 7 year - CFL<sup>28</sup>—7
    - ix. Avg. Cost per kwh<sup>29</sup>—0.11
    - x. Amount of Watts of Incandescent<sup>30</sup>—60
    - xi. Amount of Equivalent CLF<sup>31</sup>—13
    - xii. Annual Savings in KWH change from Inca to CFL<sup>32</sup>—51
    - xiii. Number of Households<sup>33</sup>—2,092,538

<sup>21</sup> Innovation. Performance. Savings. ENERGY STAR. United States Department of Energy, 2011. Web. 16 Nov. 2011. <[http://www.energystar.gov/ia/partners/manuf\\_res/CFL\\_PRG\\_FINAL.pdf](http://www.energystar.gov/ia/partners/manuf_res/CFL_PRG_FINAL.pdf)>.

<sup>22</sup> Ibid.

<sup>23</sup> Ibid.

<sup>24</sup> Ibid.

<sup>25</sup> Ibid.

<sup>26</sup> Ibid.

<sup>27</sup> Ibid.

<sup>28</sup> Ibid.

<sup>29</sup> Strong Finish to 2011 Natural Gas Storage Injection Season. U.S. Energy Information Administration (EIA). U.S. Energy Information Administration (EIA), Oct. 2011. Web. 14 Nov. 2011. <<http://www.eia.gov/>>.

<sup>30</sup> Innovation. Performance. Savings. ENERGY STAR. United States Department of Energy, 2011. Web. 16 Nov. 2011. <[http://www.energystar.gov/ia/partners/manuf\\_res/CFL\\_PRG\\_FINAL.pdf](http://www.energystar.gov/ia/partners/manuf_res/CFL_PRG_FINAL.pdf)>.

<sup>31</sup> Ibid.

<sup>32</sup> Ibid.

<sup>33</sup> Maryland QuickFacts from the US Census Bureau. State and County QuickFacts. U.S. Census Bureau, 13 Oct. 2011. Web. 11 Nov. 2011. <<http://quickfacts.census.gov/qfd/states/24000.html>>.

4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **Energy Efficiency Appliances and Other Products**
    - i.  $\$1.75 [(7 \text{ Number of replacements in 7 years incandescent} * 0.25 \text{ Avg. purchase price of an incandescent bulb})]=\text{Total Cost in 7 Years on Replacements Incandescent}$
    - ii.  $\$0 [(0 \text{ Number of replacements in 7 years CFL} * 5 \text{ Avg. purchase price of an CFL bulb})]=\text{Total Cost in 7 Years on Replacements CFL}$
    - iii.  $0.714285714 [(5 \text{ Avg. purchase price of an CFL bulb} / 7)]=\text{Total Cost Over Lifetime of CFL per year}$
    - iv.  $\$0.71 [(5 \text{ Avg. purchase price of an CFL bulb} / 7)]=\text{Cost of CFL Annually}$
    - v.  $5.8191 [(51 \text{ Annual Savings in kwh change from Inca to CFL} * 0.11 \text{ Avg. Cost per kwh})]=\text{Savings from CFL Annually}$
    - vi.  $\$5.11 [(5.8191 \text{ Savings from CFL Annually} - 0.714285714 \text{ Savings from CFL Annually})]=\text{Savings from ONE CFL Bulb}$
    - vii.  $\$10,682,017.88 [(2,092,538 \text{ Number of Households} * 5.10481 \text{ Savings from ONE CFL Bulb})]=\text{Savings Annually}$
    - viii.  $604-\$10,682,017.88 [(2,092,538 \text{ Number of Households} * 5.10481 \text{ Savings from ONE CFL Bulb})]=\text{Savings Annually}$
    - ix.  $78-\$10,682,017.88 [(\text{Reallocation of consumer savings across other consumption categories})]$
5. Input savings by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### **3.1.8 Energy Efficiency in the Power Sector—General Investment Phase**

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Energy Efficiency in the Power Sector—General**
    - i. EQP 13—Producer’s Durable Equipment Investment, Electrical transmission, distribution, generation
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Energy Efficiency in the Power Sector—General**<sup>34</sup>
    - i. 2010—\$242,655,500
    - ii. 2011—\$153,864,300
    - iii. 2012—\$199,639,289
    - iv. 2013—\$208,252,695
    - v. 2014—\$267,544,800
    - vi. 2015—\$228,101,939
    - vii. 2016—\$216,676,420
    - viii. 2017—\$216,676,420
    - ix. 2018—\$216,676,420
    - x. 2019—\$216,676,420

<sup>34</sup> All data was provided by MEA from utility companies regarding this program.

- xi. 2020—\$216,676,420
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Energy Efficiency in the Power Sector—General**
    - i. 100% towards private sector in power generation to implement new strategies
4. Input costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Energy Efficiency in the Power Sector—General**
    - i. X7809—Production Cost, Electrical power generation, distribution, transmission
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Energy Efficiency in the Power Sector—General**
    - i. Potential Biomass=2,700,000 in tons
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Energy Efficiency in the Power Sector—General**
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).<sup>35</sup>
  - a. **Energy Efficiency in the Power Sector—General**
    - i. X7809—Annual Savings to Power Sector
      1. 2010—\$17,133,600
      2. 2011—\$19,077,100
      3. 2012—\$23,688,900
      4. 2013—\$36,847,500
      5. 2014—\$54,334,000
      6. 2015—\$72,374,100
      7. 2016—\$37,242,510
      8. 2017—\$37,242,510
      9. 2018—\$37,242,510
      10. 2019—\$37,242,510
      11. 2020—\$37,242,510
5. Input savings by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.1.9 Maryland Renewable Energy Portfolio Standard

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).

<sup>35</sup> Reduction data provided by utilities to MEA.

- a. **Maryland Renewable Energy Portfolio Standard**
    - i. EQP 13—Producer’s Durable Equipment Investment, Electrical generation, distribution, transmission
  2. Determine overall cost of policy implementation for each program under the policy.
    - a. **Maryland Renewable Energy Portfolio Standard**<sup>36</sup>
      - i. 2010—\$23,290,000
      - ii. 2011—\$345,600,000
      - iii. 2012—\$125,190,000
      - iv. 2013—\$310,440,000
      - v. 2014—\$188,680,000
      - vi. 2015—\$536,200,000
      - vii. 2016—\$368,860,000
      - viii. 2017—\$1,941,270,000
      - ix. 2018—\$1,705,000,000
      - x. 2019—\$914,610,000
      - xi. 2020—\$265,600,000
  3. Distribute inputs among identified REMI PI+ sectors.
    - a. **Maryland Renewable Energy Portfolio Standard**
      - i. 100% for private producers of electricity to move towards new alternative sources.
  4. Input costs by sector into REMI PI+ model and run impacts.
  5. Export impacts and analyze.
- Operation Phase**
1. Determine relevant REMI PI+ sectors.
    - a. **Maryland Renewable Energy Portfolio Standard**
      - i. X7009—Compensation, Electrical power distribution, generation, transmission
      - ii. X7809—Production Cost, Electrical power distribution, generation, transmission
      - iii. X10009—Capital Cost, Electrical power distribution, generation, transmission
  2. Determine part of program to be affected by ongoing costs for maintenance.
    - a. **Maryland Renewable Energy Portfolio Standard**
  3. Research costs data for each policy according to part of program to be affected by program.
    - a. **Maryland Renewable Energy Portfolio Standard**<sup>37</sup>
  4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).
    - a. **Maryland Renewable Energy Portfolio Standard**
      - i. X7009—Annual costs to firm
        1. 2010—\$6,610,000
        2. 2011—\$6,460,000

<sup>36</sup> Funding levels for RPS have been provided on an annual basis by MEA.

<sup>37</sup> All data regarding maintenance and operation estimations have been provided courtesy of MEA.

3. 2012—\$6,730,000
4. 2013—\$6,730,000
5. 2014—\$6,730,000
6. 2015—\$14,470,000
7. 2016—\$14,470,000
8. 2017—\$14,470,000
9. 2018—\$15,170,000
10. 2019—\$15,170,000
11. 2020—\$15,170,000
- ii. X7809—Annual costs to firm
  1. 2010—\$33,205,000
  2. 2011—\$33,000,000
  3. 2012—\$33,205,000
  4. 2013—\$34,540,000
  5. 2014—\$34,860,000
  6. 2015—\$38,015,000
  7. 2016—\$38,675,000
  8. 2017—\$70,700,000
  9. 2018—\$91,310,000
  10. 2019—\$95,340,000
  11. 2020—\$96,255,000
- iii. X10009—Annual costs to firm
  1. 2010—\$33,205,000
  2. 2011—\$33,000,000
  3. 2012—\$33,205,000
  4. 2013—\$34,540,000
  5. 2014—\$34,860,000
  6. 2015—\$38,015,000
  7. 2016—\$38,675,000
  8. 2017—\$70,700,000
  9. 2018—\$91,310,000
  10. 2019—\$95,340,000
  11. 2020—\$96,255,000
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.1.10 Incentives and Grant Programs to Support Renewable Energy Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Commercial Clean Energy Grant Program**
    - i. 63—State Govt. Spending
  - b. **Residential Clean Energy Grants Program**
    - i. 63—State Govt. Spending

- c. **Clean Energy Incentive Tax Credit Program**
    - i. 63—State Govt. Spending
  - d. **Generating Clean Horizons Program**
    - i. 45—Residential Capital Investment
  - e. **Project Sunburst**
    - i. 63—State Govt. Spending
  - f. **Biomass Program**
    - i. 63—State Govt. Spending
  - g. **Land-based Wind Programs**
    - i. 63—State Govt. Spending
2. Determine overall cost of policy implementation for each program under the policy.
- a. **Commercial Clean Energy Grant Program**
    - i. 2010—\$0
    - ii. 2011—\$1,500,000
    - iii. 2012—\$1,500,000
    - iv. 2013—\$1,000,000
    - v. 2014—\$1,000,000
    - vi. 2015—\$1,000,000
    - vii. 2016—\$1,000,000
    - viii. 2017—\$1,000,000
    - ix. 2018—\$1,000,000
    - x. 2019—\$1,000,000
    - xi. 2020—\$1,000,000
  - b. **Residential Clean Energy Grants Program**
    - i. 2010—\$0
    - ii. 2011—\$5,600,000
    - iii. 2012—\$5,600,000
    - iv. 2013—\$4,200,000
    - v. 2014—\$4,200,000
    - vi. 2015—\$4,200,000
    - vii. 2016—\$4,200,000
    - viii. 2017—\$4,200,000
    - ix. 2018—\$4,200,000
    - x. 2019—\$4,200,000
    - xi. 2020—\$4,200,000
  - c. **Clean Energy Incentive Tax Credit Program**<sup>38</sup>
    - i. 2010—\$2,500,000
    - ii. 2011—\$2,500,000
    - iii. 2012—\$2,500,000
    - iv. 2013—\$2,500,000
    - v. 2014—\$2,500,000
    - vi. 2015—\$2,500,000

<sup>38</sup> “Clean Energy Production Tax Credit,” *Maryland Energy Administration*, accessed October 17, 2012.

- d. **Generating Clean Horizons Program**<sup>39</sup>
    - i. 2010—\$106,700,000
    - ii. 2011—\$106,700,000
    - iii. 2012—\$106,700,000
  - e. **Project Sunburst**<sup>40</sup>
    - i. 2010—\$4,690,565
    - ii. 2011—\$4,690,565
  - f. **Biomass Program**
    - i. 2010—\$1,000,500
    - ii. 2011—\$1,000,500
    - iii. 2012—\$1,000,500
    - iv. 2013—\$1,000,500
    - v. 2014—\$1,000,500
    - vi. 2015—\$1,000,500
    - vii. 2016—\$1,000,500
    - viii. 2017—\$1,000,500
  - g. **Land-based Wind Programs**<sup>41</sup>
    - i. 2010—\$100,000
    - ii. 2011—\$100,000
    - iii. 2012—\$100,000
    - iv. 2013—\$100,000
    - v. 2014—\$100,000
    - vi. 2015—\$100,000
    - vii. 2016—\$100,000
    - viii. 2017—\$100,000
3. Distribute inputs among identified REMI PI+ sectors.
- a. **Commercial Clean Energy Grant Program**
    - i. 100% spent by government (from SEIF funds) in form of grants to businesses
  - b. **Residential Clean Energy Grants Program**
    - i. 100% spent by government (from SEIF funds) in form of grants to residential investment
  - c. **Clean Energy Incentive Tax Credit Program**
    - i. 100% spent by government towards reduction of investment costs in clean energy
  - d. **Generating Clean Horizons Program**
    - i. 100% spent by households to improve household energy savings
  - e. **Project Sunburst**
    - i. 100% spent by government in form of grants

<sup>39</sup> Maryland Energy Administration, “Maryland Governor Martin O’Malley Celebrates the Completion of the Largest Solar Farm in the State” (press release, Emmitsburg, Maryland, 2012)

<sup>40</sup> “Project Sunburst,” *Maryland Energy Administration*, accessed October 17, 2012.

<sup>41</sup> “Windswept Grant Program,” *Maryland Energy Administration*, accessed October 17, 2012.

- f. Biomass Program**
    - i. 100% spent by government in form of research regarding biomass
  - g. Land-based Wind Programs**
    - i. 100% spent by government to further initiatives in land-based wind
- 4. Input sales by sector into REMI PI+ model and run impacts.
- 5. Export impacts and analyze.

### Operation Phase

- 1. Determine relevant REMI PI+ sectors.
  - a. Commercial Clean Energy Grant Program**
    - i. 82—Electrical (Commercial Sector) Fuel Costs, All Commercial Sectors
  - b. Residential Clean Energy Grants Program**
    - i. 640—Consumer Spending, (electricity)
    - ii. 78—Consumption Reallocation (all categories)
  - c. Clean Energy Incentive Tax Credit Program**
    - i. No additional costs or benefits specified
  - d. Generating Clean Horizons Program**
    - i. 640—Consumer Spending, (electricity)
    - ii. 78—Consumption Reallocation (all categories)
  - e. Project Sunburst**
    - i. 640—Consumer Spending, (electricity)
    - ii. 78—Consumption Reallocation (all categories)
  - f. Biomass Program**
    - i. 640—Consumer Spending, (electricity)
    - ii. 78—Consumption Reallocation (all categories)
  - g. Land-based Wind Programs**
    - i. 640—Consumer Spending, (electricity)
    - ii. 78—Consumption Reallocation (all categories)
- 2. Determine part of program to be affected by savings (from strategy write-up).
  - a. Commercial Clean Energy Grant Program**
  - b. Residential Clean Energy Grants Program**
  - c. Clean Energy Incentive Tax Credit Program**
  - d. Generating Clean Horizons Program**
    - i. Total Energy Used by Government in 2009—1,500,000,000 kilowatts
    - ii. Reduction Goal by 2016—16%
  - e. Project Sunburst**
  - f. Biomass Program**
  - g. Land-based Wind Programs**
    - i. Total Wind Energy Generated Annually—120,000 kilowatts
    - ii. Total Wind Energy Generation Added Since Project Windswept—421 kilowatts
    - iii. Average Annual Wind Energy Generated—120,421 kilowatts
- 3. Research savings data for each policy according to part of program to be affected by savings.

- a. **Commercial Clean Energy Grant Program**
    - i. Potential Savings from Clean Energy Grant—\$575
    - ii. Total Applicants for Grants (from MEA website)—42 Businesses
  - b. **Residential Clean Energy Grants Program**
    - i. Total Applicants for Grants (from MEA website)—5,609 Residential Applicants
    - ii. Average Grantees A Year—1,870 Residential Grantees a year
    - iii. Potential Savings from Clean Energy Grant—\$575
  - c. **Clean Energy Incentive Tax Credit Program**
    - i. Number of Business Tax Credit Applicants (From MEA website)—42
  - d. **Generating Clean Horizons Program**
    - i. Maryland Electricity cost (in KWh)<sup>42</sup>—\$0.11 per kW/h
  - e. **Project Sunburst**
    - i. Total Awardees (from MEA website)—17
    - ii. Total Money Granted (from MEA website)—\$9,381,130.00
  - f. **Biomass Program**
    - i. Annual Savings from Biomass Production—\$4,282,740.00 (from DNR)
  - g. **Land-based Wind Programs**
    - i. Maryland Electricity cost (in KWh)<sup>43</sup>—\$0.11 per kW/h
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
- a. **Commercial Clean Energy Grant Program**
    - i. 82—\$24,150 [(42 Applicants to date for Commercial Clean Energy Grants \* \$575 Annual Savings Associated with Clean Energy Initiatives)]=Average Annual Savings from Strategy
  - b. **Residential Clean Energy Grants Program**
    - i. 640—\$1,075,058 [(1,870 Residential Applicants Annually for Grants \* \$575 Potential Energy Savings from Grants)]=Average Annual Savings to Households
    - ii. 78—\$1,075,058 [(Reallocation of savings across other consumption categories)]
  - c. **Clean Energy Incentive Tax Credit Program**
    - i. No Additional Costs or Benefits associated with this program
  - d. **Generating Clean Horizons Program**
    - i. \$171,150,000.00 [(1,500,000,000 kilowatts of Energy used by Government in 2009 \* \$0.11 Average Cost of Electricity per kwh)]=Average Cost to Government in 2009 for Energy Consumption
    - ii. 240,000,000 [(1,500,000,000 kilowatts of Energy used by Government in 2009 \* 16% Reduction goal by 2016)]=Kilowatt Consumption Reduction Goal by 2016

<sup>42</sup> Average Energy Prices in the Washington-Baltimore Area. Mid-Atlantic Information Office. 27 Sept. 2011. U.S. Bureau of Labor Statistics (BLS). 11 Nov. 2011 <[http://www.bls.gov/ro3/apwb.htm#wb\\_energy\\_table1](http://www.bls.gov/ro3/apwb.htm#wb_energy_table1)>.

<sup>43</sup> Ibid.

- iii. 60,000,000 [(240,000,000 Kilowatt Consumption Reduction Goal by 2016 / 4 Years until 2016 Deadline)]=Average Annual Reduction Goal until 2016
- iv. 1,440,000,000 [(1,500,000,000 kilowatts of Energy used by Government in 2009—60,000,000 Average Annual Reduction Goal Until 2016)]=Average Annual Amount to be used by Government in Next Year
- v. \$164,304,000.00 [(1,440,000,000 Average Annual Amount to be used by Government in Next Year \* \$0.11 Average Cost per kilowatt hour)]=Average Annual Cost to Government in Next Year
- vi. 640—\$6,846,000.00 [(\$171,150,000.00 Average Annual Cost of Electricity in 2009 to Government - \$164,304,000.00 Average Annual Cost of Electricity Next Year to Government)]=Average Annual Savings Associated with Reduction
- vii. 78 — \$6,846,000 [(Reallocation of savings across all other consumption categories.)]

**e. Project Sunburst**

- i. 640—\$9,381,130.00 [(Total Money Granted Under this Project Via the MEA website)]
- ii. 78—\$9,381,130 [(Reallocation of savings to other consumption categories.)]

**f. Biomass Program**

- i. 640—\$4,282,740.00 [(Biomass Savings Annually provided by DNR)]
- ii. 78 — \$4,282,740 [(Reallocation of savings across all other consumption categories.)]

**g. Land-based Wind Programs**

- i. \$13,740.04 [(\$0.11 Average Cost per kwh of Electricity \* 120,421 kilowatts generated by Wind Energy)]=Average Annual Savings to Consume Wind Energy
- ii. 640—\$13,740
- iii. 78 — \$13,740 [(Reallocation of savings across all other consumption categories.)]

- 5. Input savings/costs by sector into REMI PI+ model and run impacts.
- 6. Export impacts and analyze.

**3.1.11 Offshore Wind Initiatives to Support Renewable Energy**

**Investment Phase**

- 1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. Offshore Wind Initiative to Support Renewable Energy**
    - i. X7809—Production Cost, Electrical power distribution, generation, transmission
- 2. Determine overall cost of policy implementation for each program under the policy.

- a. **Offshore Wind Initiative to Support Renewable Energy**<sup>44</sup>
  - i. \$639,000,000 (to be allocated for investment in 2017, provided by MEA.)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Offshore Wind Initiative to Support Renewable Energy**
    - i. 100% paid by private industry towards investment in offshore wind energy production
4. Input costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

### Operation Phase

1. Determine relevant REMI PI+ sectors.
  - a. **Offshore Wind Initiative to Support Renewable Energy**
    - i. X7809—Production Cost, Electrical power distribution, generation, transmission
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Offshore Wind Initiative to Support Renewable Energy**
    - i. Reduction Total by 2020—20%
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Offshore Wind Initiative to Support Renewable Energy**
    - i. Continued operation and maintenance costs annually after 2017 could average \$36,940,000 per year. (Data provided courtesy of MEA)
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).
  - a. **Offshore Wind Initiative to Support Renewable Energy**
    - i. X7809—annual costs from 2017-2020
      1. 2017 — \$36,940,000
      2. 2018 — \$36,940,000
      3. 2019 — \$36,940,000
      4. 2020 — \$36,940,000
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

## C.2 Transportation

### 3.2.1 Maryland Clean Cars Program

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy.
  - a. **Maryland Clean Cars Program**
    - i. 63—State Govt. Spending
    - ii. 601—Consumer Spending (autos)
2. Determine overall cost of policy implementation for each program under the policy.

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<sup>44</sup> Maryland Energy Administration, “Maryland Offshore Wind Energy Act of 2012 Facts & Figures” (Press release, Annapolis, Maryland, 2012).

- a. **Maryland Clean Cars Program**
  - i. Number of clean cars sold to date—362,955 (provided by MDE)
  - ii. Number of clean cars needed to achieve GGRA—3,751,245 (provided by MDE)
  - iii. Number of clean cars goal for 2013—325,728 (provided by MDE)
  - iv. Average increase in the private sector of clean cars in cost<sup>45</sup>—\$1,280 per vehicle
  - v. Average increase in the public sector of clean cars in price<sup>46</sup>—\$1,223 per vehicle
  - vi. Number of vehicles to be replaced by government annual—800
  - vii. Number of vehicles left to be replaced by private sector to reach goal in 2013—324,928
  - viii. Average Annual vehicles to be replaced from 2014-2020 to reach target—437,509
  - ix. Average annual vehicles replaced by government annually—800
  - x. Average annual vehicles replaced by consumers annually—436,709
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Maryland Clean Cars Program**
    - i. 63—Average annual spending by state government on clean cars for replacement fleet
      1. 2012—\$303,200
      2. 2013—\$978,000
      3. 2014—\$978,000
      4. 2015—\$978,000
      5. 2016—\$978,000
      6. 2017—\$978,000
      7. 2018—\$978,000
      8. 2019—\$978,000
      9. 2020—\$978,000
    - ii. 601—Average annual spending by consumers on clean cars
      1. 2012—\$463,558,400
      2. 2013—\$415,907,840
      3. 2014—\$558,987,520
      4. 2015—\$558,987,520
      5. 2016—\$558,987,520
      6. 2017—\$558,987,520
      7. 2018—\$558,987,520
      8. 2019—\$558,987,520
      9. 2020—\$558,987,520
  4. Input costs by sector into REMI PI+ model and run impacts.
  5. Export impacts and analyze.

<sup>45</sup> Motor Vehicle Administration, “2011 Car Sales Statistics,” *Department of Transportation*, accessed October 17, 2012.

<sup>46</sup> Ibid.

## Operation Phase

1. Determine relevant REMI PI+ sectors.
  - a. **Maryland Clean Cars Program**
    - i. 623—Consumer spending (gas)
    - ii. 78—Consumption reallocation
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Maryland Clean Cars Program**
    - i. New CAFE average standards for MPG<sup>47</sup>—29 mpg
    - ii. Average MPG of NONPVEC vehicles<sup>48</sup>—27.05
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Maryland Clean Cars Program**
    - i. Average savings per mile—1.95 gallons per mile
    - ii. Average fuel price per gallon (regular unleaded)<sup>49</sup>—\$3.63 per gallon
    - iii. Total VMT Driven By Maryland Population in 2011<sup>50</sup>—55,600,000,000 miles
    - iv. Average annual growth rate of vehicle miles traveled by MD residents<sup>51</sup>—1.80%
    - v. Number of vehicles registered in Maryland—2,221,000
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).
  - a. **Maryland Clean Cars Program**
    - i. 56,600,800,000 miles [(55,600,000,000 miles driven by MD residents in 2011 \* 1.80% growth) + 55,600,000,000 miles driven in 2011=new potential total miles traveled by MD residents in 2012
    - ii. 25,484 miles [(55,600,800,000 miles in 2012 / 2,221,000 vehicles registered in MD)]=Average number of miles traveled by each vehicle in Maryland in 2012
    - iii. \$229.96 in 2012 [(25,484 miles in 2012 / 29 miles per gallon) \* [(\$3.63 per gallon of regular unleaded)]—[(25,484 miles in 2012 / 27.05 miles per gallon) \* [(\$3.63 per gallon of regular unleaded)]=savings in gasoline by consumer in 2012 if they switched to clean cars
    - iv. \$83,464,686 [(((\$229.96 savings for those that switched to clean cars \* 362,955 clean cars sold to date)]=average annual savings by clean car consumers in 2012

<sup>47</sup> Csere, Csaba. "How Automakers Will Meet 2016 CAFE Standards - Feature - Car and Driver." Car Reviews - 2011 Car Reviews and 2012 New Cars at Car and Driver. May 2011. Car and Driver. 11 Nov. 2011 <<http://www.caranddriver.com/features/how-automakers-will-meet-2016-cafe-standards>>.

<sup>48</sup> Bureau of Transportation Statistics, "Table 4-23: Average Fuel Efficiency of U.S. Light Duty Vehicles," *Research and Innovative Technology Administration*, accessed October 17, 2012.

<sup>49</sup> Daily Fuel Gauge Report--national, state and local average prices for gasoline, diesel and E-85. 11 Nov. 2012. Oil Price Information Service (OPIS). 11 Nov. 2012 <<http://fuelgaugereport.aaa.com/?redirectto=http://fuelgaugereport.opisnet.com/index.asp>>

<sup>50</sup> Maryland Department of Transportation, "Draft 2012 Implementation Plan – Appendix." *Maryland Climate Action Plan* (2011), accessed October 17, 2012.

<sup>51</sup> Ibid.

- v.  $57,619,614,400$  miles  $[(55,600,800,000 \text{ miles driven by MD residents in } 2011 * 1.80\% \text{ growth}) + 55,600,800,000 \text{ miles driven in } 2012 = \text{new potential total miles traveled by MD residents in } 2013]$
  - vi.  $16,286$  vehicles  $[(325,728 \text{ clean car vehicle goal} * 5\% \text{ for new registrations}) = \text{New registrations possibly in Maryland in } 2013]$
  - vii.  $2,237,286$  vehicles  $[(2,221,000 \text{ registered vehicles currently} + 16,286 \text{ potentially new registrations in } 2013 \text{ if } 5\% \text{ of new clean cars are new registrations}) = \text{Total registered vehicles in } 2013]$
  - viii.  $25,754$  miles  $[(57,619,614,400 \text{ miles in } 2012 / 2,237,286 \text{ vehicles registered in MD}) = \text{Average number of miles traveled by each vehicle in Maryland in } 2013]$
  - ix.  $\$232.39$  in 2013  $[(25,754 \text{ miles in } 2013 / 29 \text{ miles per gallon}) * [(\$3.63 \text{ per gallon of regular unleaded}) - [(25,754 \text{ miles in } 2013 / 27.05 \text{ miles per gallon}) * [\$3.63 \text{ per gallon of regular unleaded}]] = \text{savings in gasoline by consumer in } 2013 \text{ if they switched to clean cars}]$
  - x.  $\$75,697,201.95$   $[(\$232.39 \text{ savings for those that switched to clean cars} * 325,728 \text{ clean cars goal in } 2013) = \text{Annual savings by clean car consumers in } 2013]$
  - xi.  $\$159,161,890$   $[(\$83,464,686 \text{ total savings to clean car consumers in } 2012 + \$75,697,201.95 \text{ total savings to clean car consumers in } 2013) = \text{total savings from clean car consumers between } 2012\text{-}2013]$
  - xii.  $\$79,580,900$   $[(\$159,161,890 \text{ total savings between } 2012\text{-}2013 \text{ clean car consumers} / 2 \text{ years}) = \text{Average annual savings from clean cars}]$
  - xiii.  $623$ — $\$79,580,900$  average annual savings from clean cars from 2012-2020
  - xiv.  $78$ — $\$79,580,900$  average annual reallocation of savings across other consumption categories
5. Input savings/costs by sector into REMI PI+ model and run impacts.
  6. Export impacts and analyze.

### **3.2.2 National Fuel Efficiency and Emission Standards for Medium- and Heavy-Duty Trucks**

#### **Investment Phase**

1. Determine relevant REMI PI+ sectors for each program under the policy.
  - a. **National Fuel Efficiency and Emission Standards for Medium- and Heavy-Duty Trucks**
    - i. X6653—Intermediate Demand, Motor vehicle parts manufacturing
    - ii. X7653—Value added (with no effect on sales or employment), Motor vehicle parts manufacturing
    - iii. X7851—Production costs, Motor vehicle manufacturing
2. Determine overall cost of policy implementation for each program under the policy.

- a. **National Fuel Efficiency and Emission Standards for Medium- and Heavy-Duty Trucks**
  - i. Costs from 2012-2016<sup>52</sup>—\$170,000,000 annually
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **National Fuel Efficiency and Emission Standards for Medium- and Heavy-Duty Trucks**
    1. X6653—\$170,000,000 annually from 2012-2016 for new parts to comply with regulation
    2. X7653—(\$170,000,000) annually from 2012-2016 (offset to ensure no value added since this is not from new sales but a need for technology)
    3. X7851—\$170,000,000 increase in production costs to auto manufacturers that are selling a final product to comply with standards
4. Input costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **National Fuel Efficiency and Emission Standards for Medium- and Heavy-Duty Trucks**
    - i. 641—Consumer Spending (gas)
    - ii. 78—Consumption reallocation (across all categories)
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **National Fuel Efficiency and Emission Standards for Medium- and Heavy-Duty Trucks**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **National Fuel Efficiency and Emission Standards for Medium- and Heavy-Duty Trucks**
    - i. Total savings for MD consumers from 2020-2025—\$138,906,752 (provided by MDE)
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **National Fuel Efficiency and Emission Standards for Medium- and Heavy-Duty Trucks**
    - i. 641—\$23,151,125 reduction in fuel consumption by MD consumers
    - ii. 78—\$23,151,125 reallocation of savings across other consumption categories
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

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<sup>52</sup> United States Environmental Protection Agency (2011), “Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles: EPA Response to Comments Document for Joint Rulemaking,” accessed October 17, 2012.

### 3.2.3 Clean Fuel Standard

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Clean Fuel Standard**
    - i. X6653—Intermediate Demand, Motor vehicle parts manufacturing
    - ii. X7653—Value added (with no effect on sales or employment), Motor vehicle parts manufacturing
    - iii. X7851—Production costs, Motor vehicle manufacturing
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Clean Fuel Standard**
    - i. Between 2012-2016 annual costs will be about \$27,780,000 to manufacturers<sup>53</sup>
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Clean Fuel Standard**
    1. X6653—\$27,780,000 annually from 2012-2016 for new parts to comply with regulation
    2. X7653—(\$27,780,000) annually from 2012-2016 (offset to ensure no value added since this is not from new sales but a need for technology)
    3. X7851—\$27,780,0000 increase in production costs to auto manufacturers that are selling a final product to comply with standards
4. Input costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Clean Fuel Standard**
    - i. 641—Consumer Spending (gas)
    - ii. 78—Consumption reallocation (across all categories)
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Clean Fuel Standard**
    - i. Average annual reduction—2.05% in fuel use
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Clean Fuel Standard**
    - i. Average fuel price per gallon (regular unleaded)<sup>54</sup>—\$3.43 per gallon
    - ii. Average Annual Miles Driven By Population<sup>55</sup>—13,041 miles

<sup>53</sup> “Clean Fuels Standard,” *Northeast States for Coordinated Air Use Management*, accessed October 17, 2012.

<sup>54</sup> Daily Fuel Gauge Report--national, state and local average prices for gasoline, diesel and E-85. 11 Nov. 2011. Oil Price Information Service (OPIS). 11 Nov. 2011  
<<http://fuelgaugereport.aaa.com/?redirectto=http://fuelgaugereport.opisnet.com/index.asp>>.

- iii. Annual New Vehicle Registration in Maryland (2010)<sup>56</sup>—186,759 (total for cars and light trucks)
  - iv. Current CAFE standards for MPG(Light Vehicles)<sup>57</sup>—25.5 mpg (average)
  - v. Note: RESI will assume that new CAFE standards have not been implemented with year one of the policy and thus use current CAFE standards for policy analysis.
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2020-2025).
- a. **Clean Fuel Standard**
    - i. 511.41 [(13,401 average miles driven annually by MD drivers / 25.5 average miles per gallon)=average gas consumed annually by Maryland drivers
    - ii. \$1,754.14 per year [(13,041 miles in one year / 25.5 miles per gallon)] \* [(\$3.43 per gallon of regular unleaded)]=average cost to new car owners in Maryland for gasoline
    - iii. 10.48 [(13,041 miles in one year / 25.5 miles per gallon)]—[(13,041 miles in one year / 25.5 miles per gallon)] \* [(2.05% reduction in gallons per year of fuel due to policy)]=savings in gasoline by consumer in gallons
    - iv. 500.93 [(511.41 gallons used on average a year—10.48 gallons reduced from clean fuel policy)]=average gallons used in Maryland annually under new policy
    - v. \$1,718.18 [(500.91 gallons used annually under new policy \* \$3.43 average per gallon of regular unleaded fuel)]=average annual cost to new car owners in Maryland for gasoline
    - vi. \$35.96 [(\$1,754.14 per year on gas for new car owners in Maryland without policy - \$1,718.18 per year on gas for new car owners in Maryland with policy)]=annual savings from on gas from implementation of new policy annually
    - vii. 641—\$6,715,838.37 [(186,759 total new registrations on all light vehicles annually \* \$35.96 average annual savings in gas from new policy implementation)]=total average annual savings for new vehicle purchases in gas in the state of Maryland from policy
    - viii. 78—\$6,715,838.37 [(Reallocation of savings across all other consumption categories)]
5. Input savings/costs by sector into REMI PI+ model and run impacts.

<sup>55</sup> Average Annual Miles per Driver by Age Group. 4 April 2011. U.S. Department of Transportation (USDOT), Federal Highway Administration (FHWA), Office of Highway Policy Information (OHPI). Web. 11 Nov. 2011. <<http://www.fhwa.dot.gov/ohim/onh00/bar8.htm>>.

<sup>56</sup> "Maryland Auto Outlook." Www.mdauto.org. 9 Aug. 2011. Maryland Automobile Dealers Association. 11 Nov. 2011 <<http://www.mdauto.org/admin/publications/AutoOutlookQuarter22011.pdf>>.

<sup>57</sup> Csere, Csaba. "How Automakers Will Meet 2016 CAFE Standards - Feature - Car and Driver." Car Reviews - 2011 Car Reviews and 2012 New Cars at Car and Driver. May 2011. Car and Driver. 11 Nov. 2011 <<http://www.caranddriver.com/features/how-automakers-will-meet-2016-cafe-standards>>.

6. Export impacts and analyze.

### 3.2.4 Transportation and Climate Initiative

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy.
  - a. **Transportation and Climate Initiative**
    - i. 63—State Govt. Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Transportation and Climate Initiative**
    - i. \$15,000 annually for oversight of policy (data provided by MDE)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Transportation and Climate Initiative**
    - i. 100% paid by government for administrative costs
4. Input costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

No additional costs or benefits have been identified for this policy.

### 3.2.5 Public Transportation Initiatives

#### Investment Phase

1. Determine relevant REMI sectors for each program under the policy.
  - a. **Locally Operated Transit Systems**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - b. **Smart Card Implementation**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - c. **College Pass**
    - iii. 63—State Government Spending
    - iv. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - b. **Charm City Circulator and Hampden Neighborhood Shuttle**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - c. **Locally Operated Transit Systems**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - d. **Smart Card Implementation**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - e. **Transit Oriented Development**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects

- f. Maryland Commuter Tax Credit**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - g. Guaranteed Ride Home**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - h. College Pass**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - i. Ride Share**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - j. Commuter Connections—Washington, D.C. Region**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - k. Baltimore Collegetown Network**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - l. Hunt Valley Shuttle**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - m. Kent Street Transit Plaza**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - n. University of Maryland College Park Carpool Program and Shuttle Bus Service**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
    - iii.
2. Determine overall cost of policy implementation for each program under the policy.
- a. Charm City Circulator and Hampden Neighborhood Shuttle**
    - i. \$41,054,429
  - b. Locally Operated Transit Systems**
    - i. \$41,054,429
  - c. Smart Card Implementation**
    - i. \$41,054,429
  - d. Transit Oriented Development**
    - i. \$41,054,429
  - e. Maryland Commuter Tax Credit**
    - i. \$41,054,429
  - f. Guaranteed Ride Home**
    - i. \$41,054,429
  - g. College Pass**
    - i. \$41,054,429

- h. Ride Share**
    - i. \$41,054,429
  - i. Commuter Connections—Washington, D.C. Region**
    - i. \$41,054,429
  - j. Baltimore Collegetown Network**
    - i. \$41,054,429
  - k. Hunt Valley Shuttle**
    - i. \$41,054,429
  - l. Kent Street Transit Plaza**
    - i. \$41,054,429
  - m. University of Maryland College Park Carpool Program and Shuttle Bus Service**
    - i. \$41,054,429
3. Distribute inputs among identified REMI sectors.
- a. Charm City Circulator and Hampden Neighborhood Shuttle**
    - i. 2010—\$2,571,429
    - ii. 2011—\$4,699,548
    - iii. 2012—\$4,699,548
    - iv. 2013—\$4,699,548
    - v. 2014—\$4,699,548
    - vi. 2015—\$4,699,548
    - vii. 2016—\$4,699,548
    - viii. 2017—\$2,571,429
    - ix. 2018—\$2,571,429
    - x. 2019—\$2,571,429
    - xi. 2020—\$2,571,429
  - b. Locally Operated Transit Systems**
    - i. 2010—\$2,571,429
    - ii. 2011—\$4,699,548
    - iii. 2012—\$4,699,548
    - iv. 2013—\$4,699,548
    - v. 2014—\$4,699,548
    - vi. 2015—\$4,699,548
    - vii. 2016—\$4,699,548
    - viii. 2017—\$2,571,429
    - ix. 2018—\$2,571,429
    - x. 2019—\$2,571,429
    - xi. 2020—\$2,571,429
  - c. Smart Card Implementation**
    - i. 2010—\$2,571,429
    - ii. 2011—\$4,699,548
    - iii. 2012—\$4,699,548
    - iv. 2013—\$4,699,548
    - v. 2014—\$4,699,548
    - vi. 2015—\$4,699,548

- vii. 2016—\$4,699,548
- viii. 2017—\$2,571,429
- ix. 2018—\$2,571,429
- x. 2019—\$2,571,429
- xi. 2020—\$2,571,429

**d. Transit Oriented Development**

- i. 2010—\$2,571,429
- ii. 2011—\$4,699,548
- iii. 2012—\$4,699,548
- iv. 2013—\$4,699,548
- v. 2014—\$4,699,548
- vi. 2015—\$4,699,548
- vii. 2016—\$4,699,548
- viii. 2017—\$2,571,429
- ix. 2018—\$2,571,429
- x. 2019—\$2,571,429
- xi. 2020—\$2,571,429

**e. Maryland Commuter Tax Credit**

- i. 2010—\$2,571,429
- ii. 2011—\$4,699,548
- iii. 2012—\$4,699,548
- iv. 2013—\$4,699,548
- v. 2014—\$4,699,548
- vi. 2015—\$4,699,548
- vii. 2016—\$4,699,548
- viii. 2017—\$2,571,429
- ix. 2018—\$2,571,429
- x. 2019—\$2,571,429
- xi. 2020—\$2,571,429

**f. Guaranteed Ride Home**

- i. 2010—\$2,571,429
- ii. 2011—\$4,699,548
- iii. 2012—\$4,699,548
- iv. 2013—\$4,699,548
- v. 2014—\$4,699,548
- vi. 2015—\$4,699,548
- vii. 2016—\$4,699,548
- viii. 2017—\$2,571,429
- ix. 2018—\$2,571,429
- x. 2019—\$2,571,429
- xi. 2020—\$2,571,429

**g. College Pass**

- i. 2010—\$2,571,429
- ii. 2011—\$4,699,548
- iii. 2012—\$4,699,548

- iv. 2013—\$4,699,548
- v. 2014—\$4,699,548
- vi. 2015—\$4,699,548
- vii. 2016—\$4,699,548
- viii. 2017—\$2,571,429
- ix. 2018—\$2,571,429
- x. 2019—\$2,571,429
- xi. 2020—\$2,571,429

**h. Ride Share**

- i. 2010—\$2,571,429
- ii. 2011—\$4,699,548
- iii. 2012—\$4,699,548
- iv. 2013—\$4,699,548
- v. 2014—\$4,699,548
- vi. 2015—\$4,699,548
- vii. 2016—\$4,699,548
- viii. 2017—\$2,571,429
- ix. 2018—\$2,571,429
- x. 2019—\$2,571,429
- xi. 2020—\$2,571,429

**i. Commuter Connections—Washington, D.C. Region**

- i. 2010—\$2,571,429
- ii. 2011—\$4,699,548
- iii. 2012—\$4,699,548
- iv. 2013—\$4,699,548
- v. 2014—\$4,699,548
- vi. 2015—\$4,699,548
- vii. 2016—\$4,699,548
- viii. 2017—\$2,571,429
- ix. 2018—\$2,571,429
- x. 2019—\$2,571,429
- xi. 2020—\$2,571,429

**j. Baltimore Collegetown Network**

- i. 2010—\$2,571,429
- ii. 2011—\$4,699,548
- iii. 2012—\$4,699,548
- iv. 2013—\$4,699,548
- v. 2014—\$4,699,548
- vi. 2015—\$4,699,548
- vii. 2016—\$4,699,548
- viii. 2017—\$2,571,429
- ix. 2018—\$2,571,429
- x. 2019—\$2,571,429
- xi. 2020—\$2,571,429

**k. Hunt Valley Shuttle**

- i. 2010—\$2,571,429
- ii. 2011—\$4,699,548
- iii. 2012—\$4,699,548
- iv. 2013—\$4,699,548
- v. 2014—\$4,699,548
- vi. 2015—\$4,699,548
- vii. 2016—\$4,699,548
- viii. 2017—\$2,571,429
- ix. 2018—\$2,571,429
- x. 2019—\$2,571,429
- xi. 2020—\$2,571,429

**l. Kent Street Transit Plaza**

- i. 2010—\$2,571,429
- ii. 2011—\$4,699,548
- iii. 2012—\$4,699,548
- iv. 2013—\$4,699,548
- v. 2014—\$4,699,548
- vi. 2015—\$4,699,548
- vii. 2016—\$4,699,548
- viii. 2017—\$2,571,429
- ix. 2018—\$2,571,429
- x. 2019—\$2,571,429
- xi. 2020—\$2,571,429

**m. University of Maryland College Park Carpool Program and Shuttle Bus Service**

- i. 2010—\$2,571,429
- ii. 2011—\$4,699,548
- iii. 2012—\$4,699,548
- iv. 2013—\$4,699,548
- v. 2014—\$4,699,548
- vi. 2015—\$4,699,548
- vii. 2016—\$4,699,548
- viii. 2017—\$2,571,429
- ix. 2018—\$2,571,429
- x. 2019—\$2,571,429
- xi. 2020—\$2,571,429

4. Input investment by sector into REMI model and run impacts.

5. Export impacts and analyze.

**Operation Phase**

2. Determine relevant REMI sectors.

**a. Charm City Circulator and Hampden Neighborhood Shuttle**

- i. 623—Consumer Spending—Gasoline and oil
- ii. 78—Consumption Reallocation—All Consumption Categories

Regional Economic  
Studies Institute

- iii. 651—Consumer Spending—Intercity bus
- iv. 603—Consumer Spending—Other motor vehicles
- v. 648—Consumer Spending—Auto insurance less claims paid
- b. Locally Operated Transit Systems**
  - i. 623—Consumer Spending—Gasoline and oil
  - ii. 78—Consumption Reallocation—All Consumption Categories
  - iii. 651—Consumer Spending—Intercity bus
  - iv. 603—Consumer Spending—Other motor vehicles
  - v. 648—Consumer Spending—Auto insurance less claims paid
- c. Smart Card Implementation**
  - i. 673—Consumer Spending—Bank service charges, trust services, and safe deposit box rentals
  - ii. 78—Consumption Reallocation—All Consumption Categories
- d. Transit Oriented Development**
  - i. 623—Consumer Spending—Gasoline and oil
  - ii. 78—Consumption Reallocation—All Consumption Categories
- e. Maryland Commuter Tax Credit**
  - i. 63—State Government Spending
- f. Guaranteed Ride Home**
  - i. 653—Consumer Spending—Taxicabs
  - ii. 78—Consumption Reallocation—All Consumption Categories
  - iii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
- g. College Pass**
  - i. 623—Consumer Spending—Gasoline and oil
  - ii. 78—Consumption Reallocation—All Consumption Categories
  - iii. 651—Consumer Spending—Intercity bus
- h. Ride Share**
  - i. 623—Consumer Spending—Gasoline and oil
  - ii. 78—Consumption Reallocation—All Consumption Categories
  - iii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
- i. Commuter Connections—Washington, D.C. Region**
  - i. 623—Consumer Spending—Gasoline and oil
  - ii. 78—Consumption Reallocation—All Consumption Categories
- j. Baltimore Collegetown Network**
  - i. 623—Consumer Spending—Gasoline and oil
  - ii. 78—Consumption Reallocation—All Consumption Categories
- k. Hunt Valley Shuttle**
  - i. 623—Consumer Spending—Gasoline and oil
  - ii. 78—Consumption Reallocation—All Consumption Categories
- l. Kent Street Transit Plaza**
  - i. 623—Consumer Spending—Gasoline and oil
  - ii. 78—Consumption Reallocation—All Consumption Categories
  - iii. 651—Consumer Spending—Intercity bus
  - iv. 648—Consumer Spending—Auto insurance less claims paid

- m. University of Maryland College Park Carpool Program and Shuttle Bus Service**
  - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - ii. 623—Consumer Spending—Gasoline and oil
  - iii. 78—Consumption Reallocation—All Consumption Categories
  - iv. 63—State Government Spending
- 3. Determine part of program to be affected by savings (from strategy write-up).
  - a. Charm City Circulator and Hampden Neighborhood Shuttle**
  - b. Locally Operated Transit Systems**
  - c. Smart Card Implementation**
  - d. Transit Oriented Development**
  - e. Maryland Commuter Tax Credit**
  - f. Guaranteed Ride Home**
  - g. College Pass**
  - h. Ride Share**
  - i. Commuter Connections—Washington, D.C. Region**
    - i. Number using the commuter Connections Page<sup>58</sup>—20,000
    - ii. Total Commuting to Work—20,000
  - j. Baltimore Collegetown Network**
  - k. Hunt Valley Shuttle**
  - l. Kent Street Transit Plaza**
  - m. University of Maryland College Park Carpool Program and Shuttle Bus Service**
- 4. Research savings data for each policy according to part of program to be affected by savings.
  - a. Charm City Circulator and Hampden Neighborhood Shuttle**
    - i. Hampden Neighborhood Shuttle<sup>59</sup>**
      - 1. Riders per Day—250
      - 2. Operating Days per Year—260
      - 3. Average Trip Length in Miles—2
      - 4. One Way Fare—\$1.00 (\$0.50 for Seniors)
      - 5. Reduction in CO<sub>2</sub>e in 2020 in mmt—0.0001
    - ii. Charm City Circulator<sup>60</sup>**
      - 1. Average Daily Ridership—11,955
    - iii. Passenger Trips—69,315,249**

<sup>58</sup> Civilian Labor Force, Employment & Unemployment by Place of Residence (LAUS) - Maryland - Division of Workforce Development and Adult Learning. Welcome to the Maryland Department of Labor, Licensing and Regulation. Maryland Department of Labor, Licensing and Regulation, 21 Oct. 2011. Web. 14 Nov. 2011. <<http://www.dlrr.state.md.us/lmi/laus/maryland.shtml>>.

<sup>59</sup> O'Malley, Martin, Anthony Brown, and Beverly Swaim-Staley. Maryland Department of Transportation, "Maryland Climate Action Plan." Last modified 2012. Accessed October 2012. [http://www.mdot.maryland.gov/Office of Planning and Capital Programming/Plans\\_Programs\\_Reports/Documents/Climate\\_Change\\_2011\\_Appendix.pdf](http://www.mdot.maryland.gov/Office of Planning and Capital Programming/Plans_Programs_Reports/Documents/Climate_Change_2011_Appendix.pdf).

<sup>60</sup> Baltimore City Department of Transportation, "Month of October Ridership Stats." Last modified 2012. <http://www.charmcitycirculator.org/news/2012/nov/month-october-ridership-stats>.

- iv. Number of Buses—698
- v. Bus Fare—1.06
- vi. Miles Traveled Annually by all Buses—22,414,441
- vii. Average Annual Passengers—2,633,760
- b. Locally Operated Transit Systems**
  - i. Passenger Trips—69,315,249
  - ii. Number of Buses—698
  - iii. Bus Fare—\$1.06
- c. Smart Card Implementation**
  - i. Number of Boardings (Rail)—71,311
  - ii. Number of Boardings (Bus)—231,795
  - iii. Percentage Rail—75%
  - iv. Percentage Bus—60%
  - v. Average ATM fee—\$2.40
  - vi. Average Fare—\$1.60
- d. Transit Oriented Development**
  - i. Number of Properties—6
  - ii. Potential Savings per Person—\$9,087
  - iii. Potential Parking—1,245.33
- e. Maryland Commuter Tax Credit**
  - i. Number of Firms—18
  - ii. Number of Employees—950
  - iii. Average Tax Credit per Employee—\$52.50
- f. Guaranteed Ride Home**
  - i. Mean Cost Per Claim<sup>61</sup>—\$36.95
  - ii. Cost of Cab<sup>62</sup>—\$161.80
  - iii. Number of Commuters in Baltimore—8,650.71
- g. College Pass**
  - i. Cost of Monthly Pass—\$64.00
  - ii. Cost to College Students—\$39.00
  - iii. Number of College Students in Collegetown Network—120,000
  - iv. Reduction in CO<sub>2</sub>e—0.0029 mmt CO<sub>2</sub>e
- h. Ride Share**
  - i. Average Daily Miles VMT<sup>63</sup>—\$28.97
  - ii. Cost of Gas—\$3.61
  - iii. Avg. MPG—27 mpg
  - iv. Number of those employed in MD<sup>64</sup>—2,771,833

<sup>61</sup> Menczer, William B. Journal of Public Transportation. 4th ed. Vol. 10. Ser. 2007. Guaranteed Ride Home Programs. Federal Transportation Administration. Web. 14 Nov. 2011. <<http://www.nctr.usf.edu/jpt/pdf/JPT%2010-4%20Menczer.pdf>>.

<sup>62</sup> Taxi Fares in Major U.S. Cities. Schaller Consulting Home Page. Schaller Consulting, Jan. 2006. Web. 14 Nov. 2011. <<http://www.schallerconsult.com/taxi/fares1.htm>>.

<sup>63</sup> 2009 National Household Travel. National Household Travel Survey. U.S. Department of Transportation, 2009. Web. 14 Nov. 2011. <<http://nhts.ornl.gov/2009/pub/stt.pdf>>.

- v. Reduction in CO<sub>2</sub>e—0.0207 mmt CO<sub>2</sub>e<sup>65</sup>
- i. Commuter Connections—Washington, D.C. Region**
  - i. Average Daily Miles VMT<sup>66</sup>—\$28.97
  - ii. Cost of Gas—\$3.61
  - iii. Avg. MPG—27
- j. Baltimore Collegetown Network**
  - i. Total Students—74,000
  - ii. Number of Buses—698
  - iii. Bus Fare—\$1.06
  - iv. Miles traveled annually by All Buses<sup>67</sup>—14
  - v. Average Annual Passengers—74,000
- k. Hunt Valley Shuttle**
  - i. Insurance Premium—\$922
  - ii. Travel Distance from York to Hunt Valley—37.1
  - iii. Avg. MPG—27
  - iv. Cost of Gas—\$3.61
  - v. Time—1
  - vi. One Month Pass<sup>68</sup>—\$136.00
  - vii. Time—2
  - viii. Total One Way Ridership<sup>69</sup>—17,333
- l. Kent Street Transit Plaza**
  - i. Cost of Monthly Pass<sup>70</sup>—\$64
  - ii. Cost of Gas—\$3.61
  - iii. Length of Track—15.5 miles
  - iv. Average Annual Ridership—8,650.71
  - v. Average Cost of Gas—\$3.61
  - vi. Average MPG—27
  - vii. Annual Congestion Cost—\$713
  - viii. Average Cost of Insurance<sup>71</sup>—\$922

<sup>64</sup> Civilian Labor Force, Employment & Unemployment by Place of Residence (LAUS) - Maryland - Division of Workforce Development and Adult Learning. Welcome to the Maryland Department of Labor, Licensing and Regulation. Maryland Department of Labor, Licensing and Regulation, 21 Oct. 2011. Web. 14 Nov. 2011. <<http://www.dllr.state.md.us/lmi/laus/maryland.shtml>>.

<sup>65</sup> O'Malley, Martin, Anthony Brown, and Beverly Swaim-Staley. Maryland Department of Transportation, "Maryland Climate Action Plan." Last modified 2012. Accessed October 2012. [http://www.mdot.maryland.gov/Office of Planning and Capital Programming/Plans\\_Programs\\_Reports/Documents/Climate\\_Change\\_2011\\_Appendix.pdf](http://www.mdot.maryland.gov/Office of Planning and Capital Programming/Plans_Programs_Reports/Documents/Climate_Change_2011_Appendix.pdf).

<sup>66</sup> 2009 National Household Travel. National Household Travel Survey. U.S. Department of Transportation, 2009. Web. 14 Nov. 2011. <<http://nhts.ornl.gov/2009/pub/stt.pdf>>.

<sup>67</sup> Colleges - Miles and Minutes. 2011. Baltimore Collegetown Network. 14 Nov. 2011 <<http://www.baltimorecollegetown.org/colleges/miles-and-minutes/>>.

<sup>68</sup> RabbitEXPRESS – Fares and Accommodations. Rabbitransit - Welcome! York County Transportation Authority, 2011. Web. 14 Nov. 2011. <<http://www.rabbitransit.org/express/pages/cashfarechart.html>>.

<sup>69</sup> 2010 Annual Report. Rabbitransit-Welcome. Rabbitransit, 2011. Web. 14 Nov. 2011. <[http://www.rabbitransit.org/docs/2010\\_Annual\\_Report.pdf](http://www.rabbitransit.org/docs/2010_Annual_Report.pdf)>.

<sup>70</sup> Regular Fares | Maryland Transit Administration. Home | Maryland Transit Administration. Maryland Transit Administration, 14 Nov. 2011. Web. 14 Nov. 2011. <<http://mta.maryland.gov/regular-fares>>.

**m. University of Maryland College Park Carpool Program and Shuttle Bus Service**

- i. Number of Annual Riders<sup>72</sup>—2,967,164
  - ii. Cost of Shuttle—\$0.00
  - iii. Parking Spots<sup>73</sup>—19,270
  - iv. Number of Permits<sup>74</sup>—17,906
  - v. Revenue from Permit Sales<sup>75</sup>—\$8,030,897.00
  - vi. Annual Citations<sup>76</sup>—72,546
  - vii. Annual Revenue from Citations—\$1,862,333.00
  - viii. Total Enrollment—37,631
  - ix. Total Employment—13,081
  - x. Total Residing On Campus<sup>77</sup>—8,363
  - xi. Commuter Student Permit Price—\$217.00
5. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).

**a. Charm City Circulator and Hampden Neighborhood Shuttle**

- i. 65,000 [250 Daily Riders \* 260 Operating Days]=Total Rides Per Year
- ii. 651—Consumer Spending—All Categories—\$48,750 [Total Rides per Year \* \$0.75 Fare (assume half of riders are seniors)]=Total Fare Revenue Per Year for Hampden Shuttle from (applied from years 2010 to 2020)
- iii. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Categories—\$40,582.15 [0.001 mmt CO<sub>2</sub>e \* 405,821,147.4 (conversion factor<sup>78</sup>)]=Fuel Savings from CO<sub>2</sub>e Reduction from Hampden Shuttle
- iv. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Categories—\$7,579,812.60 [11,955 Daily Riders \* 365 \* (1/27 Avg. MPG) \* \$3.61 per Gallon of Gas = Dollars of Fuel Saved by Riders of Charm City Circulator
- v. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Categories—\$276,131.58 [11,955 Daily Riders \* 365 \* 2 minutes Idle Time per Trip (saved) \* 0.03164 (conversion

<sup>71</sup> Auto Insurance. Insurance Information Institute. U.S. Department of Labor, Bureau of Labor Statistics; National Association of Realtors, 2011. Web. 11 Nov. 2011. <<http://www.iii.org/media/facts/statsbyissue/auto/>>.

<sup>72</sup> Departmental Mission Statement. Department of Transportation. University of Maryland, 2011. Web. 14 Nov. 2011. <<http://www.transportation.umd.edu/images/about/pdfs/ANNUAL%20REPORT%20FY%2011.pdf>>.

<sup>73</sup> Ibid.

<sup>74</sup> Ibid.

<sup>75</sup> Ibid.

<sup>76</sup> Ibid.

<sup>77</sup> Residence Halls at a Glance. Department of Resident Life | University of Maryland, College Park. Department of Resident Life | University of Maryland, College Park, 2011. Web. 14 Nov. 2011. <<http://www.resnet.umd.edu/hallsatglance/>>.

<sup>78</sup> Environmental Protection Agency, "Greenhouse Gas Equivalencies Calculator." Last modified 2012. Accessed October 2012. <http://www.epa.gov/cleanenergy/energy-resources/calculator.html>.

factor<sup>79</sup>)]:=Value of Fuel Saved from Avoided Idle Time by Charm City Circulator Users

- vi. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Categories—\$1,981,063.05 [11,955 Daily Riders \* 365 \* \$0.454 Non-Fuel Driving Cost Per Mile (savings)]:=Total Non-Fuel Driving Cost Savings

**b. Locally Operated Transit Systems**

- i. 99,306 [(69,315,249 Passenger Trips / 698 Number of Buses)]=Total Average per Bus
- ii. 651—Consumer Spending—Intercity bus—\$5,157,928.41 [(99,306 Total Average per Bus \* \$1.06 Bus Fare \* 49)]=Total Yearly Fare Revenue from 2010 to 2020

**c. Smart Card Implementation**

- i. 171,146.40 [((71,311 Number of Rail Boardings \* 0.75) \* (\$1.60 Average Fare \* 2))]=Total Annual Boards (Rail/Smart Card)
- ii. 445,046.40 [((231,795 Number of Bus Boardings \* 0.60) \* (\$1.60 Average Fare \* 2))]=Total Annual Boards (Bus/Smart Card)
- iii. \$410,751.36 [((71,311 Number of Rail Boardings \* 0.75) \* (\$1.60 Average Fare \* 2) \* \$2.40 Average ATM fee)]=Total Annual Boards (Rail)
- iv. \$1,068,111.36 [((231,795 Number of Bus Boardings \* 0.60) \* (\$1.60 Average Fare \* 2) \* \$2.40 Average ATM fee)]=Total Annual Boards (Bus)
- v. \$239,604.96 [(\$410,751.36 Total Annual Boards (Rail) - \$171,146.40 Total Annual Boards (Rail/Smart Card))]=Annual Savings for Rail
- vi. \$623,064.96 [(\$1,068,111.36 Total Annual Boards (Bus) - \$445,046.40 Total Annual Boards (Bus/Smart Card))]=Annual Savings for Bus
- vii. \$862,669.92 [(\$239,604.96 Annual Savings for Rail + \$623,064.96 Annual Savings for Bus)]=Total Annual Savings
- viii. 673—Consumer Spending—Bank service charges, trust services, and safe deposit box rentals, 78—Consumption Reallocation—All Consumption Categories—  
\$862,669.92 [(\$239,604.96 Annual Savings for Rail + \$623,064.96 Annual Savings for Bus)]=Total Annual Savings per Year from 2010 to 2020

**d. Transit Oriented Development**

- i. \$11,316,344.00 [(\$9,087 Potential Savings per Person \* 1,245.33 Potential Parking)]=Total Potential Savings
- ii. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$11,316,344.00 [(\$9,087

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<sup>79</sup> O'Malley, Martin, Anthony Brown, and Beverly Swaim-Staley. Maryland Department of Transportation, "Maryland Climate Action Plan." Last modified 2012. Accessed October 2012. [http://www.mdot.maryland.gov/Office of Planning and Capital Programming/Plans\\_Programs\\_Reports/Documents/Climate\\_Change\\_2011\\_Appendix.pdf](http://www.mdot.maryland.gov/Office of Planning and Capital Programming/Plans_Programs_Reports/Documents/Climate_Change_2011_Appendix.pdf).

Potential Savings per Person \* 1,245.33 Potential Parking)] = Total Potential Savings per Year from 2010 to 2020

**e. Maryland Commuter Tax Credit**

- i.  $\$598,500.00 [(950 \text{ Number of Employees} * 52.5 \text{ Average Tax per Employee} * 12)] = \text{Total of tax credits}$
- ii.  $63 - \text{State Government Spending} - \$598,500.00 [(950 \text{ Number of Employees} * 52.5 \text{ Average Tax per Employee} * 12)] = \text{Total Value of Tax Credits per Year for the years 2010 to 2020}$

**f. Guaranteed Ride Home**

- i.  $\$124.85 [(\%161.80 \text{ Cost of Cab} - \$36.95 \text{ Mean Cost Per Claim})] = \text{Savings}$
- ii.  $\$1,080,041.06 [(8650.71 \text{ Number of Commuters in Baltimore} * \$124.85 \text{ Savings})] = \text{Savings to Commuters}$
- iii.  $653 - \text{Consumer Spending} - \text{Taxicabs}, 78 - \text{Consumption Reallocation} - \text{All Consumption Categories} - 63 - \text{State Government Spending} - \$1,080,041.06 [(8650.71 \text{ Number of Commuters in Baltimore} * \$124.85 \text{ Savings})] = \text{Savings to Commuters per Year from 2010 to 2020}$

**g. College Pass**

- i.  $623 - \text{Consumer Spending} - \text{Gasoline and oil}, 78 - \text{Consumption Reallocation} - \text{All Consumption Categories} - \$1,176,881.33 [0.0029 \text{ mmt CO}_2\text{e} * \text{Conversion Factor}^{80}] = \text{Fuel Savings to Consumers from Reduced Idling Time per Year from 2011 to 2020}$
- ii.  $63 - \text{State Government Spending} - \$36,000,000 [(120,000 \text{ Number of College Students in Collegetown Network} * 12 * (\$64.00 - \$39.00) \text{ Subsidized Cost of a Monthly Pass})] = \text{Investment in College Pass per Year from 2010 to 2020}$
- iii.  $651 - \text{Consumer Spending} - \text{Intercity bus} - \$4,468,000.00 [(120,000 \text{ Number of College Students in Collegetown Network} * \$39.00 \text{ Cost of a College Students})] = \text{Increase in Fare Revenue Associated With College Pass}$
- iv.  $\$7,680,000.00 [(120,000 \text{ Number of College Students in Collegetown Network} * \$64.00 \text{ Cost of a Monthly Pass})] = \text{Value of Monthly Passes Before Subsidy}$
- v.  $651 - \text{Consumer Spending} - \text{Intercity} - \text{bus} - \$4,468,000.00 [(120,000 \text{ Number of College Students in Collegetown Network} * \$39.00 \text{ Cost of a College Students})] = \text{Value of Monthly Passes After Subsidy}$
- vi.  $\$3,000,000.00 [(\$7,680,000.00 - \$4,468,000.00)] = \text{Total Monthly Value of Subsidy}$
- vii.  $78 - \text{Consumption Reallocation} - \text{All Consumption Categories} - \$36,000,000 [(\$7,680,000.00 - \$4,468,000.00) * 12] = \text{Yearly Value of Subsidy from 2011 to 2020}$

<sup>80</sup> Environmental Protection Agency, "Greenhouse Gas Equivalencies Calculator." Last modified 2012. Accessed October 2012. <http://www.epa.gov/cleanenergy/energy-resources/calculator.html>.

**h. Ride Share**

- i.  $623 - \text{Consumer Spending—Gasoline and oil, } 78 - \text{Consumption Reallocation—All Consumption Categories—} \$24,552,178.61 [0.0605 \text{ mmt CO}_2\text{e} * \text{Conversion Factor}] = \text{Fuel Savings from CO}_2\text{e Reduction in 2020}$
- ii.  $63 - \text{State Government Spending—} \$720,833.33 [\$4,324,999.98 \text{ Total Cost of Implementation in Operations Phase}] = \text{Yearly Cost of Implementation from 2011 to 2016}$

**i. Commuter Connections—Washington, D.C. Region**

- i.  $1.07 [(28.97 \text{ Average Daily Miles VMT} / 27 \text{ Avg. MPG})] = \text{Gallons Used Daily}$
- ii.  $\$3.86 [(1.07 \text{ Gallons Used Daily} * \$3.61 \text{ Cost of Gas})] = \text{Price to Travel Daily}$
- iii.  $\$77,205.85 [(20,000 \text{ Total Commuting to Work} * \$3.86 \text{ Price to Travel Daily})] = \text{Total Cost to Those Commuting by Car}$
- iv.  $\$38,602.93 [(\$77,205.85 \text{ Total Cost to Those Commuting by Car} / 2)] = \text{Price of Gas per Car, if carpooling 2 to a car}$
- v.  $623 - \text{Consumer Spending—Gasoline and oil, } 78 - \text{Consumption Reallocation—All Consumption Categories—} \$38,602.93 [(\$77,205.85 \text{ Total Cost to Those Commuting by Car} - \$38,602.93 \text{ Price of Gas per Car, if carpooling 2 to a car})] = \text{Savings per Year from 2010 to 2020}$

**j. Baltimore Collegetown Network**

- i.  $106 [(74,000 \text{ Total Students} / 698 \text{ Number of Buses})] = \text{Total Average per Bus}$
- ii.  $\$5,506.53 [(106 \text{ Total Average per Bus} * \$1.06 \text{ Bus Fare} * 49)] = \text{Total Average Bus Fare}$
- iii.  $4,140 [((14 \text{ Miles traveled annually by All Buses} * 2) * 150)] = \text{Average Miles Traveled by all Buses}$
- iv.  $153 [(4,140 \text{ Average Miles Traveled by all Buses} / 27)] = \text{Average Gallons Used}$
- v.  $\$553.26 [(153 \text{ Average Gallons Used} * \$3.61)] = \text{Average Cost of Sedan}$
- vi.  $623 - \text{Consumer Spending—Gasoline and oil, } 78 - \text{Consumption Reallocation—All Consumption Categories—} \$40,941,240 [(74,000 \text{ Average Annual Passengers} * 526 \text{ Average Cost of Sedan})] = \text{Average Savings to College Students}$

**k. Hunt Valley Shuttle**

- i.  $\$2.75 [((37.1 \text{ Travel Distance from York to Hunt Valley} * 2) / 27 \text{ Avg. MPG})] = \text{Total Cost on Trip Up and Back}$
- ii.  $\$9.43 [(\$2.75 \text{ Total Cost on Trip Up and Back} * \$3.61 \text{ Cost of Gas})] = \text{Total Cost on Trip}$
- iii.  $\$4,296.56 [((\$9.43 \text{ Total Cost on Trip} * (365 - 7)) + \$922 \text{ Insurance Premium})] = \text{Annual Cost to Travel by Car}$
- iv.  $7.25 [(2 - 1) * 7.25] = \text{Time Value}$
- v.  $\$4,227.50 [((136 * 12 \text{ months}) + (7.25 \text{ Time Value} * (365 - 7)))] = \text{Annual Cost to Travel by Bus}$

- vi.  $\$69.06 [(\$4,296.56 \text{ Annual Cost to Travel by Car} - \$4,227.50 \text{ Annual Cost to Travel by Bus})]=\text{Savings}$
- vii.  $34,666 [(17,333 \text{ Total One Way Ridership} * 2)]=\text{Both Way Assumption}$
- viii.  $11,555.33 [(34,666 \text{ Both Way Assumption} / 3)]=\text{Three Routes}$
- ix.  $11,555.33 [(34,666 \text{ Both Way Assumption} / 3)]=\text{Avg. Rider for 83S Route}$
- x.  $\$798,023.30 [(11,555.33 \text{ Avg. Rider for 83S Route} * \$69.06 \text{ Savings})]=\text{Total Savings}$
- xi.  $623-\text{Consumer Spending}-\text{Gasoline and oil}, 78-\text{Consumption Reallocation}-\text{All Consumption Categories}-\$829,911.87 [(11,555.33 \text{ Avg. Rider for 83S Route} * \$69.06 \text{ Savings})]=\text{Total Savings}$

**l. Kent Street Transit Plaza**

- i.  $\$768 [(\$64 \text{ Cost of a Monthly Pass} * 12)]=\text{Cost of a Pass for a Year}$
- i.  $651-\text{Consumer Spending}-\text{Intercity bus}-\$6,643,745.28 [(\$768 \text{ Cost of a Pass for a Year} * 8,650.71 \text{ Riders per Year})]=\text{Total Fare Spending per Year from 2010 to 2020}$
- ii.  $617.91 [(8,650.71 \text{ Average Annual Ridership} / 14)]=\text{Per Station}$
- iii.  $0.57 [(15.5 \text{ Length of Track} / 27 \text{ Average MPG})]=\text{Average Gallons Needed to Travel per Day}$
- iv.  $\$751.06 [((0.57 \text{ Average Gallons Needed to Travel per Day} * \$3.61 \text{ Average Cost of Gas}) * 365)]=\text{Average Cost of Gas a Year}$
- v.  $623-\text{Consumer Spending}-\text{Gasoline and oil}, 78-\text{Consumption Reallocation}-\text{All Consumption Categories}-\$464,087.79 [(\$751.06 * 617.91)]=\text{Total Value of Fuel Savings per Year from 2010 to 2020}$
- vi.  $648-\text{Consumer Spending}-\text{Auto insurance less claims paid}, 78-\text{Consumption Reallocation}-\text{All Consumption Categories}-\$569,713.02 [(617.91 \text{ Riders} * \$922 \text{ Average Cost of Insurance})]=\text{Cost to Travel Annual from 2010 to 2020}$

**m. University of Maryland College Park Carpool Program and Shuttle Bus Service**

- i.  $\$448.50 [(\$8,030,897.00 \text{ Revenue from Permit Sales} / 17,906 \text{ Number of Permits})]=\text{Avg. Cost of Permit}$
- ii.  $\$25.67 [(\$1,862,333.00 \text{ Annual Revenue from Citations} / 72,546 \text{ Annual Citations})]=\text{Avg. Cost of Citation}$
- iii.  $\$474.17 [(\$448.50 \text{ Avg. Cost of Permit} + \$25.67 \text{ Avg. Cost of Citation})]=\text{Avg. Cost to Drive to Campus}$
- iv.  $50,712 [(37,631 \text{ Total Enrollment} + 13,081 \text{ Total Employment})]=\text{Total Population}$
- v.  $30,907.96 [(((2,967,164 / 12 \text{ months}) / 4 \text{ weeks}) / 2 \text{ times a day})]=\text{Total Riding Shuttle}$
- vi.  $19,804.04 [(50,712 \text{ Total Population} - 30,907.96 \text{ Total Riding Shuttle})]=\text{Total Not Riding Shuttle}$
- vii.  $29,268 [(8,363 \text{ Total Residing On Campus}-37,631 \text{ Total Enrollment})]=\text{Total Not On Campus}$
- viii.  $42,349 [(29,268 \text{ Total Not On Campus} + 13,081 \text{ Total Employment})]=\text{People Commuting}$

- ix. 24,443 [(42,349 People Commuting—17,906 Total Permit Holders)]=Non Permit Holders
  - x. \$5.42 [(132,455 / 24,443 Non Permit Holders)]=Total Meter Costs Per Non Holder
  - xi. \$76.19 [(\$1,862,333 Annual Revenue from Citations / 24,443 Non Permit Holders)]=Citation Costs Per Non Holder
  - xii. \$32.27 [(\$788,824 / 24,443 Non Permit Holders)]=Affiliate Costs for Non Permit
  - xiii. \$113.88 [(\$5.42 Total Meter Costs Per Non Holder + \$76.19 Citation Costs Per Non Holder + \$32.27 Affiliate Costs for Non Permit)]=Total Possible Cost to Non Permit Holder
  - xiv. \$6,351,156.00 [(\$217 Commuter Student Permit Price \* 29,268 Total Not on Campus)]=Total Cost to Commute
  - xv. \$3,175,578.00 [(\$6,351,156.00 Total Cost to Commute / 2)]=If Commuter Students Carpool, 2 to each car
  - xvi. 623—Consumer Spending—Gasoline and oil, 603—Consumer Spending—Other motor vehicles—\$3,175,578.00 [(\$6,351,156.00 Total Cost to Commute - \$3,175,578.00 If Commuter Students Carpool, 2 to each car)]=Savings
  - xvii. 623—Consumer Spending—Gasoline and oil—78—Consumption Reallocation—All Consumption Categories—\$73,562.96 [42,349 Commuters \* 0.5 (result of carpooling) \* 13 Avg. Commute Miles \* 2 Ways \* (1/27 Avg. MPG) \* \$3.61]= Value of Gasoline Savings to Commuters per Year from 2010 to 2020
6. Input savings by sector into REMI model and run impacts.
  7. Export impacts and analyze.

### 3.2.6 Initiatives to Double Ridership by 2020

#### Investment Phase

1. Determine relevant REMI sectors for each program under the policy.
  - a. **MARC East Baltimore Station**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - b. **Expanded Transit (Purple Line, Corridor Cities Transitway, Red Line)**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - c. **MARC Growth and Investment Plan**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **MARC East Baltimore Station**
    - i. \$11,974,417 per year from 2015—2020
  - b. **Expanded Transit (Purple Line, Corridor Cities Transitway, Red Line)**
    - i. \$290,900,000 per Year from 2011 - 2020



- iii. Length of Track—15.5
  - iv. Average Annual Ridership—8,650.71
  - v. Average cost of gas—\$3.61
  - vi. Average MPG—27
  - vii. Annual Congestion Cost—713
  - viii. Average Cost of Insurance<sup>84</sup>—922
  - ix. Red Line Weekly Ridership in 2030—57,000
  - x. Purple Line Annual Net Boardings in 2030—16,500,000
- c. **MARC Growth and Investment Plan**
- i. Number of Annual Passengers—8,095,577
  - ii. Number of Stations—40
  - iii. Added by 2035<sup>85</sup>—130,000
  - iv. Current Seats<sup>86</sup>—27,000
  - v. Miles Travel Annually—774,575,600
  - vi. Cost of Gas—\$3.61
  - vii. Average Per MPG—27
  - viii. Cost of Monthly Pass—\$349.00
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
- a. **Expanded Transit (Purple Line, Corridor Cities Transitway, Red Line)**
- i.  $652 \text{—Intercity Mass Transit—} \$25,467,681.50 \text{ [} \$22,376,891.33 \text{ Net Fare Revenue per Year for Red Line}^{87} \text{ from 2020—2025 + } \$3,090,790.17 \text{ Net Fare Revenue per Year for Purple Line}^{88} \text{ from 2020—2025]} = \text{Total Net Increase in Fare Revenue per Year 2020—2025}$
  - ii.  $\$3,090,790.17 \text{ [(} 45,851.65 \text{ Rides per Week in 2020 * } \$3.61 \text{ Gas Price * } 13 \text{ Average Miles per Vehicle Trip) / (} 1.34 \text{ Average Passengers per Trip * } 27 \text{ Average Miles per Gallon for Sedan)] = \text{Value of Fuel Saved by Purple Line Riders in 2020 (note: riders increase by 21,285 per year until 20205)}$
  - iii.  $\$4,143,935.03 \text{ [} 61,475 \text{ Riders per Week in 2020 * } \$3.61 \text{ Gas Price * } 13 \text{ Average Miles per Vehicle Trip) / (} 1.34 \text{ Average Passengers per Trip * } 27 \text{ Average Miles per Gallon for Sedan)] = \text{Value of Fuel Saved by Red Line Riders in 2020}$
  - iv.  $\$29,744,122.36 \text{ [} 441,251 \text{ Riders per Week in 2020 * } \$3.61 \text{ Gas Price * } 13 \text{ Average Miles per Vehicle Trip) / (} 1.34 \text{ Average Passengers per Trip *}$

<sup>84</sup> Auto Insurance. Insurance Information Institute. U.S. Department of Labor, Bureau of Labor Statistics; National Association of Realtors, 2011. Web. 11 Nov. 2011. <<http://www.iii.org/media/facts/statsbyissue/auto/>>.

<sup>85</sup> MARC Growth and Investment Plan. Maryland Transit Administration. Maryland Transit Administration, Sept. 2007. Web. 14 Nov. 2011. <<http://mta.maryland.gov/sites/default/files/marcplanfull.pdf>>.

<sup>86</sup> Ibid.

<sup>87</sup> Maryland Transit Administration, "Red Line Financial Plan Synopsis." Last modified 2012. Accessed October 2012. [http://www.baltimoreonline.com/images/stories/redline\\_documents/preliminary\\_engineering/04\\_financial\\_plan/01\\_Financial\\_Plan\\_Synopsis.pdf](http://www.baltimoreonline.com/images/stories/redline_documents/preliminary_engineering/04_financial_plan/01_Financial_Plan_Synopsis.pdf).

<sup>88</sup> Maryland Transit Administration, "Purple Line Financial Plan." Last modified 2012. Accessed October 2012. [http://dlslibrary.state.md.us/publications/JCR/2010/2010\\_61\(PL\).pdf](http://dlslibrary.state.md.us/publications/JCR/2010/2010_61(PL).pdf).

- 27 Average Miles per Gallon for Sedan)] = Value of Fuel Saved by MARC Riders in 2020
- v. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$36,978,847.56 [(\$3,090,790.17 Purple Line Fuel Savings + \$4,143,935.03 Red Line Fuel Savings + \$29,744,122.36 MARC Growth and Investment Plan)] = Total Fuel Savings in 2020
  - vi. 648—Consumer Spending—Auto insurance less claims paid, 78—Consumption Reallocation—All Consumption Categories—\$7,039,894.07 [(45,851.65 Rides per Week in 2020 \* 13 Average Miles per Vehicle Trip \* 52 Weeks \* \$0.23 Insurance Cost per Mile<sup>89</sup>) / (1.34 Average Passengers per Trip)] = Value of Insurance Saved by Purple Line Riders in 2020 (note: riders increase by 21,285 per year until 2025)
  - vii. 648—Consumer Spending—Auto insurance less claims paid, 78—Consumption Reallocation—All Consumption Categories—\$5,250,766.53 [(61,475 Rides per Week in 2020 \* 13 Average Miles per Vehicle Trip \* 52 Weeks \* \$0.23 Insurance Cost per Mile<sup>90</sup>) / (1.34 Average Passengers per Trip)] = Value of Insurance Saved by Red Line Riders in 2020
  - viii. 648—Consumer Spending—Auto insurance less claims paid, 78—Consumption Reallocation—All Consumption Categories—\$50,531,198.49 [(441,251 Rides per Week in 2011 \* 13 Average Miles per Vehicle Trip \* 52 Weeks \* \$0.23 Insurance Cost per Mile<sup>91</sup>) / (1.34 Average Passengers per Trip)] = Value of Insurance Saved by MARC Riders in 2011
  - ix. 603—Consumer Spending—Other motor vehicles, 78—Consumption Reallocation—All Consumption Categories—\$7,039,894.07 [(45,851.65 Rides per Week in 2020 \* 13 Average Miles per Vehicle Trip \* 52 Weeks \* \$0.23 Insurance Cost per Mile<sup>92</sup>) / (1.34 Average Passengers per Trip)] = Value of Driving (Less Insurance and Fuel) Saved by Purple Line Riders in 2020 (note: riders increase by 21,285 per year until 2025)
  - x. 603—Consumer Spending—Other motor vehicles, 78—Consumption Reallocation—All Consumption Categories—\$5,250,766.53 [(61,475 Rides per Week in 2020 \* 13 Average Miles per Vehicle Trip \* 52 Weeks \* \$0.23 Driving (Less Insurance and Fuel) Cost per Mile<sup>93</sup>) / (1.34 Average Passengers per Trip)] = Value of Driving (Less Insurance and Fuel) Saved by Red Line Riders in 2020
  - xi. 603—Consumer Spending—Other motor vehicles, 78—Consumption Reallocation—All Consumption Categories—\$50,531,198.49 [(441,251 Rides per Week in 2011 \* 13 Average Miles per Vehicle Trip \* 52 Weeks

<sup>89</sup> AAA Association Communication, "Your Driving Costs." Last modified 2012. Accessed October 2012. <http://newsroom.aaa.com/wp-content/uploads/2012/04/YourDrivingCosts2012.pdf>.

<sup>90</sup> Ibid.

<sup>91</sup> Ibid.

<sup>92</sup> Ibid.

<sup>93</sup> Ibid.

\*  $\$0.23 \text{ Driving (Less Insurance and Fuel) Cost per Mile}^{94} / (1.34 \text{ Average Passengers per Trip}) = \text{Value of Driving (Less Insurance and Fuel) Saved by MARC Riders in 2011}$

5. Input savings by sector into REMI model and run impacts.
6. Export impacts and analyze.

### 3.2.7 Intercity Transportation Initiatives

#### Investment Phase

1. Determine relevant REMI sectors for each program under the policy.
  - a. **MARC Station Parking Enhancements**
    - i. 63—State Government Spending
    - ii. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - b. **Refurbishing MARC and Other Rail Vehicles**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - c. **Update on Maryland High Speed Rail**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **MARC Station Parking Enhancements**
    - i. 63—\$4,385,158.50 in 2011
    - ii. 68—\$4,385,158.50 in 2011
    - iii. 63—\$4,530,541.50 per year 2012-2013
    - iv. 68—\$4,530,541.50 per year 2012-2013
    - v. 63—\$3,717,625 in 2014
    - vi. 68—\$3,717,625 in 2014
    - vii. 63—\$3,572,541.50 in 2014-2015
    - viii. 68—\$3,572,541.50 per year 2015-2016
  - b. **Refurbishing MARC and Other Rail Vehicles**
    - i. 63—\$4,385,158.50 in 2011
    - ii. 68—\$4,385,158.50 in 2011
    - iii. 63—\$4,530,541.50 per year 2012-2013
    - iv. 68—\$4,530,541.50 per year 2012-2013
    - v. 63—\$3,717,625 in 2014
    - vi. 68—\$3,717,625 in 2014
    - vii. 63—\$3,572,541.50 in 2014-2015
    - viii. 68—\$3,572,541.50 per year 2015-2016
  - c. **Update on Maryland High Speed Rail**
    - i. No funding specified
3. Input investment by sector into REMI model and run impacts.
4. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI sectors.

<sup>94</sup> AAA Association Communication, "Your Driving Costs." Last modified 2012. Accessed October 2012. <http://newsroom.aaa.com/wp-content/uploads/2012/04/YourDrivingCosts2012.pdf>.

- a. **MARC Station Parking Enhancements**
    - i. 652—Intercity Mass Transit
    - ii. 623—Consumer Spending—Gasoline and oil
    - iii. 648—Consumer Spending—Auto insurance less claims paid
    - iv. 603—Consumer Spending—Other motor vehicles
  - b. **Refurbishing MARC and Other Rail Vehicles**
    - i. 652—Intercity Mass Transit
    - ii. 623—Consumer Spending—Gasoline and oil
    - iii. 648—Consumer Spending—Auto insurance less claims paid
    - iv. 603—Consumer Spending—Other motor vehicles
  - c. **Update on Maryland High Speed Rail**
    - i. 652—Intercity Mass Transit
2. Determine part of program to be affected by savings (from strategy write-up).
- a. **MARC Station Parking Enhancements**
    - i. Phase I—428 new parking spaces
    - ii. Odenton station feasibility study—2,500 additional parking spaces
  - b. **Refurbishing MARC and Other Rail Vehicles**
    - i. 23 cars scheduled to be overhauled between FY 2005 and FY 2012
  - c. **Update on Maryland High Speed Rail**
    - i. \$9.4 million allocation to MDOT for high-speed stimulus to complete environmental and engineering work to replace BWI Station as of Sept. 2010
3. Research savings data for each policy according to part of program to be affected by savings.
- a. **MARC Station Parking Enhancements**
    - i. Average cost of monthly MARC pass<sup>95</sup>—\$349/month (Transit Link Card)
    - ii. Average cost savings of using public transit<sup>96</sup>—\$9,383/year for Baltimore City
    - iii. Average cost of MARC station parking<sup>97</sup>—\$6.39/day average (between 7 stations and not including outliers)
    - iv. Note about Transit Link Card data use: A Monthly Transit Link pass is used in the calculations of all rail passes. Often users of the MARC system traveling in and around the metropolitan region of Maryland/Washington, D.C. will wish to visit areas within the city which are accessible through walking or easy-to-navigate light rail systems. Instead of purchasing separate fares for each point of travel, most individuals prefer having one card designated for travel within the region. The cost benefit ranges from easy parking to less time spent searching for dollars to pay for extra fare

<sup>95</sup> MARC Train Service Order Form. CommuterDirect.com®. 2011. MARC. 14 Nov. 2011 <[https://www.commuterpage.com/orderforms/transitorders\\_v3.cfm?sysid=12](https://www.commuterpage.com/orderforms/transitorders_v3.cfm?sysid=12)>.

<sup>96</sup> "Riding Public Transit Saves Individuals \$9,242 Annually." APTA Homepage. 1 Dec. 2010. American Public Transportation Association (APTA). 14 Nov. 2011 <[http://www.apta.com/mediacenter/pressreleases/2010/Pages/100112\\_Transit\\_Savings.aspx](http://www.apta.com/mediacenter/pressreleases/2010/Pages/100112_Transit_Savings.aspx)>.

<sup>97</sup> MARC Parking Details | Maryland Transit Administration. Home | Maryland Transit Administration. Nov. 2011. Maryland Transit Administration (MTA). 14 Nov. 2011 <<http://mta.maryland.gov/marc-parking-details>>.

cards or to add value to existing fare cards. The average cost of monthly fares for MARC has been calculated using the transit link pass over a span of stations from Aberdeen to Washington, D.C.

**b. Refurbishing MARC and Other Rail Vehicles**

- i. Average cost of monthly MARC pass<sup>98</sup>—\$349/month (Transit Link Card)
- ii. Capacity of MARC train cars (single-level and bi-level)<sup>99</sup>—121 seats (average)
- iii. Note about Transit Link Card data use: A Monthly Transit Link pass is used in the calculations of all rail passes. Often users of the MARC system traveling in and around the metropolitan region of Maryland/Washington, D.C. will wish to visit areas within the city which are accessible through walking or easy-to-navigate light rail systems. Instead of purchasing separate fares for each point of travel, most individuals prefer having one card designated for travel within the region. The cost benefit ranges from easy parking to less time spent searching for dollars to pay for extra fare cards or to add value to existing fare cards. The average cost of monthly fares for MARC has been calculated using the transit link pass over a span of stations from Aberdeen to Washington, D.C.

**c. Update on Maryland High Speed Rail**

- i. Average cost of monthly MARC pass for BWI Rail Station between stations for Baltimore City and Washington, D.C.<sup>100</sup>—\$227/month (Transit Link Card)
- ii. Number of parking spots at BWI Rail Station<sup>101</sup>—3,187 spots
- iii. Cost of MARC station parking at BWI Rail Station<sup>102</sup>—\$9/day
- iv. Cost of BWI Garage (daily)<sup>103</sup>—\$12/day
- v. Note about Transit Link Card data use: A Monthly Transit Link pass is used in the calculations of all rail passes. Often users of the MARC system traveling in and around the metropolitan region of Maryland/Washington, D.C. will wish to visit areas within the city which are accessible through walking or easy-to-navigate light rail systems. Instead of purchasing separate fares for each point of travel, most individuals prefer having one card designated for travel within the region. The cost benefit ranges from easy parking to less time spent searching for dollars to pay for extra fare cards or to add value to existing fare cards. The average cost of fare for the

<sup>98</sup> MARC Train Service Order Form. CommuterDirect.com®. 2011. MARC. 14 Nov. 2011 <[https://www.commuterpage.com/orderforms/transitorders\\_v3.cfm?sysid=12](https://www.commuterpage.com/orderforms/transitorders_v3.cfm?sysid=12)>.

<sup>99</sup> Dresser, Michael. "New cars may ease MARC crowding - Baltimore Sun." Featured Articles From The Baltimore Sun. 20 Aug. 2008. The Baltimore Sun. 14 Nov. 2011 <[http://articles.baltimoresun.com/2008-08-20/news/0808190131\\_1\\_marc-new-cars-passenger-cars](http://articles.baltimoresun.com/2008-08-20/news/0808190131_1_marc-new-cars-passenger-cars)>.

<sup>100</sup> MARC Train Service Order Form. CommuterDirect.com®. 2011. MARC. 14 Nov. 2011 <[https://www.commuterpage.com/orderforms/transitorders\\_v3.cfm?sysid=12](https://www.commuterpage.com/orderforms/transitorders_v3.cfm?sysid=12)>.

<sup>101</sup> MARC Parking Details | Maryland Transit Administration. Home | Maryland Transit Administration. Nov. 2011. Maryland Transit Administration (MTA). 14 Nov. 2011 <<http://mta.maryland.gov/marc-parking-details>>.

<sup>102</sup> Ibid.

<sup>103</sup> Parking. Baltimore Washington International Thurgood Marshall Airport. 11 Nov. 2011. <<http://www.bwiairport.com/en/parking/information-rates/daily-garage>>.

BWI Rail Station has been calculated under the assumption that most tourists will travel from BWI to Baltimore and BWI to Washington, D.C.

4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).

**a. MARC Station Parking Enhancements**

- i. 652—Intercity Mass Transit—\$12,262,464 [(428 new Phase I parking spots + 2,500 new Odenton parking spots (assume 1 vehicle parked per day) \* \$349/month (assume all buy monthly pass) \* 12 months)]
- ii. 652—Intercity Mass Transit—\$6,829,120.80 [((2,500 new Odenton parking spots + 428 Phase I parking spots )(assume 1 vehicle parked per day) \* \$6.39/day on average (assume all park at station garage) \* 365 days)]=annual increase in revenue
- iii. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$3,712,871.82 [(2,928 Passengers \* 2 minutes idle per trip \* 2 trips per Day \* 365 trips per year \* \$0.032 conversion to \$)]=Value of Fuel Saved per Year by Passengers
- iv. 648—Consumer Spending—Auto insurance less claims paid, 78—Consumption Reallocation—All Consumption Categories \$6,307,585.44 [((2,928 passengers \* 365 days \* 2 trips \* 13 miles)/1.34 average persons per vehicle trip) \* \$0.304 Insurance per Mile]=Value of Insurance Saved by Passengers per Year from 2015—2020
- v. 603—Consumer Spending—Other motor vehicles, 78—Consumption Reallocation—All Consumption Categories \$6,307,585.44 [((2,928 passengers \* 365 days \* 2 trips \* 13 miles)/1.34 average persons per vehicle trip) \* \$0.304 driving cost per mile less insurance less fuel]=Value of Driving Cost (less fuel less insurance) Saved by Passengers per Year from 2015—2020

**b. Refurbishing MARC and Other Rail Vehicles**

- i. 652—Intercity Mass Transit—\$11,655,204 [(23 cars refurbished (assume still in use in addition to newer cars) \* 121 seats per car on average \* \$349/month (assume all buy monthly pass) \* 12 months]=annual increase in revenue per year from 2010—2020

**c. Update on Maryland High Speed Rail**

- i. 652—Intercity Mass Transit—\$16,138,968 [(3,187 spots at BWI Rail Station (assume 1 vehicle parked per day) \* \$227/month (assume all buy monthly pass) \* 12 months)] + [(3,187 spots at BWI Rail Station (assume 1 vehicle parked per day) \* \$9/day (assume all park at station) \* 260 days)] = annual increase in revenue
- ii. 652—Intercity Mass Transit—\$2,485,860 (3,187 spots at BWI Rail Station (assume 1 vehicle parked per day) \* \$3/day savings (comparing \$12/day and \$9/day parking fees) \* 260 days = annual savings for riders)

5. Input savings by sector into REMI model and run impacts.
6. Export impacts and analyze.

### 3.2.8 Bike and Pedestrian Initiatives

#### Investment Phase

1. Determine relevant REMI sectors for each program under the policy.
  - a. **Bicycle/Pedestrian Enhancements**
    - i. 68—Government Spending Non-Pecuniary (Amenity)
  - b. **Bike Racks on Buses, MARC, Subway, Light Rail**
    - i. 68—Government Spending Non-Pecuniary (Amenity)
  - c. **Construction of Bike Lanes and Bike Paths**
    - i. 68—Government Spending Non-Pecuniary (Amenity)
  - d. **East Coast Greenway**
    - i. 68—Government Spending Non-Pecuniary (Amenity)
  - e. **Bike Stations**
    - i. 68—Government Spending Non-Pecuniary (Amenity)
  - f. **Bike Rentals**
    - i. 68—Government Spending Non-Pecuniary (Amenity)
  - g. **Bike Racks**
    - i. 68—Government Spending Non-Pecuniary (Amenity)
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Bicycle/Pedestrian Enhancements**
    - ii. \$19,168,800 per year 2012-2016
  - h. **Bike Racks on Buses, MARC, Subway, Light Rail**
    - i. *No funding specified*
  - i. **Construction of Bike Lanes and Bike Paths**
    - i. *No funding specified*
  - j. **East Coast Greenway**
    - i. *No funding specified*
  - k. **Bike Stations**
    - i. \$32,081,600 in 2011
    - ii. \$26,787,930 per year 2012-2013
    - iii. \$24,743,270 in 2014
    - iv. \$23,201,600 in 2015
    - v. \$20,455,130 in 2016
    - vi. \$18,605,800 per year 2017-2020
  - l. **Bike Rentals**
    - i. \$32,081,600 in 2011
    - ii. \$26,787,930 per year 2012-2013
    - iii. \$24,743,270 in 2014
    - iv. \$23,201,600 in 2015
    - v. \$20,455,130 in 2016
    - vi. \$18,605,800 per year 2017-2020
  - m. **Bike Racks**
    - i. \$32,081,600 in 2011
    - ii. \$26,787,930 per year 2012-2013
    - iii. \$24,743,270 in 2014
    - iv. \$23,201,600 in 2015

- v. \$20,455,130 in 2016
- vi. \$18,605,800 per year 2017-2020
- 3. Input investment by sector into REMI model and run impacts.
- 4. Export impacts and analyze.

### Operation Phase

- 2. Determine relevant REMI sectors.
  - a. Bicycle/Pedestrian Enhancements**
    - i. 623—Consumer Spending—Gasoline and Oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
  - b. Bike Racks on Buses, MARC, Subway, Light Rail**
    - i. 623—Consumer Spending—Gasoline and Oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
  - c. Construction of Bike Lanes and Bike Paths**
    - i. 623—Consumer Spending—Gasoline and Oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
  - d. East Coast Greenway**
    - i. 623—Consumer Spending—Gasoline and Oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
  - e. Bike Stations**
    - i. 623—Consumer Spending—Gasoline and Oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
  - f. Bike Rentals**
    - i. 623—Consumer Spending—Gasoline and Oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
  - g. Bike Racks**
    - i. 623—Consumer Spending—Gasoline and Oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
- 3. Determine part of program to be affected by savings (from strategy write-up)<sup>104</sup>.
  - a. Bicycle/Pedestrian Enhancements**
    - i. Total reduction achieved by 2020—57.14 metric tons of Co2
    - ii. Annual reduction over 10 years (2011—2020)—5.71 metric tons of Co2
  - b. Bike Racks on Buses, MARC, Subway, Light Rail**
    - i. Total reduction achieved by 2020—57.14 metric tons of Co2
    - ii. Annual reduction over 10 years (2011—2020)—5.71 metric tons of Co2
  - c. Construction of Bike Lanes and Bike Paths**
    - i. Total reduction achieved by 2020—57.14 metric tons of Co2
    - ii. Annual reduction over 10 years (2011—2020)—5.71 metric tons of Co2
  - d. East Coast Greenway**
    - i. Total reduction achieved by 2020—57.14 metric tons of Co2

<sup>104</sup> O'Malley, Martin, Anthony Brown, and Beverly Swaim-Staley. Maryland Department of Transportation, "Maryland Climate Action Plan." Last modified 2012. Accessed October 2012. [http://www.mdot.maryland.gov/Office\\_of\\_Planning\\_and\\_Capital\\_Programming/Plans\\_Programs\\_Reports/Documents/Climate\\_Change\\_2011\\_Appendix.pdf](http://www.mdot.maryland.gov/Office_of_Planning_and_Capital_Programming/Plans_Programs_Reports/Documents/Climate_Change_2011_Appendix.pdf).

- ii. Annual reduction over 10 years (2011—2020)—5.71 metric tons of Co2
- e. Bike Stations**
  - i. Total reduction achieved by 2020—57.14 metric tons of Co2
  - ii. Annual reduction over 10 years (2011—2020)—5.71 metric tons of Co2
- f. Bike Rentals**
  - i. Total reduction achieved by 2020—57.14 metric tons of Co2
  - ii. Annual reduction over 10 years (2011—2020)—5.71 metric tons of Co2
- g. Bike Racks**
  - i. Total reduction achieved by 2020—57.14 metric tons of Co2
  - ii. Annual reduction over 10 years (2011—2020)—5.71 metric tons of Co2
- 4. Research savings data for each policy according to part of program to be affected by savings.
- 5. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. Bicycle/Pedestrian Enhancements**
    - i. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$16,232.85 [(400 metric tons CO2 \* (1/1,000,000) \* \$405,821,147 Conversion<sup>105</sup> to \$ Fuel)/10]=Value of Fuel Use Reductions in 2011 (note: Value of Fuel Use Reduction incrementally increases by \$16,232.85 per year until \$162,328 in 2020)
  - b. Bike Racks on Buses, MARC, Subway, Light Rail**
    - i. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$16,232.85 [(400 metric tons CO2 \* (1/1,000,000) \* \$405,821,147 Conversion to \$ Fuel)/10]=Value of Fuel Use Reductions in 2011 (note: Value of Fuel Use Reduction incrementally increases by \$16,232.85 per year until \$162,328 in 2020)
  - c. Construction of Bike Lanes and Bike Paths**
    - i. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$16,232.85 [(400 metric tons CO2 \* (1/1,000,000) \* \$405,821,147 Conversion to \$ Fuel)/10]=Value of Fuel Use Reductions in 2011 (note: Value of Fuel Use Reduction incrementally increases by \$16,232.85 per year until \$162,328 in 2020)
  - d. East Coast Greenway**
    - i. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$16,232.85 [(400 metric tons CO2 \* (1/1,000,000) \* \$405,821,147 Conversion to \$ Fuel)/10]=Value of Fuel Use Reductions in 2011 (note: Value of Fuel Use

<sup>105</sup> All Conversions : Environmental Protection Agency, "Greenhouse Gas Equivalencies Calculator." Last modified 2012. Accessed October 2012. <http://www.epa.gov/cleanenergy/energy-resources/calculator.html>.

Reduction incrementally increases by \$16,232.85 per year until \$162,328 in 2020)

- e. Bike Stations**
    - i. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$16,232.85 [(400 metric tons CO<sub>2</sub> \* (1/1,000,000) \* \$405,821,147 Conversion to \$ Fuel)/10]=Value of Fuel Use Reductions in 2011 (note: Value of Fuel Use Reduction incrementally increases by \$16,232.85 per year until \$162,328 in 2020)
  - f. Bike Rentals**
    - i. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$16,232.85 [(400 metric tons CO<sub>2</sub> \* (1/1,000,000) \* \$405,821,147 Conversion to \$ Fuel)/10]=Value of Fuel Use Reductions in 2011 (note: Value of Fuel Use Reduction incrementally increases by \$16,232.85 per year until \$162,328 in 2020)
  - g. Bike Racks**
    - i. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$16,232.85 [(400 metric tons CO<sub>2</sub> \* (1/1,000,000) \* \$405,821,147 Conversion to \$ Fuel)/10]=Value of Fuel Use Reductions in 2011 (note: Value of Fuel Use Reduction incrementally increases by \$16,232.85 per year until \$162,328 in 2020)
- 6. Input savings by sector into REMI model and run impacts.
  - 7. Export impacts and analyze.

### 3.2.9 Pricing Initiatives

#### Investment Phase

- 1. Determine relevant REMI sectors for each program under the policy.
  - a. Electronic Toll Collection**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - b. High Occupancy Toll Lanes**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - c. VMT Fees**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - d. Congestion Pricing and Managed Lanes**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - e. Parking Impact Fees**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - f. Employer Commute Incentives**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
- 2. Determine overall cost of policy implementation for each program under the policy.
  - a. Electronic Toll Collection**
    - i. \$15,004,210 per year 2011-2014

- b. **High Occupancy Toll Lanes**
    - i. \$15,004,210 per year 2011-2014
  - c. **VMT Fees**
    - i. \$15,004,210 per year 2011-2014
  - d. **Congestion Pricing and Managed Lanes**
    - i. \$15,004,210 per year 2011-2014
  - e. **Parking Impact Fees**
    - i. \$15,004,210 per year 2011-2014
  - f. **Employer Commute Incentives**
    - i. \$15,004,210 per year 2011-2014
3. Distribute inputs among identified REMI sectors.
  4. Input investment by sector into REMI model and run impacts.
  5. Export impacts and analyze.

### Operation Phase

2. Determine relevant REMI sectors.
  - a. **Electronic Toll Collection**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
  - b. **High Occupancy Toll Lanes**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
  - c. **VMT Fees**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
  - d. **Congestion Pricing and Managed Lanes**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
  - e. **Parking Impact Fees**
    - i. 652—Intercity Mass Transit
  - f. **Employer Commute Incentives**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
3. Determine part of program to be affected by savings (strategy write-up).
  - a. **Electronic Toll Collection**
  - b. **High Occupancy Toll Lanes**
  - c. **VMT Fees**
  - d. **Congestion Pricing and Managed Lanes**
  - e. **Parking Impact Fees**
  - f. **Employer Commute Incentives**
4. Research savings data for each policy according to part of program to be affected by savings.

**a. Electronic Toll Collection**

- i. Avg. Wait Time at Toll Booth Reduction<sup>106</sup>=2.5 minutes
- ii. Avg. Annual Commuters Passing Through Tolls<sup>107</sup>=153,800,000
- iii. Number of hours a year=8,765
- iv. Number of Tolls Booths in MD<sup>108</sup>=10
- v. Gas wasted in idle per year<sup>109</sup>=5,528,176.045
- vi. Assumed Price per Gallon of Gas=3.43

**b. High Occupancy Toll Lanes**

- i. Avg. Reduction in Time from HOT Lane<sup>110</sup>=2%
- ii. Current Congestion Time In MD (Total by Commuter Annually)<sup>111</sup>=34
- iii. Number of those employed in MD<sup>112</sup>=2,771,833
- iv. Assumed Price per Gallon of Gas =3.43
- v. Gas wasted in idle per minute Idle<sup>113</sup>=0.014377571

**c. VMT Fees**

- i. Net Annual Revenue Projections<sup>114</sup>=644.1 millions

**d. Congestion Pricing and Managed Lanes**

- i. Toll Lane Miles in MD<sup>115</sup>=3,140
- ii. Total that are congested<sup>116</sup>=30.40%
- iii. Gas wasted in idle per minute Idle<sup>117</sup>=0.014377571
- iv. Current Congestion Time In MD (Total by Commuter Annually)<sup>118</sup>=2,040 in min

<sup>106</sup> Saka, Anthony A., Dennis K. Agboh, Simon Ndiritu, and Richard A. Glassco. "An Estimation of Mobile Emissions Reduction." RITA | National Transportation Library. National Transportation Centre, Mar. 2000. Web. 14 Nov. 2011. <<http://ntl.bts.gov/lib/16000/16800/16888/PB2000105915.pdf>>.

<sup>107</sup> MdTA Toll Facilities. MdTA Index. Maryland Transportation Authority, 2011. Web. 14 Nov. 2011. <<http://www.mdt.maryland.gov/TollFacilities/facilities.html>>.

<sup>108</sup> Ibid.

<sup>109</sup> ISDH: ISDH Home. IN.gov: Home. IN.gov. Web. 14 Nov. 2011.

<[http://www.in.gov/isdh/files/Idling\\_Brochure.](http://www.in.gov/isdh/files/Idling_Brochure.)>.

<sup>110</sup> Baker, Michael, and Cambridge Systematics. "Maryland Climate Action Plan Draft 2012." Maryland Department of Transportation. Maryland Department of Transportation, 11 Apr. 2011. Web. 16 Nov. 2011.

<[http://www.mdot.maryland.gov/Planning/Plans\\_Programs\\_Reports/Documents/Climate\\_Change\\_2011\\_Appendix.pdf](http://www.mdot.maryland.gov/Planning/Plans_Programs_Reports/Documents/Climate_Change_2011_Appendix.pdf)>.

<sup>111</sup> Ibid.

<sup>112</sup> Civilian Labor Force, Employment & Unemployment by Place of Residence (LAUS) - Maryland - Division of Workforce Development and Adult Learning. Welcome to the Maryland Department of Labor, Licensing and Regulation. Maryland Department of Labor, Licensing and Regulation, 21 Oct. 2011. Web. 14 Nov. 2011.

<<http://www.dlrr.state.md.us/lmi/laus/maryland.shtml>>.

<sup>113</sup> ISDH: ISDH Home. IN.gov: Home. IN.gov. Web. 14 Nov. 2011.

<[http://www.in.gov/isdh/files/Idling\\_Brochure.](http://www.in.gov/isdh/files/Idling_Brochure.)>.

<sup>114</sup> Baker, Michael, and Cambridge Systematics. "Maryland Climate Action Plan Draft 2012." Maryland Department of Transportation. Maryland Department of Transportation, 11 Apr. 2011. Web. 16 Nov. 2011.

<[http://www.mdot.maryland.gov/Planning/Plans\\_Programs\\_Reports/Documents/Climate\\_Change\\_2011\\_Appendix.pdf](http://www.mdot.maryland.gov/Planning/Plans_Programs_Reports/Documents/Climate_Change_2011_Appendix.pdf)>.

<sup>115</sup> Ibid.

<sup>116</sup> Ibid.

<sup>117</sup> ISDH: ISDH Home. IN.gov: Home. IN.gov. Web. 14 Nov. 2011.

<[http://www.in.gov/isdh/files/Idling\\_Brochure.](http://www.in.gov/isdh/files/Idling_Brochure.)>.

- v. Number of those that pass through a MD Toll Annually<sup>119</sup> = 207,530
  - vi. Avg. Price of Gas=\$3.61 (assumed)
  - e. Parking Impact Fees**
    - i. Daily Parking<sup>120</sup>=\$0.75 average per hour
    - ii. Assume 8 Hours=\$6.00 (cost per day) (daily parking\*8)
    - iii. Number of those that work in the city of Baltimore<sup>121</sup>=1,289,169
  - f. Employer Commute Incentives**
    - i. Assume 15% of Employers in Metro Area provide Passes or something to employees<sup>122</sup>
    - ii. Reduction in Annual VMT<sup>123</sup>=1,094,381
    - iii. Avg. MPG=27 mpg
    - iv. Avg. Assumed Price Per Gallon=\$3.61 per gallon
5. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
- a. Electronic Toll Collection**
    - i. 384,500,000 [Avg. Annual Commuters Passing Through Tolls \* Avg. Wait Time at Toll Booth Reduction]: = Total Number of Idle Minutes Saved per Year.
    - ii. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$121,165,780.71 [Total Number of Idle Minutes Saved per Year \* 0.0316 (conversion factor)]: = \$19,944,277.13
  - b. High Occupancy Toll Lanes**
    - i. Current Congestion Time in MD (Total by Commuter Annually Mins)=2,040 (Current Congestion Time In MD (Total by Commuter Annually)\*60)

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<sup>118</sup> Baker, Michael, and Cambridge Systematics. "Maryland Climate Action Plan Draft 2012." Maryland Department of Transportation. Maryland Department of Transportation, 11 Apr. 2011. Web. 16 Nov. 2011. <[http://www.mdot.maryland.gov/Planning/Plans\\_Programs\\_Reports/Documents/Climate\\_Change\\_2011\\_Appendix.pdf](http://www.mdot.maryland.gov/Planning/Plans_Programs_Reports/Documents/Climate_Change_2011_Appendix.pdf)>.

<sup>119</sup> Civilian Labor Force, Employment & Unemployment by Place of Residence (LAUS) - Maryland - Division of Workforce Development and Adult Learning. Welcome to the Maryland Department of Labor, Licensing and Regulation. Maryland Department of Labor, Licensing and Regulation, 21 Oct. 2011. Web. 14 Nov. 2011. <<http://www.dllr.state.md.us/lmi/laus/maryland.shtml>>.

<sup>120</sup> Documents – Resource Types – SFpark. SFpark. Municipal Transportation Agency, 2011. Web. 16 Nov. 2011. <<http://sfpark.org/resource-type/documents/>>

<sup>121</sup> Civilian Labor Force, Employment & Unemployment by Place of Residence (LAUS) - Maryland - Division of Workforce Development and Adult Learning. Welcome to the Maryland Department of Labor, Licensing and Regulation. Maryland Department of Labor, Licensing and Regulation, 21 Oct. 2011. Web. 14 Nov. 2011. <<http://www.dllr.state.md.us/lmi/laus/maryland.shtml>>.

<sup>122</sup> Baker, Michael, and Cambridge Systematics. "Maryland Climate Action Plan Draft 2012." Maryland Department of Transportation. Maryland Department of Transportation, 11 Apr. 2011. Web. 16 Nov. 2011. <[http://www.mdot.maryland.gov/Planning/Plans\\_Programs\\_Reports/Documents/Climate\\_Change\\_2011\\_Appendix.pdf](http://www.mdot.maryland.gov/Planning/Plans_Programs_Reports/Documents/Climate_Change_2011_Appendix.pdf)>.

<sup>123</sup> Ibid.

- ii. Total Yearly Congestion For those Passing Through MD  
tolls=5,654,539,320 (Current Congestion Time in MD (Total by  
Commuter Annually Mins)\* Number of those employed in MD)
- iii. If HOT Lanes Enforced, Avg. Annual Time Reduced=106,022,612.3  
(Avg. Reduction in Time from HOT Lane\*Current Congestion Time in  
MD [(Total by Commuter Annually Mins))\*( Number of those employed  
in MD)]
- iv. IF HOT Lanes enforced, new avg. annual congestion time=5,548,516,708  
(Total Yearly Congestion For those Passing Through MD tolls-If HOT  
Lanes Enforced, Avg. Annual Time Reduced)
- v. Amount Wasted on Time a Year (mins) =5,654,539,320 (Current  
Congestion Time in MD (Total by Commuter Annually Mins)\* (Number  
of those employed in MD))
- vi. Amount Wasted on Time a Year - WITH HOT LANES  
(mins)=5,548,516,708 [(Current Congestion Time in MD (Total by  
Commuter Annually Mins)- Current Congestion Time in MD (Total by  
Commuter Annually Mins)\* Avg. Reduction in Time from HOT Lane)]\*  
(Number of those employed in MD)]
- vii. Amount of Gas Wasted Without HOT Lanes=81,298,540.48 [(Amount  
Wasted on Time a Year (mins)\* Gas wasted in idle per minute Idle)]
- viii. Amount of Gas Wasted With HOT Lanes =79,774,192.85 [(Amount  
Wasted on Time a Year - WITH HOT LANES (mins)\* (Gas wasted in  
idle per minute Idle)]
- ix. Amount of Gas Wasted without HOT Lanes (\$)= \$278,853,993.86  
[(Assumed Price per Gallon of Gas)\*( Amount of Gas Wasted Without  
HOT Lanes)]
- x. Amount of Gas Wasted with HOT Lanes (\$)= \$273,625,481.48 [(Assumed  
Price per Gallon of Gas)\*( Amount of Gas Wasted With HOT Lanes)]
- xi. 623—Consumer Spending—Gasoline and oil, 78—Consumption  
Reallocation—All Consumption Categories—\$5,499,465.17 [(Amount of  
Gas Wasted without HOT Lanes (\$))—(Amount of Gas Wasted with HOT  
Lanes (\$))]=Savings From HOT Lanes per year from 2010—2020

**c. VMT Fees**

- i. 63—State Government Spending—\$644,100,000 [(Annual Net Revenue  
Projection from MDOT MD Climate Action Plan 2012 Draft)]

**d. Congestion Pricing and Managed Lanes**

- i. Total Gallons of Gas Wasted Annually =29.33024482 (Gas wasted  
in idle per minute Idle\* Current Congestion Time In MD (Total by  
Commuter Annually))
- ii. Avg. Cost to Consumer Due to Congestion=\$100.60 (Total Gallons of Gas  
Wasted Annually\*avg. price of gas)
- iii. If Congestion is reduced by 30.4%
  - 1. Total Congestion Time Reduced Annually (in mins)=620.16 (Total  
that are congested\* Current Congestion Time In MD (Total by  
Commuter Annually))

2. Total Minutes in Congestion Under Congestion Cost Policy=1419.84 (Current Congestion Time In MD (Total by Commuter Annually)—(Total Congestion Time Reduced Annually (in mins))
3. Avg. Gallons Used in New Congestion=20.41385039 (Gas wasted in idle per minute Idle\* Total Minutes in Congestion Under Congestion Cost Policy)
4. Avg. Cost to Consumer under new Pricing=\$70.02 (Avg. Price of Gas\* Avg. Gallons Used in New Congestion)
- iv. Savings to consumer=\$30.58 (Avg. Cost to Consumer Due to Congestion- Avg. Cost to Consumer under new Pricing)
- v. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$89,164,662.06 (Savings to consumer\* Number of those employed in MD)=Total Avg. Annual Savings to All those on MD Roads 2010—2020

**e. Parking Impact Fees**

- i. Suppose they work in Baltimore but live outside City=30 weekly cost (assumer 8 hrs\*5)
- ii. Annual Cost to Consumer to Park in Baltimore City=1560 (Suppose they work in Baltimore but live outside City\*52)
- iii. 63—State Government Spending—\$100,555,182.00 [(Number of those that work in the city of Baltimore\*0.05)\*( Annual Cost to Consumer to Park in Baltimore City)]=Total Possible Revenue Recouped from City if 5% commute to areas without parking lots

**f. Employer Commute Incentives**

- i. Avg. Gallons Saved Annually=40,532.62963 (Reduction in Annual VMT/Avg. MPG)
- ii. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$139,026.92 (Avg. Gallons Saved Annually\* Avg. Assumed Price Per Gallon)= Savings Annually 2010—2020

6. Input savings by sector into REMI model and run impacts.
7. Export impacts and analyze.

**3.2.10 Transportation Technology Initiatives**

**Investment Phase**

1. Determine relevant REMI sectors for each program under the policy.

**a. Traffic Flow Improvements**

- i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects

**b. Truck Stop Electrification**

- i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects

- c. **Timing of Highway Construction Schedules**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - d. **Electronic Toll Collection**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - e. **Traffic Signal Synchronization**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - f. **Variable Message Signs**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - g. **Telework Partnership with Employers**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - h. **Smart Card Implementation**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - i. **Light-Emitting Diode Traffic Signals**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - j. **Vehicle Technologies**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - k. **Transportation Fuels**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
2. Determine overall cost of policy implementation for each program under the policy.
- a. **Traffic Flow Improvements**
    - i. *No funding specified*
  - b. **Truck Stop Electrification**
    - i. *No funding specified*
  - c. **Timing of Highway Construction Schedules**
    - i. *No funding specified*
  - d. **Electronic Toll Collection**
    - i. *No funding specified*
  - e. **Traffic Signal Synchronization**
    - i. *No funding specified*
  - f. **Variable Message Signs**
    - i. \$250,000 per year 2011-2014
  - g. **Telework Partnership with Employers**
    - i. *No funding specified*
  - h. **Smart Card Implementation**
    - i. *No funding specified*

- i. Light-Emitting Diode Traffic Signals**
    - i. \$3,744,000 in 2012
  - j. Vehicle Technologies**
    - i. *No funding specified*
  - k. Transportation Fuels**
    - i. *No funding specified*
3. Input investment by sector into REMI model and run impacts.
  4. Export impacts and analyze.

### Operation Phase

7. Determine relevant REMI sectors.
  - a. Traffic Flow Improvements**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All consumption categories
  - b. Truck Stop Electrification**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All consumption categories
  - c. Timing of Highway Construction Schedules**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All consumption categories
  - d. Electronic Toll Collection**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All consumption categories
  - e. Traffic Signal Synchronization**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All consumption categories
  - f. Variable Message Signs**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All consumption categories
  - g. Telework Partnership with Employers**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All consumption categories
  - h. Smart Card Implementation**
    - i. 673—Consumer Spending—Bank service charges, trust services, and safe deposit box rentals
    - ii. 78—Consumption Reallocation—All consumption categories
  - i. Light-Emitting Diode Traffic Signals**
    - i. X6409—Exogenous Final Demand—Electric power generation, transmission, and distribution
    - ii. 63—State Government Spending
  - j. Vehicle Technologies**
    - i. 648—Consumer Spending—Auto insurance less claims paid
    - ii. 78—Consumption Reallocation—All consumption categories
  - k. Transportation Fuels**
    - i. 623—Consumer Spending—Gasoline and oil

- ii. 78—Consumption Reallocation—All consumption categories
8. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Traffic Flow Improvements**
    - i. Annual Reduction in Diesel Fuel=2,520,000 gallons (assume 40% of vehicles traveling are trucks) (6,300,000\*0.4)
    - ii. Annual Reduction in Fuel=3,780,000 (assumer 60% of vehicles traveling are cars) (6,300,000\*0.6)
  - b. **Truck Stop Electrification**
    - i. 23 cars scheduled to be overhauled between FY 2005 and FY 2012
  - c. **Timing of Highway Construction Schedules**
  - d. **Electronic Toll Collection**
  - e. **Traffic Signal Synchronization**
  - f. **Variable Message Signs**
  - g. **Telework Partnership with Employers**
    - i. Total Employers=35
    - ii. Savings for 50 people working from home=\$789,810
  - h. **Smart Card Implementation**
  - i. **Light-Emitting Diode Traffic Signals**
    - i. 39,000 traffic signals in Baltimore City (From write-up)
  - j. **Vehicle Technologies**
  - k. **Transportation Fuels**
9. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Traffic Flow Improvements**
    - i. Cost of Diesel Fuel<sup>124</sup>= \$3.89 per gallon
    - ii. Assumed Price of Gas= \$3.61 per gallon
  - b. **Truck Stop Electrification**
    - i. Number of Parking Spaces at Station<sup>125</sup>=63
    - ii. Avg. Fuel Saved per hour of Operation<sup>126</sup>=0.8 (gallons of fuel saved an hour)
    - iii. Rest Period of 8 Hours (sleep)=8
    - iv. Cost of Diesel Fuel<sup>127</sup>=\$3.89 per gallon
    - v. Hours in a Day=24
  - c. **Timing of Highway Construction Schedules**
    - i. Example of overnight(non-peak) lane closure for I-95/I-495 near Branch Ave (Capitol Beltway)

<sup>124</sup> Lowest Diesel Fuel Prices in the Last 24 Hours. Maryland Gas Prices - Find Cheap Gas Prices in Maryland. 2011. Web. 14 Nov. 2011. <<http://www.marylandgasprices.com/index.aspx?fuel=D>>.

<sup>125</sup> Maryland Moves. Baltimore Metropolitan Council. Baltimore Metropolitan Council for the Regional Transportation Board May 2006. Web. 16 Nov. 2011. <<http://www.baltometro.org/eNews/MM-5-06.pdf>>.

<sup>126</sup> Truck Stop Electrification. California Energy Commission. California Energy Commission, June 2006. Web. 16 Nov. 2011. <<http://www.energy.ca.gov/2006publications/CEC-600-2006-001/CEC-600-2006-001-FS.PDF>>.

<sup>127</sup> Lowest Diesel Fuel Prices in the Last 24 Hours. Maryland Gas Prices - Find Cheap Gas Prices in Maryland. 2011. Web. 14 Nov. 2011. <<http://www.marylandgasprices.com/index.aspx?fuel=D>>.

- ii. Average Delay from Construction=55.5mins (Example of I-95 in Howard County from SHA Work Zone Analysis Guide: Appendix C)
  - iii. On Peak Assume 50%=83.25 minutes
  - iv. Gas wasted in idle per minute Idle<sup>128</sup>=0.014377571
  - v. Assumed Price of Gas=\$3.61 per gallon
  - vi. Avg. Cars Overnight=8,812 (Example of I-95 in Howard County from SHA Work Zone Analysis Guide: Appendix C)
  - vii. Cost of Diesel Fuel<sup>129</sup>=\$3.89 per gallon
- d. Electronic Toll Collection**
- i. Avg. Wait Time at Toll Booth Reduction<sup>130</sup>=2.5 minutes
  - ii. Avg. Annual Commuters Passing Through Tolls<sup>131</sup>=153,800,000
  - iii. Number of Tolls Booths in MD<sup>132</sup>=10
  - iv. Gas wasted in idle<sup>133</sup>=5,528,176 gallons
  - v. Number of hours a year=8,765
  - vi. Assumed Price per Gallon of Gas=\$3.61 per gallon
- e. Traffic Signal Synchronization**
- i. Min delay in time<sup>134</sup>=13%
  - ii. Gas wasted in idle per minute Idle<sup>135</sup>=0.014377571
  - iii. Current Congestion Time In MD (Total by Commuter Annually)<sup>136</sup>=2,040 in minutes
  - iv. Number of Registered Vehicles=3,382,451 (provided by MDE courtesy of MVA)
- f. Variable Message Signs**
- i. Avg. Reduction with VMS=17%
  - ii. Gas wasted in idle per minute Idle<sup>137</sup>=0.014377571

<sup>128</sup> ISDH: ISDH Home. IN.gov: Home. IN.gov. Web. 14 Nov. 2011.

<[http://www.in.gov/isdh/files/Idling\\_Brochure.>](http://www.in.gov/isdh/files/Idling_Brochure.>).

<sup>129</sup> Lowest Diesel Fuel Prices in the Last 24 Hours. Maryland Gas Prices - Find Cheap Gas Prices in Maryland. 2011. Web. 14 Nov. 2011. <<http://www.marylandgasprices.com/index.aspx?fuel=D>>.

<sup>130</sup> Saka, Anthony A., Dennis K. Agboh, Simon Ndiritu, and Richard A. Glassco. "An Estimation of Mobile Emissions Reduction." RITA | National Transportation Library. National Transportation Centre, Mar. 2000. Web. 14 Nov. 2011. <<http://ntl.bts.gov/lib/16000/16800/16888/PB2000105915.pdf>>.

<sup>131</sup> MdTA Toll Facilities. MdTA Index. Maryland Transportation Authority, 2011. Web. 14 Nov. 2011. <<http://www.mdtta.maryland.gov/TollFacilities/facilities.html>>.

<sup>132</sup> MdTA Toll Facilities. MdTA Index. Maryland Transportation Authority, 2011. Web. 14 Nov. 2011. <<http://www.mdtta.maryland.gov/TollFacilities/facilities.html>>.

<sup>133</sup> ISDH: ISDH Home. IN.gov: Home. IN.gov. Web. 14 Nov. 2011. <[http://www.in.gov/isdh/files/Idling\\_Brochure.>](http://www.in.gov/isdh/files/Idling_Brochure.>).

<sup>134</sup> "RITA | ITS | Benefits: The Texas Traffic Light Synchronization program reduced delays by 24.6 percent by updating traffic signal control equipment and optimizing signal timing." RITA | ITS | Welcome to the Costs Database. 10 Aug. 2005. U.S. Department of Transportation (USDOT). 11 Nov. 2011

<<http://www.itscosts.its.dot.gov/its/benecost.nsf/ID/D0DCC197DC7382BE852573D8006F7EDA?OpenDocument>>.

<sup>135</sup> ISDH: ISDH Home. IN.gov: Home. IN.gov. Web. 14 Nov. 2011. <[http://www.in.gov/isdh/files/Idling\\_Brochure.>](http://www.in.gov/isdh/files/Idling_Brochure.>).

<sup>136</sup> Baker, Michael, and Cambridge Systematics. "Maryland Climate Action Plan Draft 2012." Maryland Department of Transportation. Maryland Department of Transportation, 11 Apr. 2011. Web. 16 Nov. 2011. <[http://www.mdot.maryland.gov/Planning/Plans\\_Programs\\_Reports/Documents/Climate\\_Change\\_2011\\_Appendix.pdf>](http://www.mdot.maryland.gov/Planning/Plans_Programs_Reports/Documents/Climate_Change_2011_Appendix.pdf>).

- iii. Number of Registered Vehicles=3,382,451 (provided by MDE courtesy of MVA)
  - iv. Current Congestion Time In MD (Total by Commuter Annually)<sup>138</sup>=2,040 in minutes
  - g. Telework Partnership with Employers**
  - h. Smart Card Implementation**
    - i. Number of Boardings (Rail)—71,311
    - ii. Number of Boardings (Bus)—231,795
    - iii. Percentage Rail—75%
    - iv. Percentage Bus—60%
    - v. Average ATM fee—\$2.40
    - vi. Average Fare—\$1.60
  - i. Light-Emitting Diode Traffic Signals**
    - i. 20,500 Traffic Signals replaced with LED Traffic Signals
    - ii. \$276,000—Savings a year in energy costs from switch
    - iii. \$154,000—Savings in labor and maintenance
    - iv. \$430,000—Total Yearly Savings
    - v. Total Yearly Savings/Number of Traffic Signals=\$20.98 per signal in savings
  - j. Vehicle Technologies**
    - i. Goal in 2016=35mpg
    - ii. Current Average miles per gallon=27 mpg
    - iii. Difference=8 mpg
    - iv. Annual growth in mpg to reach goal=2 mpg
    - v. Average Annual Miles Driven By Population<sup>139</sup>=13,041
    - vi. New Vehicle Registrations in MD=2,700 (courtesy of MVA)
  - k. Transportation Fuels**
    - i. Annual increase in renewable fuels<sup>140</sup>=8,750,000
    - ii. Reduction that can come about from Biofuels<sup>141</sup>=0.29
10. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
- a. Traffic Flow Improvements**
    - i. \$9,802,800 [2,520,000 gallons of diesel \* \$3.89 price per gallon]=Value of diesel saved

<sup>137</sup> ISDH: ISDH Home. IN.gov: Home. IN.gov. Web. 14 Nov. 2011.

<[http://www.in.gov/isdh/files/Idling\\_Brochure.>](http://www.in.gov/isdh/files/Idling_Brochure.>).

<sup>138</sup> Baker, Michael, and Cambridge Systematics. "Maryland Climate Action Plan Draft 2012." Maryland Department of Transportation. Maryland Department of Transportation, 11 Apr. 2011. Web. 16 Nov. 2011.

<[>](http://www.mdot.maryland.gov/Planning/Plans_Programs_Reports/Documents/Climate_Change_2011_Appendix.pdf).

<sup>139</sup> "State & Urbanized Area Statistics - Our Nation's Highways - 2000." Home | Federal Highway Administration. 4 Apr. 2011. Federal Highway Administration (FHWA). 11 Nov. 2011

<[>](http://www.fhwa.dot.gov/ohim/onh00/onh2p11.htm).

<sup>140</sup> Task Force on Renewable Alternative Fuels. State of Maryland. 31 Dec. 2007. Web. 14 Nov. 2011. <[>](http://www.mda.state.md.us/pdf/altfuelsreport.pdf).

<sup>141</sup> Ibid.

- ii.  $\$13,637,295$  [3,780,000 gallons of gasoline \*  $\$3.61$  price per gallon]=value of gasoline saved
- iii. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories— $\$23,440,095$  [ $\$9,802,800 + \$13,637,295$ ]=Total value of fuel saved per year from 2010—2020

**b. Truck Stop Electrification**

- i. Gallons Saved Per Rest Period =6.4 (Avg. Fuel Saved per hour of Operation\*Rest Period of 8 Hours (sleep))
- ii. Savings of Fuel Per Truck Rest = $\$26.19$  (Gallons Saved Per Rest Period\*Price of Diesel Fuel)
- iii. Assume one truck every 8 hours=3 trucks a day (hours in a day/8)
- iv. Total Fuel Saved a Day = $\$78.56$  saved daily (Savings of Fuel Per Truck Rest\*Assume one truck every 8 hours)
- v. Annual Fuel Saved= $\$28,673.85$  (Total Fuel Saved a Day\*365)
- vi. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories— $\$1,806,452.28$  [(Annual Fuel Saved\*Number of Parking Spaces at Station)]= Total Annual Savings from Truck Stop Electrification Stopping in MD

**c. Timing of Highway Construction Schedules**

- i. Avg. Gas Wasted Idle Peak Hours=1.196932785 (On Peak Assume 50%\*Gas wasted in idle per minute Idle)
- ii. Avg. Gas Wasted Idle Non-Peak Hours =0.79795519 (Average Delay from Construction\*Gas wasted in idle per minute Idle)
- iii. Cost of Peak Hours=4.318234255 (Avg. Gas Wasted Idle Peak Hours\*Assumed Price of Gas)
- iv. Cost of Off Peak Hours =2.878822837 (Avg. Gas Wasted Idle Non-Peak Hours\*Assumed Price of Gas)
- v. Savings to Night time Construction=1.439411418 (Cost of Peak Hours-Cost of Off Peak Hours)
- vi. Assume 40% Trucks=3524.8 (Avg. Cars Overnight\*0.4)
- vii. Assume 60% Cars=5287.2 (Avg. Cars Overnight\*0.6)
- viii. Total Cost to Truck on Peak=4,218.94868 gallons fuel wasted (Assume 40% Trucks\*Avg. Gas Wasted Idle Peak Hours)
- ix. Cost to Truck on Peak=  $\$17,262.21$  (Total Cost to Truck on Peak\*Cost of Diesel Fuel)
- x. Total Cost to Trucks Off-Peak=2,812.632453 gallons fuel (Assume 40% Trucks\*Avg. Gas Wasted Idle Non-Peak Hours)
- xi. Cost to Truck Off-Peak = $\$11,508.14$  (Total Cost to Trucks Off-Peak\*Cost of Diesel Fuel)
- xii. Savings to Trucks if Construction Night = $\$5,754.07$  (Cost to Truck on Peak - Cost to Truck Off-Peak)
- xiii. Total Cost to Cars On Peak=6,328.42302 (Assume 60% Cars\*Avg. Gas Wasted Idle Peak Hours)
- xiv. Assumed Price of Gas=3.61

- xv. Cost to Cars on Peak = \$22,831.37 (Total Cost to Cars On Peak\* Assumed Price of Gas)
- xvi. Total Cost to Cars Off Peak = 2,812.632453 (Assume 40% Trucks\* Avg. Gas Wasted Idle Non-Peak Hours)
- xvii. Assumed Price of Gas = 3.61
- xviii. Cost to Cars Off Peak = \$10,147.28 (Total Cost to Cars Off Peak\* Assumed Price of Gas)
- xix. Savings to Cars = \$12,684.09 (Cost to Cars on Peak - Cost to Cars Off Peak)
- xx. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$18,438.16 [ $\$12,684.09$  savings to cars +  $\$5,754.07$ ]=Total fuel savings per year from 2010 to 2020

**d. Electronic Toll Collection**

- i. Number of Mins a year = 525,900 (Number of hours a year\*60)
- ii. Amount of Time Saved in a Year on Avg. = 384,500,000 mins (Avg. Wait Time at Toll Booth Reduction\* Avg. Annual Commuters Passing Through Tolls)
- iii. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$19,944,277.13 [(Gas wasted in idle\* Assumed Price per Gallon of Gas)]=Total Saved From Electronic Tolls

**e. Traffic Signal Synchronization**

- i. Reduction in time = 265.2 [(Current Congestion Time In MD (Total by Commuter Annually))\* (Min delay in time)]
- ii. Savings in Fuel for Typical Consumer = 3.812931826 (Gas wasted in idle per minute Idle\*reduction in time)
- iii. Savings in Dollar Amounts = 13.7561048 (Savings in Fuel for Typical Consumer\*3.61)
- iv. iii. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$46,529,350.46 [(Number of Registered Vehicles\* Savings in Dollar Amounts)]= Annual Savings to All Registered Vehicles in MD

**f. Variable Message Signs**

- i. Assume Only 25% of vehicles registered see sign = 845,612.75 (Number of Registered Vehicles\*0.25)
- ii. VMS Sign Reduction = 346.8 [(Current Congestion Time In MD (Total by Commuter Annually))\*( Avg. Reduction with VMS)]
- iii. New Minutes Traveled = 1693.2 [(Current Congestion Time In MD (Total by Commuter Annually)—(VMS Sign Reduction)]
- iv. Total Gallons of Gas Wasted = 24.3441032 (New Minutes Traveled\* Gas wasted in idle per minute Idle)
- v. Cost to Drivers = 87.82743832 (Total Gallons of Gas Wasted\*3.61)
- vi. Total Savings to MD Drivers = 74,181,492.61 (Cost to Drivers\* Assume Only 25% of vehicles registered see sign)

- vii. Assume half are trucks = \$37,090,746.31 (Total Savings to MD Drivers/2)
- viii. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$37,090,746.31 = Total fuel savings to households

**g. Telework Partnership with Employers**

- i. 26,071.43 Car Trips Avoided Per Year =  $(50 * (365 - 104.2857 \text{ Weekend Days}) * 2)$
- ii. 12,552.91 Gallons of Fuel Saved Per Year =  $(26,071.43 * 13 \text{ Average Miles Per Trip} * (1/27 \text{ Average MPG}))$
- iii. \$45,287.76 Value of Gas Saved =  $(\# \text{ Gallons Saved} * \text{Assumed Price of Gas})$
- iv. \$1,649.83 Value of Gas Saved From Idling =  $(\text{Car Trips Avoided} * 2 \text{ min Average Idling Per Trip} * 0.031 \text{ (conversion factor)})$
- v. viii. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$46,937.59 [ $\$45,287.76 + \$1,649.83$ ]=Total value of fuel saved
- vi. 603—Consumer Spending—Other motor vehicles, 78—Consumption Reallocation—All Consumption Categories—\$11,836.43 [ $(26,071.43 * 13 \text{ Average Miles Per Trip} * 0.454 \text{ (non-fuel Driving Cost Per Mile)})$ ]= Value of Non-Fuel Driving Cost Saved

**h. Smart Card Implementation**

- i. \$171,146.40 [ $((71,311 \text{ Number of Rail Boardings} * 0.75) * (\$1.60 \text{ Average Fare} * 2))$ ]=Total Annual Boards (Rail/Smart Card)
- ii. \$445,046.40 [ $((231,795 \text{ Number of Bus Boardings} * 0.60) * (\$1.60 \text{ Average Fare} * 2))$ ]=Total Annual Boards (Bus/Smart Card)
- iii. \$410,751.36 [ $((71,311 \text{ Number of Rail Boardings} * 0.75) * (\$1.60 \text{ Average Fare} * 2) * \$2.40 \text{ Average ATM fee})$ ]=Total Annual Boards (Rail)
- iv. \$1,068,111.36 [ $((231,795 \text{ Number of Bus Boardings} * 0.60) * (\$1.60 \text{ Average Fare} * 2) * \$2.40 \text{ Average ATM fee})$ ]=Total Annual Boards (Bus)
- v. \$239,604.96 [ $(\$410,751.36 \text{ Total Annual Boards (Rail)} - \$171,146.40 \text{ Total Annual Boards (Rail/Smart Card)})$ ]=Annual Savings for Rail
- vi. \$623,064.96 [ $(\$1,068,111.36 \text{ Total Annual Boards (Bus)} - \$445,046.40 \text{ Total Annual Boards (Bus/Smart Card)})$ ]=Annual Savings for Bus
- vii. \$862,669.92 [ $(\$239,604.96 \text{ Annual Savings for Rail} + \$623,064.96 \text{ Annual Savings for Bus})$ ]=Total Annual Savings
- viii. 673—Consumer Spending—Bank Service charges, trust services, and safe deposit box rentals, 78—Consumption Reallocation—All Consumption Categories—\$862,669.92 [ $(\$239,604.96 \text{ Annual Savings for Rail} + \$623,064.96 \text{ Annual Savings for Bus})$ ]=Total Annual Savings

**i. Light-Emitting Diode Traffic Signals**

- i. 63—State Government Spending, X6409—Exogenous Final Demand—Electric power generation, transmission, and distribution—\$818,220

[(39,000 Number of Traffic Signals to be Replaced \* \$20.98 per Signal Savings)]=Average Estimated Savings Annually for 39,000 Signals Replaced from 2010—2020

**j. Vehicle Technologies**

- i. Current Gas Wasted by a driver =483 (Average Annual Miles Driven By Population/current avg)
- ii. Current Cost=\$1,742.54 (Current Gas Wasted by a driver\* 3.61)
- iii. If move 2 mpg next year=449.6896552 (Average Annual Miles Driven By Population/29)
- iv. Gallons Saved =33.31034483 (Current Gas Wasted by a driver-If move 2 mpg next year)
- v. Cost next year =\$120.18 (Gallons Saved\*3.61)
- vi. Savings=\$120.18
- vii. Transport by Truck=\$162,236.78 (savings/2)
- viii. Households=\$162,236.78
- ix. 603—Consumer Spending—Other motor vehicles, 78—Consumption Reallocation—All Consumption Categories—\$324,486.00 [(New Vehicle Registrations in MD\*savings)]=Savings

**k. Transportation Fuels**

- i. 77,962,500 [(8,750,000 Average Proposed Reduction in Regular Fuel \* 8.91)] = Average Annual Reduction in Fuel Converted to Kilograms
- ii. 77,962.50 [(77,962,500 CO2 emissions from Regular Fuel in kilograms / 1000)] = Conversion to CO2 in metric tons
- iii. 22,609.125 [(0.29 Reduction that can come about from Biofuels \* 77,962.50 Conversion to CO2 in metric tons)] = Average Annual Reduction from Biofuels in CO2 metric tons
- iv. 55,353.375 [(77,962.50 GHG Conversion to CO2 in metric tons— 22,609.13 Reduction to account for Biofuels)] = Average Reductions from Strategy not a part of biofuels
- v. 55,353,375 [(55,353.375 Average Reduction from Strategy not a part of biofuels \* 1,000)] = Average Reduction from Strategy not a part of biofuels in kilograms
- vi. 6,212,500 (55,353,375 Average Reduction from Strategy not a part of biofuels in kg / 8.91)] = Average Reduction from Strategy not a part of biofuels converted to gallons of gas
- vii. \$30,012,500 [(8,750,000 Annual increase in renewable fuels \* \$3.61 Average Cost of a Gallon of Gas)] = Average Annual Cost if no Reduction Occurs
- viii. \$21,308,875 (6,212,500 Reductions in Current Fuels not associated with biofuels \* \$3.61 average gallon of gas)] = Average Annual Savings from Conversion of Renewable Fuels not associated with biofuels
- ix. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$9,154,665.63 (\$30,012,500 Cost if no reduction occurred in regular gas - \$21,308,875 Savings from

reduction in gas)\*1.052 adjust price of fuel] = Average Annual Savings  
Associated with Reduction

11. Input savings by sector into REMI model and run impacts.
12. Export impacts and analyze.

### 3.2.11 Electric Vehicles Initiatives

#### Investment Phase

1. Determine relevant REMI sectors for each program under the policy.
  - a. **Vehicle-to-Grid (V2G)**
    - i. 68—Government Spending including Non-Pecuniary (Amenity)
  - b. **Electric Vehicles**
    - i. 68—Government Spending including Non-Pecuniary (Amenity)
  - c. **Maryland Electric Vehicles Initiatives**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
  - d. **Maryland Transit Administration Support for Howard County Bus Project**
    - i. 68—Government Spending including Non-Pecuniary (Amenity)
  - e. **Clean and Efficient Strategies**
    - i. 68—Government Spending including Non-Pecuniary (Amenity)
  - f. **Baltimore City Electric Vehicles Infrastructure**
    - i. 68—Government Spending including Non-Pecuniary (Amenity) Aspects
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Vehicle-to-Grid (V2G)**
    - i. *No Investment Costs Specified*
  - b. **Electric Vehicles**
    - i. \$409,344 per year (2010-2020)
  - c. **Maryland Electric Vehicles Initiatives**
    - i. \$511,680 per year (2010-2020)
  - d. **Maryland Transit Administration Support for Howard County Bus Project**
    - i. \$28,814 per year (2010-2020)
  - e. **Clean and Efficient Strategies**
    - i. *No Investment Costs Specified*
  - f. **Baltimore City Electric Vehicles Infrastructure**
    - i. *No Investment Costs Specified*
3. Input investment by sector into REMI model and run impacts.
4. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI sectors.
  - a. **Vehicle-to-Grid (V2G)**
    - i. X6409—Exogenous Final Demand—Electric power generation, transmission, and distribution
  - b. **Electric Vehicles**
    - i. 623—Consumer Spending—Gasoline and oil

- ii. 78—Consumption Reallocation—All consumption categories
- c. Maryland Electric Vehicles Initiatives**
  - i. 623—Consumer Spending—Gasoline and oil
  - ii. 78—Consumption Reallocation—All consumption categories
- d. Maryland Transit Administration Support for Howard County Bus Project**
  - i. 63—State Government Spending
- e. Clean and Efficient Strategies**
  - i. 623—Consumer Spending—Gasoline and oil
  - ii. 78—Consumption Reallocation—All consumption categories
- f. Baltimore City Electric Vehicles Infrastructure**
  - i. 623—Consumer Spending—Gasoline and oil
  - ii. 78—Consumption Reallocation—All consumption categories
- 2. Determine part of program to be affected by savings (from strategy write-up).
  - a. Vehicle-to-Grid (V2G)**
    - i. \$30 per megawatt in Maryland’s regulated energy market
  - b. Electric Vehicles**
    - i. Currently 10,874 cars are registered in the state of Maryland as Hybrids
    - ii. 65 new recharging stations to be installed
    - iii. Proposed 20% tax credit for charging station infrastructure
  - c. Maryland Electric Vehicles Initiatives**
    - i. Currently 10,874 cars are registered in the state of Maryland as Hybrids
    - ii. 65 new recharging stations to be installed
  - d. Maryland Transit Administration Support for Howard County Bus Project**
    - i. Replace 3 diesel buses with new Electric Buses
    - ii. Add 2 quick charge stations
  - e. Clean and Efficient Strategies**
    - i. Two (2) quick charge stations to be installed for Baltimore Fleet
  - f. Baltimore City Electric Vehicles Infrastructure**
    - i. Plans to install 8 new charge stations in Baltimore City garages
- 3. Research savings data for each policy according to part of program to be affected by savings.
  - a. Vehicle-to-Grid (V2G)**
    - i. Maryland Electricity cost (in KWh)<sup>142</sup>—\$0.133 per kW/h
    - ii. Average kilowatt introduced into grid by electric vehicle<sup>143</sup>—6 kilowatts
    - iii. Annual New Vehicle Registration in Maryland (2010)<sup>144</sup>—186,759 (total for cars and light trucks)

<sup>142</sup> "Average Energy Prices in the Washington-Baltimore Area." U.S. Bureau of Labor Statistics. 27 Sept. 2011. 11 Nov. 2011 <[http://www.bls.gov/ro3/apwb.htm#wb\\_energy\\_table1](http://www.bls.gov/ro3/apwb.htm#wb_energy_table1)>.

<sup>143</sup> Motavalli, Jim. "In a Blackout, Nissan, Mitsubishi and Toyota E.V.'s Could Function as Generators - NYTimes.com." Automobiles - Wheels Blog - NYTimes.com 1 Sept. 2011. 22 Nov. 2011 <<http://wheels.blogs.nytimes.com/2011/09/01/in-a-blackout-nissan-mitsubishi-and-toyota-e-v-s-could-function-as-generators/>>.

<sup>144</sup> "Maryland Auto Outlook." Wwww.mdauto.org. 9 Aug. 2011. Maryland Automobile Dealers Association. 11 Nov. 2011 <<http://www.mdauto.org/admin/publications/AutoOutlookQuarter22011.pdf>>.

- iv. Energy consumed per capita in the state of Maryland<sup>145</sup>—1,429 trillion Btu
- v. Annual Energy Generation for the state of Maryland<sup>146</sup>—248 trillion Btu
- vi. Note: External research was conducted to construct an average price for Electric Vehicles in the US. RESI constructed this average price across the top 5 reported prices for new 2012 models of Electric Vehicles. Ford's Focus EV has yet to report an official price for their 2012 model and thus was not included in the average. Instead the Honda Fit EV was included in the top five and used to create the average price of Electric Vehicles.

**b. Electric Vehicles**

- i. Average Cost for One Recharge Station<sup>147</sup>—\$7,872.00 annual maintenance
- ii. Maryland Electricity cost (in KWh)<sup>148</sup>—\$0.133 per kW/h
- iii. Average fuel price per gallon (regular unleaded)<sup>149</sup>—\$3.61 per gallon
- iv. Average Annual Miles Driven By Population<sup>150</sup>—13,041 miles
- v. Annual New Vehicle Registration in Maryland (2010)<sup>151</sup>—186,759 (total for cars and light trucks)
- vi. Average Cost per Mile for Electric Vehicles—\$0.02 per mile
- vii. Average mile per kilowatt-hour—95.88 miles/KWh
- viii. Average Cost to MD driver annually (in gasoline)—\$1,764.99
- ix. Average Battery Size charge time—5.1 hours
- x. Note: External research was conducted to construct an average price for Electric Vehicles in the US. RESI constructed this average price across the top 5 reported prices for new 2012 models of Electric Vehicles. Ford's Focus EV has yet to report an official price for their 2012 model and thus was not included in the average. Instead the Honda Fit EV was included in the top five and used to create the average price of Electric Vehicles.

**c. Maryland Electric Vehicles Initiatives**

- i. Average Cost for One Recharge Station<sup>152</sup>—\$7,872.00 annual maintenance

<sup>145</sup> Data - Prices. Maryland. Nov. 2011. U.S. Energy Information Administration (EIA). 14 Nov. 2011 <<http://www.eia.gov/state/state-energy-profiles-data.cfm?sid=MD#Prices>>.

<sup>146</sup> Ibid.

<sup>147</sup> "Electric Vehicle Charging Stations." 2010. EVsRoll.com. 14 Nov. 2011 <[http://www.evscroll.com/Electric\\_Vehicle\\_Charging\\_Stations.html](http://www.evscroll.com/Electric_Vehicle_Charging_Stations.html)>.

<sup>148</sup> "Average Energy Prices in the Washington-Baltimore Area." U.S. Bureau of Labor Statistics. 27 Sept. 2011. 11 Nov. 2011 <[http://www.bls.gov/ro3/apwb.htm#wb\\_energy\\_table1](http://www.bls.gov/ro3/apwb.htm#wb_energy_table1)>.

<sup>149</sup> Daily Fuel Gauge Report--national, state and local average prices for gasoline, diesel and E-85. 11 Nov. 2011. Oil Price Information Service (OPIS). 11 Nov. 2011 <<http://fuelgaugereport.aaa.com/?redirectto=http://fuelgaugereport.opisnet.com/index.asp>>

<sup>150</sup> "State & Urbanized Area Statistics - Our Nation's Highways - 2000." Home | Federal Highway Administration. 4 Apr. 2011. Federal Highway Administration (FHWA). 11 Nov. 2011 <<http://www.fhwa.dot.gov/ohim/onh00/onh2p11.htm>>.

<sup>151</sup> "Maryland Auto Outlook." Wwww.mdauto.org. 9 Aug. 2011. Maryland Automobile Dealers Association. 11 Nov. 2011 <<http://www.mdauto.org/admin/publications/AutoOutlookQuarter22011.pdf>>.

<sup>152</sup> "Electric Vehicle Charging Stations." 2010. EVsRoll.com. 14 Nov. 2011 <[http://www.evscroll.com/Electric\\_Vehicle\\_Charging\\_Stations.html](http://www.evscroll.com/Electric_Vehicle_Charging_Stations.html)>.

- ii. Maryland Electricity cost (in KWh)<sup>153</sup>—\$0.133 per kW/h
  - iii. Average fuel price per gallon (regular unleaded)<sup>154</sup>—\$3.61 per gallon
  - iv. Average Annual Miles Driven By Population<sup>155</sup>—13,041 miles
  - v. Annual New Vehicle Registration in Maryland (2010)<sup>156</sup>—186,759 (total for cars and light trucks)
  - vi. Average Cost per Mile for Electric Vehicles—\$0.02 per mile
  - vii. Average mile per kilowatt-hour—95.88 miles/KWh
  - viii. Average Cost to MD driver annually (in gasoline)—\$1,764.99
  - ix. Average Battery Size charge time—5.1 hours
  - x. Note: External research was conducted to construct an average price for Electric Vehicles in the US. RESI constructed this average price across the top 5 reported prices for new 2012 models of Electric Vehicles. Ford's Focus EV has yet to report an official price for their 2012 model and thus was not included in the average. Instead the Honda Fit EV was included in the top five and used to create the average price of Electric Vehicles.
- d. Maryland Transit Administration Support for Howard County Bus Project**
- i. Maryland Electricity cost (in KWh)<sup>157</sup>—\$0.133 per kW/h
  - ii. Total Miles of Routes 1 and 2 (Annual)<sup>158</sup>—779,928 annual miles
  - iii. Average Cost of Diesel Fuel<sup>159</sup>—\$3.76 per gallon
  - iv. Average Miles per gallon of Hybrid Bus<sup>160</sup>— 5.4 miles per gallon
  - v. Average miles per gallon of transit buses<sup>161</sup>—6.4 miles per gallon
  - vi. Average Cost for One Recharge Station<sup>162</sup>—\$7,872.00 annual maintenance
  - vii. Note –RESI will take into consideration that Hybrid Transit Buses have a diesel hybrid. Partial energy is derived from the ion-battery cells and from

<sup>153</sup> "Average Energy Prices in the Washington-Baltimore Area." U.S. Bureau of Labor Statistics. 27 Sept. 2011. 11 Nov. 2011 <[http://www.bls.gov/ro3/apwb.htm#wb\\_energy\\_table1](http://www.bls.gov/ro3/apwb.htm#wb_energy_table1)>.

<sup>154</sup> Daily Fuel Gauge Report--national, state and local average prices for gasoline, diesel and E-85. 11 Nov. 2011. Oil Price Information Service (OPIS). 11 Nov. 2011

<<http://fuelgaugereport.aaa.com/?redirectto=http://fuelgaugereport.opisnet.com/index.asp>

<sup>155</sup> "State & Urbanized Area Statistics - Our Nation's Highways - 2000." Home | Federal Highway Administration. 4 Apr. 2011. Federal Highway Administration (FHWA). 11 Nov. 2011

<<http://www.fhwa.dot.gov/ohim/onh00/onh2p11.htm>>.

<sup>156</sup> "Maryland Auto Outlook." Wwww.mdauto.org. 9 Aug. 2011. Maryland Automobile Dealers Association. 11 Nov. 2011 <<http://www.mdauto.org/admin/publications/AutoOutlookQuarter22011.pdf>>.

<sup>157</sup> "Average Energy Prices in the Washington-Baltimore Area." U.S. Bureau of Labor Statistics. 27 Sept. 2011. 11 Nov. 2011 <[http://www.bls.gov/ro3/apwb.htm#wb\\_energy\\_table1](http://www.bls.gov/ro3/apwb.htm#wb_energy_table1)>.

<sup>158</sup> KFH Group, Inc. "Harford County Transportation Development Plan." Harford County. June 2007. Office of Planning, Maryland Transit Administration (MTA). 14 Nov. 2011

<<http://www.harfordcountymd.gov/services/community/doc/985.pdf>>.

<sup>159</sup> Ibid.

<sup>160</sup> Allison Hybrid H 40 EP | H 50 EP. Allisontransmission.com. 2011. Allison Transmission. 14 Nov. 2011 <<http://www.allisontransmission.com/servlet/DownloadFile?Dir=publications/pubs&FileToGet=SA5983EN.pdf>>

<sup>161</sup> RITA | BTS | Table 4-15: Bus Fuel Consumption and Travel. RITA | Bureau of Transportation Statistics (BTS). Bureau of Transportation, 26 Apr. 2010. Web. 14 Nov. 2011.

<[http://www.bts.gov/publications/national\\_transportation\\_statistics/html/table\\_04\\_15.html](http://www.bts.gov/publications/national_transportation_statistics/html/table_04_15.html)>.

<sup>162</sup> "Electric Vehicle Charging Stations." 2010. EVsRoll.com. 14 Nov. 2011

<[http://www.evscroll.com/Electric\\_Vehicle\\_Charging\\_Stations.html](http://www.evscroll.com/Electric_Vehicle_Charging_Stations.html)>.

the diesel counterpart. RESI assumes that this energy distribution is equal for all intents and purposes.

**e. Clean and Efficient Strategies**

- i. Average Cost for One Recharge Station<sup>163</sup>—\$7,872.00 annual maintenance
- ii. Maryland Electricity cost (in KWh)<sup>164</sup>—\$0.133 per kW/h
- iii. Average fuel price per gallon (regular unleaded)<sup>165</sup>—\$3.61 per gallon
- iv. Average number of vehicles in downtown fleet<sup>166</sup>—5,800 vehicles
- v. Percentage of downtown fleet that are fuel efficient<sup>167</sup>—35%
- vi. Average Annual Miles Driven By Population<sup>168</sup>—13,041 miles
- vii. Average Cost per Mile for Electric Vehicles—\$0.02 per mile
- viii. Average mile per kilowatt-hour—95.88 miles/KWh
- ix. Average Cost to MD driver annually (in gasoline)—\$1,764.99
- x. Average Battery Size charge time—5.1 hours
- xi. Note: External research was conducted to construct an average price for Electric Vehicles in the US. RESI constructed this average price across the top 5 reported prices for new 2012 models of Electric Vehicles. Ford's Focus EV has yet to report an official price for their 2012 model and thus was not included in the average. Instead the Honda Fit EV was included in the top five and used to create the average price of Electric Vehicles.

**f. Baltimore City Electric Vehicles Infrastructure**

- i. Average Cost for One Recharge Station<sup>169</sup>—\$7,872.00 annual maintenance
- ii. Maryland Electricity cost (in KWh)<sup>170</sup>—\$0.133 per kW/h
- iii. Average fuel price per gallon (regular unleaded)<sup>171</sup>—\$3.61 per gallon

<sup>163</sup> "Electric Vehicle Charging Stations." 2010. EVsRoll.com. 14 Nov. 2011

<[http://www.evscroll.com/Electric\\_Vehicle\\_Charging\\_Stations.html](http://www.evscroll.com/Electric_Vehicle_Charging_Stations.html)>.

<sup>164</sup> "Average Energy Prices in the Washington-Baltimore Area." U.S. Bureau of Labor Statistics. 27 Sept. 2011. 11 Nov. 2011 <[http://www.bls.gov/ro3/apwb.htm#wb\\_energy\\_table1](http://www.bls.gov/ro3/apwb.htm#wb_energy_table1)>.

<sup>165</sup> Daily Fuel Gauge Report--national, state and local average prices for gasoline, diesel and E-85. 11 Nov. 2011. Oil Price Information Service (OPIS). 11 Nov. 2011

<<http://fuelgaugereport.aaa.com/?redirectto=http://fuelgaugereport.opisnet.com/index.asp>>.

<sup>166</sup> "Baltimore Ready to Install 9 Electric Vehicle Charging Stations." General Services / Press Releases. 2010. City of Baltimore, Maryland - Official Website. 14 Nov. 2011

<<http://baltimorecity.gov/Government/AgenciesDepartments/GeneralServices/PressReleases/tabid/1028/articleType/ArticleView/articleId/1143/Baltimore-Ready-to-Install-9-Electric-Vehicle-Charging-Stations.aspx>>.

<sup>167</sup> Ibid.

<sup>168</sup> "State & Urbanized Area Statistics - Our Nation's Highways - 2000." Home | Federal Highway Administration. 4 Apr. 2011. Federal Highway Administration (FHWA). 11 Nov. 2011

<<http://www.fhwa.dot.gov/ohim/onh00/onh2p11.htm>>.

<sup>169</sup> "Electric Vehicle Charging Stations." 2010. EVsRoll.com. 14 Nov. 2011

<[http://www.evscroll.com/Electric\\_Vehicle\\_Charging\\_Stations.html](http://www.evscroll.com/Electric_Vehicle_Charging_Stations.html)>.

<sup>170</sup> "Average Energy Prices in the Washington-Baltimore Area." U.S. Bureau of Labor Statistics. 27 Sept. 2011. 11 Nov. 2011 <[http://www.bls.gov/ro3/apwb.htm#wb\\_energy\\_table1](http://www.bls.gov/ro3/apwb.htm#wb_energy_table1)>.

<sup>171</sup> Daily Fuel Gauge Report--national, state and local average prices for gasoline, diesel and E-85. 11 Nov. 2011. Oil Price Information Service (OPIS). 11 Nov. 2011

<<http://fuelgaugereport.aaa.com/?redirectto=http://fuelgaugereport.opisnet.com/index.asp>>.

- iv. Average Annual Miles Driven By Population<sup>172</sup>—13,041 miles
  - v. Annual New Vehicle Registration in Maryland (2010)<sup>173</sup>—186,759 (total for cars and light trucks)
  - vi. Average Cost per Mile for Electric Vehicles—\$0.02 per mile
  - vii. Average mile per kilowatt-hour—95.88 miles/KWh
  - viii. Average Cost to MD driver annually (in gasoline)—\$1,764.99
  - ix. Average Battery Size charge time—5.1 hours
  - x. Note: External research was conducted to construct an average price for Electric Vehicles in the US. RESI constructed this average price across the top 5 reported prices for new 2012 models of Electric Vehicles. Ford's Focus EV has yet to report an official price for their 2012 model and thus was not included in the average. Instead the Honda Fit EV was included in the top five and used to create the average price of Electric Vehicles.
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
- a. Vehicle-to-Grid (V2G)**
    - i.  $600 [(10,874 \text{ hybrids registered in the state of Maryland} / 186,759 \text{ new vehicle registrations (light vehicles) annually in Maryland}) * [(186,759 \text{ new vehicle registrations (light vehicles) annually in Maryland})]=\text{average possible purchases of electric vehicles in the state of Maryland}]$
    - ii.  $1,314,872 [(6 \text{ kilowatts produced by an electric vehicle} * 600 \text{ average possible purchase of electric vehicles} * 365 \text{ days a year})]=\text{average possible kilowatts introduced into grid by electric vehicles}]$
    - iii.  $418,798,559,276 [(1,469 \text{ trillion BTUs} * 0.000293071 \text{ kilowatt hours for 1 BTU})]=\text{average consumption of kilowatts in Maryland annually}]$
    - iv.  $\$55,700,208,383.72 [(\$0.133 \text{ average cost per kilowatt hour} * 418,798,559 \text{ average consumption of kilowatt hours in Maryland annually})]=\text{average annual cost of consumption of kilowatt hours in Maryland}]$
    - v.  $418,797,244,404 [(418,798,559 \text{ average consumption of kilowatts in Maryland} - 1,314,872 \text{ contribution of kilowatts from electric vehicles annually})]=\text{annual consumption of kilowatt hours less contribution from EVs}]$
    - vi.  $\$55,700,033,505.75 [(417,483,687 \text{ annual consumption of kilowatt hours less contribution from EVs} * \$0.133 \text{ average cost per kilowatt hour})]=\text{average cost of kilowatt consumption annually in Maryland less the kilowatt contribution of EVs}]$
    - vii.  $\$174,877.97 [(\$55,700,208.38 \text{ annual consumption costs of kilowatts in Maryland} - \$55,525,330.41 \text{ annual consumption costs of kilowatts in Maryland less the EV contribution})]=\text{annual savings from EVs in V2G}]$

<sup>172</sup> "State & Urbanized Area Statistics - Our Nation's Highways - 2000." Home | Federal Highway Administration. 4 Apr. 2011. Federal Highway Administration (FHWA). 11 Nov. 2011 <<http://www.fhwa.dot.gov/ohim/onh00/onh2p11.htm>>.

<sup>173</sup> "Maryland Auto Outlook." Wwww.mdauto.org. 9 Aug. 2011. Maryland Automobile Dealers Association. 11 Nov. 2011 <<http://www.mdauto.org/admin/publications/AutoOutlookQuarter22011.pdf>>.

- viii. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$39,446.16 [(1,314,872 contribution of kilowatts from electric vehicles annually / 1000 kilowatts per one megawatt) \* [(\$30.00 per megawatt hour)]=average annual savings to electric companies

**b. Electric Vehicles**

- i. 600 [(10,874 hybrids registered in the state of Maryland / 186,759 new vehicle registrations (light vehicles) annually in Maryland) \* [(186,759 new vehicle registrations (light vehicles) annually in Maryland)]=average possible purchases of electric vehicles in The State of Maryland
- ii. \$1.80 [(5.1 average battery charge time \* \$0.133 per KW/h average price per kilowatt-hour in Maryland)]=average cost to fill a tank to electric vehicle consumer
- iii. \$0.02 [(\$1.80 average cost to fill tank of EV / 95.88 average miles per tank)]=average cost per mile of electric vehicle
- iv. \$244.28 [(\$0.02 average cost per mile of EV \* 13,041 miles driven annually by Maryland residents)]=average annual cost to drive an EV in Maryland
- v. \$1,617.44 [(\$1,861.72 cost to drive annually with gasoline powered vehicles - \$244.28 cost to drive an EV annually in MD)]=annual savings to those that purchase EV
- vi. \$970,460.82 [(\$1,617.44 annual savings to EV owners \* 600 average annual possible purchase of EVs in Maryland)]=average annual savings to EV car owners in Maryland
- vii. \$409,344.00 [(\$7,872.00 average cost of maintenance for one recharge station annually \* 65 charge stations in Maryland—20% tax credit)]=annual cost to maintain new charge stations
- viii. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$561,116.82 [(\$970,460.82 average annual fuel savings to EV car owners - \$409,344.00 annual maintenance fees of 65 new recharge stations)]=average annual savings to Maryland EV owners net convenience fees of recharge stations

**c. Maryland Electric Vehicles Initiatives**

- i. 600 [(10,874 hybrids registered in the state of Maryland / 186,759 new vehicle registrations (light vehicles) annually in Maryland) \* [(186,759 new vehicle registrations (light vehicles) annually in Maryland)]=average possible purchases of electric vehicles in the state of Maryland
- ii. \$1.80 [(5.1 average battery charge time \* \$0.133 per KW/h average price per kilowatt-hour in Maryland)]=average cost to fill a tank to electric vehicle consumer
- iii. \$0.02 [(\$1.80 average cost to fill tank of EV / 95.88 average miles per KW/h)]=average cost per mile of electric vehicle
- iv. \$244.28 [(\$0.02 average cost per mile of EV \* 13,041 miles driven annually by Maryland residents)]=average annual cost to drive an EV in Maryland

- v.  $\$1,617.44 [(\$1,861.72 \text{ cost to drive annually with gasoline powered vehicles} - \$244.28 \text{ cost to drive an EV annually in MD}) = \text{annual savings to those that purchase EV}$
- vi.  $623\text{—Consumer Spending—Gasoline and oil, } 78\text{—Consumption Reallocation—All Consumption Categories—}\$970,464 [(\$1,617.44 \text{ annual savings to EV owners} * 600 \text{ average annual possible purchase of EVs in Maryland}) = \text{average annual savings to EV car owners in Maryland}$
- vii.  $623\text{—Consumer Spending—Gasoline and oil, } 78\text{—Consumption Reallocation—All Consumption Categories—}\$511,680.00 [(\$7,872.00 \text{ average cost of maintenance for one recharge station annually} * 65 \text{ charge stations in Maryland}) = \text{annual cost to maintain new charge stations}$

**d. Maryland Transit Administration Support for Howard County Bus Project**

- i.  $\$474,554.14 [(779,928 \text{ average annual miles of Routes 1 and 2} / 6.4 \text{ average miles per gallon of transit buses}) * [(\$3.89 \text{ per gallon of diesel fuel}) = \text{average cost annually of one diesel bus for Routes 1 and 2}$
- ii.  $\$1,423,662.41 [(\$474,554.14 \text{ average annual cost of one diesel bus for Routes 1 and 2} * 3 \text{ buses to be replaced}) = \text{average cost annually of three diesel bus for Routes 1 and 2}$
- iii.  $\$9,604.67 [(779,928 \text{ average annual miles of Routes 1 and 2} / 5.4 \text{ average miles per gallon of transit bus} * .50 \text{ energy distribution}) * [\$0.133 \text{ Maryland energy cost per kilowatt hour}) = \text{average annual cost of new hybrid bus for Routes 1 and 2 (Electricity)}$
- iv.  $\$281,217.36 [(779,928 \text{ average annual miles of Routes 1 and 2} / 5.4 \text{ average miles per gallon of transit bus} * .50 \text{ energy distribution}) * [\$3.89 \text{ per gallon of diesel fuel}) = \text{average annual cost of new hybrid bus for Routes 1 and 2 (Diesel)}$
- v.  $\$888,210.09 [((\$9,604.67 \text{ average cost in electric} + \$281,217.36 \text{ average cost in diesel fuel for Routes 1 and 2 for a single bus}) * 3 \text{ new buses}) + [\$7,872.00 \text{ average cost of maintenance for one recharge station annually} * 2) = \text{average annual costs of 3 new hybrid bus and 2 recharge stations}$
- vi.  $623\text{—State Government Spending—}\$580,010.33 [(\$1,423,662.41 \text{ average annual cost for three diesel buses on Routes 1 and 2} - \$888,210.09 \text{ annual costs for 3 new hybrid buses and 2 recharge stations for Routes 1 and 2}) = \text{Overall Average Annual Savings from replacing three diesel buses and adding two recharge stations}$

**e. Clean and Efficient Strategies**

- i.  $2,030 [(5,8000 \text{ total vehicles registered with the downtown fleet} * 35\% \text{ are fuel efficient vehicles}) = \text{average possible purchases of electric vehicles for downtown fleet}$
- ii.  $\$1.80 [(5.1 \text{ average battery charge time} * \$0.133 \text{ per KW/h average price per kilowatt-hour in Maryland}) = \text{average cost to fill a tank to electric vehicle}$
- iii.  $\$0.02 [(\$1.80 \text{ average cost to fill tank of EV} / 95.88 \text{ average miles per KW/h}) = \text{average cost per mile of electric vehicle}$

- iv. \$244.28 [(\$0.02 average cost per mile of EV \* 13,041 miles driven annually by Maryland residents)]=average annual cost to drive an EV in Maryland
- v. \$1,617.44 [(\$1,861.72 cost to drive annually with gasoline powered vehicles - \$244.28 cost to drive an EV annually in MD)]=annual savings attributed to purchase of an Electric Vehicles
- vi. \$3,283,392.44 [(\$1,617.44 annual savings to EV owners \* 2,030 possible purchase of EVs for downtown fleet)]=average annual savings in gas for EV fleet
- vii. \$15,744.00 [(\$7,872.00 average cost of maintenance for one recharge station annually \* 2 charge stations in Maryland)]=annual cost to maintain new charge stations
- viii. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$3,071,327.40 [(\$3,087,071.40 average annual fuel savings to EV cars - \$15,744.00 annual maintenance fees of 2 new recharge stations)]=average annual savings to Downtown Fleet

**f. Baltimore City Electric Vehicles Infrastructure**

- i. 600 [(10,874 hybrids registered in the state of Maryland / 186,759 new vehicle registrations (light vehicles) annually in Maryland)] \* [(186,759 new vehicle registrations (light vehicles) annually in Maryland)]=average possible purchases of electric vehicles in the state of Maryland
- ii. \$1.80 [(5.1 average battery charge time \* \$0.133 per KW/h average price per kilowatt-hour in Maryland)]=average cost to fill a tank to electric vehicle consumer
- iii. \$0.02 [(\$1.80 average cost to fill tank of EV / 95.88 average miles per KW/h)]=average cost per mile of electric vehicle
- iv. \$244.28 [(\$0.02 average cost per mile of EV \* 13,041 miles driven annually by Maryland residents)]=average annual cost to drive an EV in Maryland
- v. \$1,617.44 [(\$1,861.72 cost to drive annually with gasoline powered vehicles - \$244.28 cost to drive an EV annually in MD)]=annual savings to those that purchase EV
- vi. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$970,460.82 [(\$1,617.44 annual savings to EV owners \* 600 average annual possible purchase of EVs in Maryland)]=average annual savings to EV car owners in Maryland
- vii. 623—Consumer Spending—Other motor vehicles, 78—Consumption Reallocation—All Consumption Categories—\$62,976.00 [(\$7,872.00 average cost of maintenance for one recharge station annually \* 8 charge stations in Maryland)]=annual cost to maintain new charge stations

- 5. Input savings by sector into REMI model and run impacts.
- 6. Export impacts and analyze.

### 3.2.12 Low-Emitting Vehicles Initiatives

#### Investment Phase

1. Determine relevant REMI sectors for each program under the policy.
  - a. **Howard Transit Paratransit Fleet Replacement Vehicles**
    - i. 63—State Government Spending
  - b. **Clean and Efficient Strategies**
    - i. 63—State Government Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Howard Transit Paratransit Fleet Replacement Vehicles**
    - i. 2010: \$1,600,000
    - ii. 2011—2020: \$400,000 per year
  - b. **Clean and Efficient Strategies**
    - i. *No Investment Costs Specified*
3. Input investment by sector into REMI model and run impacts.
4. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI sectors.
  - a. **Howard Transit Paratransit Fleet Replacement Vehicles**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All consumption categories
  - b. **Clean and Efficient Strategies**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All consumption categories
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Howard Transit Paratransit Fleet Replacement Vehicles**
    - i. Number of Sedans=4
    - ii. Number of Buses=1
  - b. **Clean and Efficient Strategies**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Howard Transit Paratransit Fleet Replacement Vehicles - We have calculated the savings in dollars for Howard County Transportation**
    - i. Average Savings for EV=\$1,520
    - ii. Vehicles Miles for ADA=1,545
    - iii. Cost of Diesel Fuel=3.76
    - iv. Average Miles per gallon of Diesel Sedan=25.5 mpg
    - v. Average cost of EV per miles=\$0.02
    - vi. Average MPG of Hybrid Buses=5.4 mpg
    - vii. Average MPG of Diesel Buses = 6.1 mpg
    - viii. Cost for Diesel Bus to Travel ADA Route Annually - \$907.54

- b. Clean and Efficient Strategies**
    - i. Clean and Efficient Strategies (all reductions)<sup>174</sup>**
      1. Baltimore City 18.9 tons
        2. Howard County 4.98 tons
        3. JHU 1.992 tons
        4. Anne Arundel Schools 15.22 tons
      - ii. Avg. price per gallon of fuel =3.43
  4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
    - a. Howard Transit Paratransit Fleet Replacement Vehicles**
    - i. Average Annual Savings = \$ 235.65 (Average Cost of Diesel Sedan (Gas) - Average cost of EV for ADA route)
      - ii. Average Annual Savings from 3 sedans=\$706.95 (Average Annual Savings\*3)
      - iii. Average Miles per gallon of Bus=6.4
      - iv. Average Cost of Diesel Bus=938.92 [(Vehicles Miles for ADA/Average Miles per gallon of Bus)\* (Cost of Diesel Fuel)]
      - v. Average MPG of Hybrid Buses=5.4
      - vi. Average Gallons of Fuel Needed =286.0648148 (Vehicles Miles for ADA/Average MPG of Hybrid Buses)
      - vii. Average Cost of Hybrid Buses for Electricity=\$19.02
      - viii. Average Cost of Hybrid Buses for Diesel = \$556.39 [(Cost of Diesel Fuel\*Average Gallons of Fuel Needed)/2]
      - ix. Average Overall Annual Cost of Hybrid Bus=\$575.42 (Average Cost of Hybrid Buses for Electricity + Average Cost of Hybrid Buses for Diesel)
      - x. Average Annual Savings from Hybrid Bus=\$350.72 (Average Cost of Diesel Bus - Average Overall Annual Cost of Hybrid Bus)
      - xi. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$1,057.67 [(Average Annual Savings from Hybrid Bus+ Average Annual Savings from 3 sedans)]= Total Savings Annually from Policy
    - b. Clean and Efficient Strategies**
    - i. Total reduction of CO<sub>2</sub>=0.0039 mmt
      - ii. \$1,600,000 [0.0039 \* 405,821,147.4 conversion]=Total value of reduction
5. Input savings by sector into REMI model and run impacts.
6. Export impacts and analyze.

### 3.2.13 Evaluating the GHG Emissions Impacts from Major Projects and Plans

*This policy was omitted from the analysis.*

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<sup>174</sup> "U.S. EPA Sensitive Population Grant for the City of Baltimore and the City of Annapolis (Fire Trucks and Ambulances)." Maryland Department of the Environment (MDE). 14 Nov. 2011  
<[http://www.mde.state.md.us/programs/Air/MobileSources/DieselVehicleInformation/DieselRetrofitProjects/Pages/balto\\_annapcity\\_retrofit.aspx](http://www.mde.state.md.us/programs/Air/MobileSources/DieselVehicleInformation/DieselRetrofitProjects/Pages/balto_annapcity_retrofit.aspx)>.

### 3.2.14 Airport Initiatives

#### Investment Phase

*No investment costs were specified by the agency for this policy.*

#### Operation Phase

1. Determine relevant REMI sectors.
  - a. **Compressed Natural Gas Buses**
    - i. 63—State Government Spending
  - b. **Air Emissions Reductions**
    - i. 63—State Government Spending
  - c. **BWI Energy Audit**
    - i. 63—State Government Spending
  - d. **BWI Utility Master Plan**
    - i. 63—State Government Spending
  - e. **BWI Energy Efficiency**
    - i. 63—State Government Spending
  - f. **Enhanced Access to BWI by Other Travel Modes**
    - i. 63—State Government Spending
  - g. **BWI's Periodic Air Quality Assessments**
    - i. 63—State Government Spending
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Compressed Natural Gas Buses**
  - b. **Air Emissions Reductions**
  - c. **BWI Energy Audit**
  - d. **BWI Utility Master Plan**
  - e. **BWI Energy Efficiency**
  - f. **Enhanced Access to BWI by Other Travel Modes**
  - g. **BWI's Periodic Air Quality Assessments**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Compressed Natural Gas Buses**
    - i. Average Cost of Fuel—\$3.61 per gallon
  - b. **Air Emissions Reductions**
    - i. Average Cost of Fuel—\$3.61 per gallon
  - c. **BWI Energy Audit**
    - i. Average Cost of Fuel—\$3.61 per gallon
  - d. **BWI Utility Master Plan**
    - i. Average Cost of Fuel—\$3.61 per gallon
  - e. **BWI Energy Efficiency**
    - i. Average Cost of Fuel—\$3.61 per gallon
  - f. **Enhanced Access to BWI by Other Travel Modes**
    - i. Average Cost of Fuel—\$3.61 per gallon
  - g. **BWI's Periodic Air Quality Assessments**
    - i. Average Cost of Fuel—\$3.61 per gallon

4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **Compressed Natural Gas Buses**
    - i. 63—State Government Spending—\$2,509,315.04 [.006 mmt CO<sub>2</sub>e \* \$405,821,147.4 conversion]=Value of fuel saved at BWI per year from 2012—2020
  - b. **Air Emissions Reductions**
    - i. 63—State Government Spending—\$2,509,315.04 [.006 mmt CO<sub>2</sub>e \* \$405,821,147.4 conversion]=Value of fuel saved at BWI per year from 2012—2020
  - c. **BWI Energy Audit**
    - i. 63—State Government Spending—\$2,509,315.04 [.006 mmt CO<sub>2</sub>e \* \$405,821,147.4 conversion]=Value of fuel saved at BWI per year from 2012—2020
  - d. **BWI Utility Master Plan**
    - i. 63—State Government Spending—\$2,509,315.04 [.006 mmt CO<sub>2</sub>e \* \$405,821,147.4 conversion]=Value of fuel saved at BWI per year from 2012—2020
  - e. **BWI Energy Efficiency**
    - i. 63—State Government Spending—\$2,509,315.04 [.006 mmt CO<sub>2</sub>e \* \$405,821,147.4 conversion]=Value of fuel saved at BWI per year from 2012—2020
  - f. **Enhanced Access to BWI by Other Travel Modes**
    - i. 63—State Government Spending—\$2,509,315.04 [.006 mmt CO<sub>2</sub>e \* \$405,821,147.4 conversion]=Value of fuel saved at BWI per year from 2012—2020
  - g. **BWI's Periodic Air Quality Assessments**
    - i. 63—State Government Spending—\$2,509,315.04 [.006 mmt CO<sub>2</sub>e \* \$405,821,147.4 conversion]=Value of fuel saved at BWI per year from 2012—2020
5. Input savings by sector into REMI model and run impacts.
6. Export impacts and analyze.

### 3.2.15 Port Initiatives

#### Investment Phase

1. Determine relevant REMI sectors for each program under the policy.
  - a. **Port of Baltimore Initiatives**
    - i. 63—State Government Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Port of Baltimore Initiatives**
    - i. 2010: \$14,400
3. Input investment by sector into REMI model and run impacts.
4. Export impacts and analyze.

## Operation Phase

1. Determine relevant REMI sectors.
  - a. **Port of Baltimore Initiatives**
    - i. 63—State Government Spending
2. Determine part of program to be affected by savings (from 6.2.11 write-up).
  - a. **Port of Baltimore Initiatives**
    - i. Retrofit tire gantry cranes with Diesel Oxidation Catalysts
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Port of Baltimore Initiatives**
    - i. Total Tire Gantry Cranes to be Retrofitted<sup>175</sup>—12 tire gantry cranes
    - ii. Average cost of Diesel Oxidation Catalysts Retrofit<sup>176</sup>—\$1,200.00 per retrofitted vehicle
    - iii. Reductions resulting from DOC retrofit<sup>177</sup>—20% air particles
    - iv. Fees associated with Title V Permit for emissions<sup>178</sup>—\$52.23 per ton + \$200 base fee
    - v. Useful Life of a Rubber Tire Gantry<sup>179</sup>—19 years per RTG
    - vi. Emissions from Rubber Tire Gantry (average annually)<sup>180</sup>—875 tons of pollutants per RTG
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **Port of Baltimore Initiatives**
    - i.  $\$757.89 [(12 \text{ tire gantry cranes} * \$1,200.00 \text{ per retrofitted vehicle}) / [(19 \text{ number of useful years})]=\text{annual cost incurred per retrofit of RTGs}$
    - ii.  $\$548,615.00 [(875 \text{ tons of pollutants from RTGs on average a year} * \$52.23 \text{ per ton}) + \{(\$200.00 \text{ base fee of Title V permit}) * [(12 \text{ cranes in operation at Seagirt})]=\text{annual average cost of permit from RTGs}$
    - iii.  $8,400 [(875 \text{ tons of pollutants from RTGs on average a year} * 20\% \text{ reduction in RTG pollution due to retrofit} * 12 \text{ cranes})]=\text{average reduction in tons of air pollutants from DOC retrofit}$

<sup>175</sup> Port of Baltimore. 2009. Ports America - Home. PortsAmerica.com 11 Nov. 2011 <<http://www.portsamerica.com/baltimore-maryland.html>>.

<sup>176</sup> "U.S. EPA Sensitive Population Grant for the City of Baltimore and the City of Annapolis (Fire Trucks and Ambulances)." Maryland Department of the Environment (MDE). 14 Nov. 2011 <[http://www.mde.state.md.us/programs/Air/MobileSources/DieselVehicleInformation/DieselRetrofitProjects/Pages/balto\\_annapcity\\_retrofit.aspx](http://www.mde.state.md.us/programs/Air/MobileSources/DieselVehicleInformation/DieselRetrofitProjects/Pages/balto_annapcity_retrofit.aspx)>.

<sup>177</sup> Green Port of Baltimore. Air Quality. Maryland Department of Transportation; Port Administration. 11 Nov. 2011 <<http://mpa.maryland.gov/content/air-quality.php>>.

<sup>178</sup> MARC Parking Details | Maryland Transit Administration. Home | Maryland Transit Administration. Nov. 2011. Maryland Transit Administration (MTA). 14 Nov. 2011 <<http://mta.maryland.gov/marc-parking-details>>.

<sup>179</sup> Starcrest Consulting Group, LLC. "Rubber Tired Gantry (RTG) Crane Load Factor Study." Nov. 2009. Port of Los Angeles; Port of Long Beach. 14 Nov. 2011 <<http://www.polb.com/civica/filebank/blobload.asp?BlobID=6915>>.

<sup>180</sup> New Hybrid Crane to Reduce the Carbon Footprint. About MAERSK. 31 March 2011. MAERSK. 11 Nov. 2011. <<http://www.maersk.com/AboutMaersk/News/Pages/20110331-154630.aspx>>.

- iv. \$439,489.89 [((8,400 tons on average of air pollutants from RTG retrofitted \* \$52.23 per ton of pollutant) + \$200.00 base fee of permit)]=average annual cost of permit after retrofitting of twelve cranes
  - v. \$440,247.79 [(\$438,732.00 average cost of new permit after retrofit + (\$63.16 per crane for cost of retrofit annually)]=average annual cost of reduction in emissions
  - vi. 63—State Government Spending—\$108,367.21 [(\$548,615.00 before retrofit permit costs - \$440,247.79 average annual costs (permit and depreciating costs of retrofit)]=annual savings to industry
5. Input savings by sector into REMI model and run impacts.
  6. Export impacts and analyze.

### 3.2.16 Freight and Freight Rail Strategies

#### Investment Phase

5. Determine relevant REMI sectors for each program under the policy.
  - a. **Freight and Freight Rail Strategies**
    - i. 63—State Government Spending
6. Determine overall cost of policy implementation for each program under the policy.
  - b. **Freight and Freight Rail Strategies**
    - i. 2010: \$14,400
7. Input investment by sector into REMI model and run impacts.
8. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI sectors.
  - a. **Auxiliary Power Units for Existing Locomotives**
    - i. 63—State Government Spending
    - ii. 623—Consumer Spending—Gasoline and oil
    - iii. 78—Consumption Reallocation—All Consumption Categories
2. Determine part of program to be affected by savings (from 6.2.3 write-up).
  - a. **Auxiliary Power Units for Existing Locomotives**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Auxiliary Power Units for Existing Locomotives**
    - i. Marginal Savings per Year<sup>181</sup>=\$1,339
    - ii. Number of Locomotives with CSX<sup>182</sup>=20
  - b. **Technology Advances for Non-highway Vehicles**
    - i. Avg. Contribution in 2006 of CO2 Emissions from US<sup>183</sup>=55,400,000 tons

<sup>181</sup> Truck and Locomotive Idling Solutions. South East Diesel Collaborative, 25 June 2008. Web. 14 Nov. 2011. <<http://www.southeastdiesel.org/Presentations%20for%203rd%20Annual%20Meeting/Day%202/Idle%20Reduct%20Tech-%20anthony%20erb.pdf>>.

<sup>182</sup> Fuel Efficiency. CSX Corporation. Web. 11 Nov. 2011.

<<http://www.csx.com/index.cfm/about-csx/projects-and-partnerships/fuel-efficiency/>>.

<sup>183</sup> Pathways to Reduced Transportation CO2 in the Year 2050. Cornell University. 11 Nov. 2011

<<http://www.cee.cornell.edu/academics/graduate/loader.cfm?csModule=security/getfile&PageID=84226>>.

- ii. Avg. Rail Miles in the US<sup>184</sup>=140,000
  - iii. Avg. Rail Miles in Maryland<sup>185</sup>=759
  - iv. Avg. Potential Fuel Reduction of Elect Loco<sup>186</sup>=0.625
  - v. Average Reduction of Emissions from Program—30%
  - vi. Avg. Cost of a gallon of gas in MD=\$3.61 per gallon
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
    - a. **Auxiliary Power Units for Existing Locomotives**
      - i. 63—State Government Spending—\$26,780 [(\$1,339 Marginal Savings per Year \* 20 Number of Locomotives with CSX)]=Average Annual Savings Associated with this program
  5. Input savings by sector into REMI model and run impacts.
  6. Export impacts and analyze.

### 3.2.17 Federal Renewable Fuel Standard

#### Investment Phase

*No investment costs were specified by the agency for this policy.*

#### Operation Phase

1. Determine relevant REMI sectors.
  - a. **Federal Renewable Fuel Standard**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Federal Renewable Fuel Standard**
    - i. Reduction=240,000 metric tons (.24\*1,000,000)
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Federal Renewable Fuel Standard**
    - i. Cost of Avg. Gallon of Gas=\$3.61 per gallon
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **Federal Renewable Fuel Standard**
    - i. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$12,147,306.40 [(0.24 mmt CO<sub>2</sub>e \* 405,821,147.4)/8]=Total value of fuel saved per year from 2013—2020
5. Input savings by sector into REMI model and run impacts.

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<sup>184</sup> Rail Track Mileage and Number of Class I Rail Carriers, United States, 1830-2008. The Geography of Transport Systems. Web. 14 Nov. 2011.

<<http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/usrail18402003.html>>.

<sup>185</sup> Freight Railroads in Maryland. Association of American Railroads. 2009. Web. 11 Nov. 2011.

<<http://www.aar.org/Railroads-States/Maryland-2009.pdf>>.

<sup>186</sup> Pathways to Reduced Transportation CO<sub>2</sub> in the Year 2050. Cornell University. 11 Nov. 2011

<<http://www.cee.cornell.edu/academics/graduate/loader.cfm?csModule=security/getfile&PageID=84226>>.

6. Export impacts and analyze.

### 3.2.18 CAFE Standards: Model Years 2008-2011

#### Investment Phase

*No investment costs were specified by the agency for this policy.*

#### Operation Phase

1. Determine relevant REMI sectors.
  - a. **CAFE Standards: Model Years 2008-2011**
    - i. 623—Consumer Spending—Gasoline and oil
    - ii. 78—Consumption Reallocation—All Consumption Categories
2. Determine part of program to be affected by savings (from 6.2.6 write-up).
  - a. **CAFE Standards: Model Years 2008-2011**
    - i. Raise MPG standards for all new light vehicles to 27.5 mpg by 2011
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **CAFE Standards: Model Years 2008-2011**
    - i. By 2011 New MPG<sup>187</sup>=27.3 mpg
    - ii. Average Annual Miles Driven By Population<sup>188</sup>=13,041
    - iii. Avg. Price of Gas=\$3.61
    - iv. Previous Ruling on CAFE Standards<sup>189</sup>=22.5 mpg
    - v. Average Annual Miles Driven By Population<sup>190</sup>=13,041
    - vi. New Vehicle Registrations in MD=2,700 courtesy of MVA
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **CAFE Standards: Model Years 2008-2011**
    - i. Annual Gallons of Gas Used=477.6923077 (By 2011 New MPG/ Average Annual Miles Driven By Population)
    - ii. Average Cost to MD Driver Under new CAFE=\$1,723.39 (Annual Gallons of Gas Used\* Avg. Price of Gas)
    - iii. Annual Gallons of Gas Used Under old CAFE=579.6 (Average Annual Miles Driven By Population/ Previous Ruling on CAFE Standards)
    - iv. Average price of gas today=3.61
    - v. Cost to Drivers today under old CAFE=\$2,091.05 (Annual Gallons of Gas Used Under old CAFE\*average price of gas)
    - vi. 623—Consumer Spending—Gasoline and oil, 78—Consumption Reallocation—All Consumption Categories—\$5,645,840.13 (Cost to

<sup>187</sup> “Average Fuel Economy Standards for Light Trucks.” Department of Transportation. 14 Nov. 2011  
<<http://www.nhtsa.gov/DOT/NHTSA/Rulemaking/Rules/Associated%20Files/2006FinalRule.pdf>>

<sup>188</sup> "State & Urbanized Area Statistics - Our Nation's Highways - 2000." Home | Federal Highway Administration. 4 Apr. 2011. Federal Highway Administration (FHWA). 11 Nov. 2011  
<<http://www.fhwa.dot.gov/ohim/onh00/onh2p11.htm>>.

<sup>189</sup> “Average Fuel Economy Standards for Light Trucks.” Department of Transportation. 14 Nov. 2011  
<<http://www.nhtsa.gov/DOT/NHTSA/Rulemaking/Rules/Associated%20Files/2006FinalRule.pdf>>

<sup>190</sup> Ibid.

Drivers today under old CAFE\* New Vehicle Registrations in MD)=  
Annual Savings from New CAFE Standards

5. Input savings by sector into REMI model and run impacts.
6. Export impacts and analyze.

### 3.2.19 Promoting Hybrid and Electric Vehicles

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. Promoting Hybrid and Electric Vehicles**
    - i. 63—State Government Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. Promoting Hybrid and Electric Vehicles**
    - i. \$110,000 annually (provided by MEA)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. Promoting Hybrid and Electric Vehicles**
    - i. 100% spent by government on administrative costs and oversight
4. Input costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI PI+ sectors.
  - a. Promoting Hybrid and Electric Vehicles**
    - i. 641—Consumer spending (gas)
    - ii. 78—Consumption Reallocation
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. Promoting Hybrid and Electric Vehicles**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. Promoting Hybrid and Electric Vehicles**
    - i. Total Hybrids registered in Maryland=10,874 (MDOT provided)
    - ii. Average Annual Savings to Drive an EV (from 3.2.11)=\$1,520.73
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. Electric Vehicle Infrastructure Program**
    - i. 641—\$16,536,361.76 [(10,874 Total Hybrids Registered in Maryland \* \$1,520.73 Average Annual Savings to Drive an EV)]=Average Savings to all Hybrid Owners in Maryland
    - ii. 78—\$16,536,361.76 [(reallocation of savings across all other consumption categories)]
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.2.20 Pay-as-You-Drive (PAYD) Insurance

#### Investment Phase

No investment costs were specified by the agency for this policy.

#### Operation Phase

1. Determine relevant REMI PI+ sectors.
  - a. **Voluntary Efforts to Promote Pay as Your Drive Insurance**
    - i. 648—Consumer spending (auto insurance)
    - ii. 78—Consumption reallocation (across all categories)
2. Determine part of program to be affected by savings (strategy write-up).
  - a. **Voluntary Efforts to Promote Pay as Your Drive Insurance**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Voluntary Efforts to Promote Pay as Your Drive Insurance**
    - i. MD Population age 18 and older<sup>191</sup>—4,481,657
    - ii. Baltimore City Population age 18 and older<sup>192</sup>—485,828
    - iii. Progressive 2011 market share—5.72% (data provided by MIA)
    - iv. Total employed and living in Baltimore City<sup>193</sup>—101,968
    - v. Average annual premium to Baltimore City residents for car insurance—\$4,074
    - vi. Average savings from PAYD—10% (Progressive’s website)
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **Voluntary Efforts to Promote Pay as Your Drive Insurance**
    - i. 10.8% [(485,828 Baltimore City population age 18 or older / 4,481,657 MD population age 18 or older)]=percentage of potential insurance holders in Baltimore City
    - ii. 256,351 [(485,828 MD population age 18 or older \* 5.72% market share of Progressive members in MD)]=Potential number of Progressive customers in Maryland
    - iii. 27,789 [(256,351 potential number of Progressive customers in Maryland \* 10.8% percentage of potential insurance holder in Baltimore City)]=Number of potential progressive clients residing in Baltimore City
    - iv. 0.6% [(27,789 number of potential progressive clients residing in Baltimore City / 4,481,657 MD population age 18 or older)]=percentage of those that are insured by progressive in Maryland residing in Baltimore City
    - v. 632 [(101,968 total employed and living in Baltimore City \* 0.6% percentage of those that are insured by Progressive in Maryland residing

<sup>191</sup> United States Census Bureau, “ACS Demographic and Housing Estimates: 2010 American Community Survey 1-Year Estimates,” *American FactFinder*, (Maryland and Baltimore City, Maryland), accessed October 17, 2012.

<sup>192</sup> Ibid.

<sup>193</sup> United States Census Bureau’s Center for Economic Studies, “OnTheMap,” *Longitudinal Employer-Household Dynamics*, accessed October 17, 2012.

- in Baltimore City)] = Number of potential Progressive members in Baltimore City that may take advantage of PAYD
  - vi.  $\$407 [(\$4,074 \text{ average annual premium paid by Baltimore City residents for car insurance} * 10\% \text{ discount on average for PAYD consumers through Progressive})]$  = Annual premium savings to consumers using PAYD
  - vii.  $\$257,577 [(632 \text{ number of potential Progressive members in Baltimore City that may take advantage of PAYD} * \$407 \text{ average annual premium savings to consumers using PAYD})]$  = Average annual savings from PAYD to Maryland residents
  - viii. 648— $\$257,577$  savings to Maryland residents from PAYD
  - ix. 78— $\$257,577$  reallocation of savings across other consumption categories
5. Input savings/costs by sector into REMI PI+ model and run impacts.
  6. Export impacts and analyze.

### C.3 Agriculture and Forestry

#### 3.3.1 Managing Forests to Capture Carbon

##### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Managing Forests to Capture Carbon**
    - i. X6403—Exogenous Final Demand (Support activities for agriculture and forestry)
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Managing Forests to Capture Carbon**
    - i.  $\$3,700,000$  per year (2010-2020) (costs provided by DNR)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Managing Forests to Capture Carbon**
    - i. 100% paid by government for forestry projects between 2010-2020
4. Input costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

##### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Managing Forests to Capture Carbon**
    - i. X5401—Forestry; fishing, hunting, trapping, Sales
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Managing Forests to Capture Carbon**
    - i. Contribution to GDP per Acre =  $\$478$
    - ii. Number of acres to be planted = 30,000
    - iii. Acres planted thus far = 12,618
    - iv. Total acres left = 17,382 (number of acres planted - acres planted thus far)
3. Research savings data for each policy according to part of program to be affected by savings.

- a. **Managing Forests to Capture Carbon**
  - i. Annual acres of trees planted per year=2,173
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2012-2020).
  - a. **Managing Forests to Capture Carbon**
    - i.  $\$8,308,596 - [(\$478 \text{ Contribution to GDP per Acre} * 17,382 \text{ Number of Acres to Planted})] = \text{Average Annual Contribution to GDP for Acres Left to Plant}$
    - ii.  $X5401 - \$1,038,575 [(\$8,308,596 \text{ Average Annual Contribution to GDP for Acres Left to Plant} / 8 \text{ years left until 2020})] = \text{Average Annual Contribution to GDP over remainder of project}$
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.3.2 Creating Ecosystem Markets to Encourage GHG Emissions Reductions Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Wetland Markets**
    - i. 63—State Govt. Spending
  - b. **Stream and Waterway Markets**
    - i. 63—State Govt. Spending
  - c. **Forest Markets**
    - i. 63—State Govt. Spending
  - d. **Critical Area Markets**
    - i. 63—State Govt. Spending
  - e. **Species and Habitat Markets**
    - i. 63—State Govt. Spending
  - f. **Nutrient Markets**
    - i. 63—State Govt. Spending
  - g. **Carbon Markets: RGGI and Maryland CO2 Budget Trading Program Offsets**
    - i. 63—State Govt. Spending
  - h. **Carbon Markets: GGRA of 2009—Offsets and Early Reductions**
    - i. 63—State Govt. Spending
  - i. **Carbon Markets: GGRA of 2009—Nutrient Trading with Carbon Co-benefits**
    - i. 63—State Govt. Spending
  - j. **Biomass Markets**
    - i. 63—State Govt. Spending
2. Determine overall cost of policy implementation for each program under the policy.<sup>194</sup>

<sup>194</sup> DNR has stated that the program would potentially cost \$50,000 annually. RESI has analyzed this program from 2010-2020 at that cost to the government.

- a. **Wetland Markets**
    - i. \$5,000 (provided by DNR)
  - b. **Stream and Waterway Markets**
    - i. \$5,000 (provided by DNR)
  - c. **Forest Markets**
    - i. \$5,000 (provided by DNR)
  - d. **Critical Area Markets**
    - i. \$5,000 (provided by DNR)
  - e. **Species and Habitat Markets**
    - i. \$5,000 (provided by DNR)
  - f. **Nutrient Markets**
    - i. \$5,000 (provided by DNR)
  - g. **Carbon Markets: RGGI and Maryland CO2 Budget Trading Program Offsets**
    - i. \$5,000 (provided by DNR)
  - h. **Carbon Markets: GGRA of 2009—Offsets and Early Reductions**
    - i. \$5,000 (provided by DNR)
  - i. **Carbon Markets: GGRA of 2009—Nutrient Trading with Carbon Co-benefits**
    - i. \$5,000 (provided by DNR)
  - j. **Biomass Markets**
    - i. \$5,000 (provided by DNR)
3. Distribute inputs among identified REMI PI+ sectors.
- a. **Wetland Markets**
    - i. 100% paid by government to cover administrative costs
  - b. **Stream and Waterway Markets**
    - i. 100% paid by government to cover administrative costs
  - c. **Forest Markets**
    - i. 100% paid by government to cover administrative costs
  - d. **Critical Area Markets**
    - i. 100% paid by government to cover administrative costs
  - e. **Species and Habitat Markets**
    - i. 100% paid by government to cover administrative costs
  - f. **Nutrient Markets**
    - i. 100% paid by government to cover administrative costs
  - g. **Carbon Markets: RGGI and Maryland CO2 Budget Trading Program Offsets**
    - i. 100% paid by government to cover administrative costs
  - h. **Carbon Markets: GGRA of 2009—Offsets and Early Reductions**
    - i. 100% paid by government to cover administrative costs
  - i. **Carbon Markets: GGRA of 2009—Nutrient Trading with Carbon Co-benefits**
    - i. 100% paid by government to cover administrative costs
  - j. **Biomass Markets**
    - i. 100% paid by government to cover administrative costs

4. Input costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Wetland Markets**
    - i. 63—State Government Spending
    - ii. X7802—Production costs, Logging
    - iii. X7801—Production costs, Forestry; fishing, hunting, trapping
  - b. **Stream and Waterway Markets**
    - i. 63—State Government Spending
    - ii. X7802—Production costs, Logging
    - iii. X7801—Production costs, Forestry; fishing, hunting, trapping
  - c. **Forest Markets**
    - i. 63—State Government Spending
    - ii. X7802—Production costs, Logging
    - iii. X7801—Production costs, Forestry; fishing, hunting, trapping
  - d. **Critical Area Markets**
    - i. 63—State Government Spending
    - ii. X7802—Production costs, Logging
    - iii. X7801—Production costs, Forestry; fishing, hunting, trapping
  - e. **Species and Habitat Markets**
    - i. 63—State Government Spending
    - ii. X7802—Production costs, Logging
    - iii. X7801—Production costs, Forestry; fishing, hunting, trapping
  - f. **Nutrient Markets**
    - i. 63—State Government Spending
    - ii. X7802—Production costs, Logging
    - iii. X7801—Production costs, Forestry; fishing, hunting, trapping
    - iv. 80—Electricity (Industrial Sector) Fuel Costs, All Industrial sectors
  - g. **Carbon Markets: RGGI and Maryland CO2 Budget Trading Program Offsets**
    - i. 63—State Government Spending
    - ii. X7802—Production costs, Logging
    - iii. X7801—Production costs, Forestry; fishing, hunting, trapping
  - h. **Carbon Markets: GGRA of 2009—Offsets and Early Reductions**
    - i. 80—Electricity (Industrial Sector) Fuel Costs, All Industrial sectors
  - i. **Carbon Markets: GGRA of 2009—Nutrient Trading with Carbon Co-benefits**
    - i. 80—Electricity (Industrial Sector) Fuel Costs, All Industrial sectors
  - j. **Biomass Markets**
    - i. 63—State Government Spending
    - ii. X7802—Production costs, Logging
    - iii. X7801—Production costs, Forestry; fishing, hunting, trapping
2. Determine part of program to be affected by savings (from strategy write-up).

- a. **Wetland Markets**
    - i. Acres of Wetlands=45
  - b. **Stream and Waterway Markets**
  - c. **Forest Markets**
    - i. Contribution to GDP per 1 acre of Forest Land—\$478
  - d. **Critical Area Markets**
    - i. Contribution to GDP per 1 acre of Forest Land—\$478
  - e. **Species and Habitat Markets**
  - f. **Nutrient Markets**
  - g. **Carbon Markets: RGGI and Maryland CO2 Budget Trading Program Offsets**
    - i. Total allowances yearly by the state of Maryland for GHG—37,503,983 metric tons
    - ii. Number of years of auctions—4 years
  - h. **Carbon Markets: GGRA of 2009—Offsets and Early Reductions**
  - i. **Carbon Markets: GGRA of 2009—Nutrient Trading with Carbon Co-benefits**
  - j. **Biomass Markets**
3. Research savings data for each policy according to part of program to be affected by savings.
- a. **Wetland Markets**
    - i. Average Value of Wetland (1 acre)=\$175,000
  - b. **Stream and Waterway Markets**
    - i. Current Miles of Waterway=15,000
    - ii. Benefit to Healthy Waterway=\$568,000,000 (spent by fishers on equipment to fish in MD in 2008)
    - iii. Percentage of Streams Unhealthy=46%
  - c. **Forest Markets**
    - i. Average Acreage Lost a year<sup>195</sup>=7,000
  - d. **Critical Area Markets**
    - i. Total Critical Area Acres in MD=680,000 acres
    - ii. Cost of Buffer=\$2 per feet
    - iii. Intensely Developed Land=0.05
  - e. **Species and Habitat Markets**
    - i. Cost per acre of habitat area<sup>196</sup>=\$5,750 per acre
    - ii. Species of Wildlife<sup>197</sup>=167
    - iii. Plants<sup>198</sup>=447
    - iv. Total Habitat Creatures/Plants=614
    - v. Assuming each species needs 45 acres=27,630 acres needed

<sup>195</sup> Ecosystem Services Working Group Final Report. Maryland Department of Natural Resources. Maryland Department of Natural Resources, Oct. 2011. Web. 14 Nov. 2011.  
<<http://www.dnr.state.md.us/dnrnews/pdfs/ESWGFinalReportOct2011.pdf>>.

<sup>196</sup> Ibid.

<sup>197</sup> Ibid.

<sup>198</sup> Ibid.

- f. Nutrient Markets**
    - i. Total Potential Realization<sup>199</sup>=\$45,000,000.00
  - g. Carbon Markets: RGGI and Maryland CO2 Budget Trading Program Offsets**
    - i. Total Proceeds to Date<sup>200</sup>=\$169,600,423.80
    - ii. Number of Years=4
  - h. Carbon Markets: GGRA of 2009—Offsets and Early Reductions**
    - i. ERA Awardees 2009-2011<sup>201</sup>
    - ii. AES Warriors Run=\$75,169
    - iii. Mirant Chalk Point=\$142,534
    - iv. Sum of Awarded CO2=\$217,703
    - v. Auction Price at Time of Award=2.19
  - i. Carbon Markets: GGRA of 2009—Nutrient Trading with Carbon Co-benefits**
    - i. **Assumption**-We will stack the benefits together and package
    - ii. 50% CO2 Credits=\$21,200,052.98 (50% reduced revenue)
    - iii. 50% Potential Nutrient Credit<sup>202</sup>=\$22,500,000.00 (50% reduced revenue)
  - j. Biomass Markets**
    - i. Annual Savings from 2015-2020=\$21,413,700.00 (from DNR)
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
- a. Wetland Markets**
    - i. \$7,875,000 [(45 acres of Wetlands to be restored \* \$175,000 value of an acre of wetland)]=Average Savings from Restoration of 45 Acres of Wetlands
    - ii. 63—\$984,375 [(\$7,875,000 / 8 years)]=average revenue paid to government by private firms
    - iii. X7802—\$474,188 average annual costs
    - iv. X7801—\$474,188 average annual costs
  - b. Stream and Waterway Markets**
    - i. \$261,280,000 [(\$568,000,000 Annual Benefit attributed to Healthy Waterways \* 46% Waterways unhealthy)]=Current Loss of Savings, But Potential Realization of Savings if these Waterways are Brought from unhealthy to healthy

<sup>199</sup> Jones, CY, Evan Branosky, Mindy Selman, and Michelle Perez. "How Nutrient Trading Could Help Restore the Chesapeake Bay." World Resource Institute. World Resource Institute, Feb. 2010. Web. 14 Nov. 2011. <[http://pdf.wri.org/working\\_papers/how\\_nutrient\\_trading\\_could\\_help\\_restore\\_the\\_chesapeake\\_bay.pdf](http://pdf.wri.org/working_papers/how_nutrient_trading_could_help_restore_the_chesapeake_bay.pdf)>.

<sup>200</sup> MD Proceeds by Auction. Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Welcome. Regional Greenhouse Gas Initiative CO2 Budget Trading Program, 2011. Web. 14 Nov. 2011. <[http://rggi.org/docs/MD\\_Proceeds\\_by\\_Auction.pdf](http://rggi.org/docs/MD_Proceeds_by_Auction.pdf)>.

<sup>201</sup> Early Reduction CO2 Allowance Awards. Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program. Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program, 18 Dec. 2009. Web. 16 Nov. 2011. <[http://www.rrgi.org/docs/md\\_proceeds\\_by\\_auction.pdf](http://www.rrgi.org/docs/md_proceeds_by_auction.pdf)>.

<sup>202</sup> Jones, CY, Evan Branosky, Mindy Selman, and Michelle Perez. "How Nutrient Trading Could Help Restore the Chesapeake Bay." World Resource Institute. World Resource Institute, Feb. 2010. Web. 14 Nov. 2011. <[http://pdf.wri.org/working\\_papers/how\\_nutrient\\_trading\\_could\\_help\\_restore\\_the\\_chesapeake\\_bay.pdf](http://pdf.wri.org/working_papers/how_nutrient_trading_could_help_restore_the_chesapeake_bay.pdf)>.

- ii.  $63 - \$32,660,000 [(\$261,280,000 / 8 \text{ years})] = \text{average annual revenue paid to government by private firms}$
- iii. X7802—\$16,330,000 average annual costs
- iv. X7801—\$16,330,000 average annual costs

**c. Forest Markets**

- i.  $\$3,346,000 [(7,000 \text{ acres of Forest Land Lost Annually} * \$478 \text{ Contribution to GDP of one acre of Forest Area})] = \text{Average Annual Savings of restoration of Forest Areas}$
- ii.  $63 - \$418,250 [(\$3,346,000 / 8 \text{ years})] = \text{average annual revenue paid to government by private firms}$
- iii. X7802—\$209,125 average annual costs
- iv. X7801—\$209,125 average annual costs

**d. Critical Area Markets**

- i. 34,000 acres [(680,000 acres of Critical Area in MD \* 5% Intensely Developed Land)] = Total Acres of Intensely Developed Land in acres
- ii. 8,851.38 square feet [(square root(34,000 acres of Intensely Developed Land \* 43,560 sq feet per acre) \* 23% of which may be buffer area)] = Sq. Feet of Critical Areas that are Buffer Zone
- iii.  $\$17,702.77 [(8,851.38 \text{ sq feet of buffer area} * \$2.00 \text{ per sq feet})] = \text{Average Savings to Buffer Area}$
- iv.  $\$15,392,269.20 [(\$478 \text{ Total Contribution to GDP from Forest Acres} * 32,201.4 \text{ Acres of Woods})] = \text{Average Annual Savings from Rest of Critical Area}$
- v.  $\$15,409,971.97 [(\$17,702.77 \text{ Average Savings to Buffer Area} + \$15,392,269.20 \text{ Average Annual Savings from Rest of Critical Area})] = \text{Average Annual Savings From Whole Critical Area}$
- vi.  $63 - \$1,926,246.50 [(\$15,392,269.20 / 8 \text{ years})] = \text{average annual revenue paid to government by private firms}$
- vii. X7802—\$963,123.25 average annual costs
- viii. X7801—\$963,123.25 average annual costs

**e. Species and Habitat Markets**

- i. 2,763 [(27,630 acres available \* 10% sold a year)] = Average Annual Acres Sold a Year
- ii.  $\$15,887,250 [(2,763 \text{ acres} * \$5,750 \text{ Value of Habitat Area})] = \text{Average Revenue from Sale of Habitat Area}$
- iii.  $63 - \$1,985,906.25 [(\$15,887,250 / 8 \text{ years})] = \text{average annual revenue paid to government by private firms}$
- iv. X7802—\$992,953.13 average annual costs
- v. X7801—\$992,953.13 average annual costs

**f. Nutrient Markets**

- i. \$45,000,000 [(Potential Realization from DNR website)]
- ii.  $63 - \$5,625,000 [(\$45,000,000 / 8 \text{ years})] = \text{average annual revenue paid to government by private firms}$
- iii. X7802—\$2,812,500 average annual costs
- iv. X7801—\$2,812,500 average annual costs

- g. Carbon Markets: RGGI and Maryland CO2 Budget Trading Program Offsets**
    - i.  $\$42,400,105.95 [(\$169,600,423.80 \text{ Total Proceeds to Date} / 4 \text{ Years of Auctions to Date}) = \text{Average Revenue from RGGI Auctions}]$
    - ii.  $63 - \$5,300,013.25 [(\$42,400,105.95 / 8 \text{ years}) = \text{average annual funds paid over next 8 years}]$
    - iii. X7802— $\$2,650,006.63$  average annual costs
    - iv. X7801— $\$2,650,006.63$  average annual costs
  - h. Carbon Markets: GGRA of 2009—Offsets and Early Reductions**
    - i.  $217,703 \text{ ERAs} [(75,169 \text{ AES Warriors Run ERA} + 142,534 \text{ Mirant Chalk Point ERA}) = \text{Sum of ERAs Awarded thus Far}]$
    - ii.  $\$476,769.57 [(217,703 \text{ Sum of ERAs Awarded thus Far} * \$2.19 \text{ Auction Prices at Time Of Award}) = \text{Average Savings to Awardees}]$
    - iii.  $80 - \$59,596.25 [(\$476,769.57 \text{ average savings to awardees} / 8 \text{ years}) = \text{average annual savings}]$
  - i. Carbon Markets: GGRA of 2009—Nutrient Trading with Carbon Co-benefits**
    - i.  $\$43,700,052.98 [(\$21,200,052.98 \text{ Potential Profits from CO2 Credit Sales} + \$22,500,000 \text{ Potential Profit from Nutrient Credit Sales}) = \text{Total Potential Revenue from the Bundle}]$
    - ii.  $80 - \$5,462,506.63 [(\$43,700,052.98 / 8 \text{ years}) = \text{average annual savings}]$
  - j. Biomass Markets**
    - i.  $\$4,282,740.00$  [(From DNR)]
    - ii.  $63 - \$535,342.50 [(\$4,282,740 / 8 \text{ years}) = \text{average annual revenue from Biomass Markets}]$
    - iii. X7802— $\$267,671.25$  costs to production
    - iv. X7802— $\$267,671.25$  costs to production
5. Input savings by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.3.3 Increasing Urban Trees to Capture Carbon Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy.
  - a. Increasing Urban Trees to Capture Carbon**
    - i. X6412—Exogenous Final Demand (Construction)
    - ii. X6526—Exogenous Final Demand (Architectural, engineering, and related services)
    - iii. X6403—Exogenous Final Demand (Support activities for agriculture and forestry)
2. Determine overall cost of policy implementation for each program under the policy.
  - a. Increasing Urban Trees to Capture Carbon**
    - i.  $\$1,200,000$  total from 2010-2020 (provided by DNR)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. Increasing Urban Trees to Capture Carbon**
    - i. 100% from government to plant tree and for administrative costs

4. Input costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Increasing Urban Trees to Capture Carbon**
    - i. 640—Consumer spending (electricity)
    - ii. 78—Reallocation of savings (across all consumption categories)
    - iii. 82—Electricity (Commercial Sector) Fuel Costs, All Commercial sectors
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Increasing Urban Trees to Capture Carbon**
    - i. Number of Trees to be planted=12,500,000
    - ii. Trees planted thus far=5,114,478
    - iii. Remaining Trees to Plant=6,535,522
    - iv. Number of years Left=8
    - v. Average Planting of Trees per year=933,646
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Increasing Urban Trees to Capture Carbon**
    - i. Average savings in energy per tree<sup>203</sup>=\$20.00
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).
  - a. **Increasing Urban Trees to Capture Carbon**
    - i. \$250,000,000 per year—[((\$20.00 energy savings per tree \* 12,500,000 trees planted after full implementation)] = total savings after full implementation in 2020
    - ii. \$22,727,272.73 savings annually [((\$250,000,000 total savings after full implementation in 2020 / 11 years of the program)]=average annual savings during operation phase
    - iii. \$11,363,636.50 [(\$22,727,272.73 average annual savings / 2 sectors)]=average annual savings per sector
    - iv. 640—\$11,363,636.50 average annual savings to consumers
    - v. 78—\$11,363,636.50 reallocation of savings across all other consumption categories
    - vi. 82—\$11,363,636.50 average annual savings to the commercial sector
5. Input savings by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.3.4 Creating and Protecting Wetlands and Waterway Borders to Capture Carbon Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy.

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<sup>203</sup> David J. Nowak, Susan M. Stein, Paula B. Randler, Eric J. Greenfield, Sara J. Comas, Mary A. Carr, and Ralph J. Alig, "Sustaining America's Urban Trees and Forest," *General Technical Report NRS-62* (June 2010), Newton Square, Pennsylvania: United States Department of Agriculture.

- a. **Creating and Protecting Wetlands and Waterway Borders to Capture Carbon**
  - i. X6532—Exogenous Final Demand (Other professional, technical, and scientific services)
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Creating and Protecting Wetlands and Waterway Borders to Capture Carbon**
    - i. \$17,187,817 (total from 2010-2020) (provided by DNR)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Creating and Protecting Wetlands and Waterway Borders to Capture Carbon**
    - i. 100% spent by state to use for administrative costs and restoration costs
4. Input sales by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Creating and Protecting Wetlands and Waterway Borders to Capture Carbon**
    - i. TOUR1—Tourism spending (amount)
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Creating and Protecting Wetlands and Waterway Borders to Capture Carbon**
    - i. Acres to be restored—1,142
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Creating and Protecting Wetlands and Waterway Borders to Capture Carbon**
    - i. Total visitors to State Parks in 2010<sup>204</sup>—10,000,000
    - ii. Out-of-state visitors—29%
    - iii. In-state visitors—71%
    - iv. In-state pass cost—\$75.00
    - v. Out-of-state pass—\$100.00
    - vi. In-state visitors—7,100,000
    - vii. Out-of-state visitors—2,900,000
    - viii. Number of acres in state parks—137,000
    - ix. Average secondary spending by state park visitors in 2010—\$594.33
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).

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<sup>204</sup> Rebecca Dougherty (March 2011), “2010 Maryland State Parks Economic Impact and Visitor Study,” Department of Business and Economic Development, accessed October 17, 2012.

- a. **Creating and Protecting Wetlands and Waterway Borders to Capture Carbon**
  - i. \$532,500,000 [(\$75.00 in-state park pass \* 7,100,000 in-state visitors in 2010)] = Total cost of tourism to state parks by in-state visitors in 2010
  - ii. \$290,000,000 [(\$100.00 out-of-state park pass \* 2,900,000 out-of-state visitors in 2010)] = Total cost of tourism to state parks by out-of-state visitors in 2010
  - iii. \$822,500,000 [(\$532,500,000 potential park pass revenues from in-state residents in 2010 + \$290,000,000 potential park pass revenues from out-of-state residents in 2010)] = total potential revenues received in 2010 from state park visitors
  - iv. \$6,003.65 [(\$822,500,000 total potential park revenues received in 2010 from state park visitors / 137,000 acres in state parks)] = average spending per acre by visitors to state park annually
  - v. \$5,943,300,000 [(\$594.33 additional tourism spending by visitors in 2010 \* 10,000,000 visitors in 2010 to state parks)] = total additional spending by visitors in 2010
  - vi. \$5,943,300,000 [(\$594.33 additional tourism spending by visitors in 2010 \* 10,000,000 visitors in 2010 to state parks)] = total additional spending by visitors in 2010
  - vii. \$43,831.75 [(\$5,943,300,000 total additional spending by visitors in 2010 / 137,000 number of acres)] = average additional spending by acre by visitors
  - viii. \$49,385.40 [(\$43,831.75 average additional spending by acre by visitors in 2010 + \$6,003.65 average spending per acre by visitors to state park annually)] = average total spending by visitors annually
  - ix. \$56,397,670 [(\$49,385.40 average total spending by visitors annually per acre \* 1,142 acres to be restored)] = total additional revenue between 2010-2020
  - x. \$5,127,061 [(\$56,397,670 total additional revenue between 2010-2020 / 11 years over program life)] = average annual additional tourism spending from restored acres
  - xi. TOUR1—\$5,127,061 average annual spending by visitors visiting restored acres of wetlands
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.3.5 Geological Opportunities to Store Carbon

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Geological Opportunities to Store Carbon**
    - i. X932—Employment, Other professional, scientific, and technical services
2. Determine overall cost of policy implementation for each program under the policy.

- a. **Geological Opportunities to Store Carbon**
  - i. 4 \$66,701 total from 2010-2020 (provided by DNR)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Geological Opportunities to Store Carbon**
    - i. 100% spending by state government through hiring of professionals
4. Input costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Geological Opportunities to Store Carbon**
    - i. 80—Electricity (Industrial sectors) Fuel Cost, All Industrial Sectors
    - ii. 84—Natural Gas (Industrial sectors) Fuel Cost, All Industrial Sectors
    - iii. 88—Residual (Industrial sectors) Fuel Cost, All Industrial Sectors
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Geological Opportunities to Store Carbon**
    - i. Target Waste Gate Formation 4.4 gigatonnes
    - ii. Target Needmore Shale 0.01 gigatonnes
    - iii. Target Oriskany Sandstone 0.981 gigatonnes
    - iv. Target Medina Sandstone 3.382 gigatonnes
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Geological Opportunities to Store Carbon**
    - i. Tonnes to Gallon Conversion=317.76
    - ii. Number of Gallons in a barrel=42
    - iii. Cost per Barrel<sup>205</sup>=101

Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).

- b. **Geological Opportunities to Store Carbon**
  - i. 8.773 gigatonnes (4.4 gigatonnes of waste gate formation + 0.01 gigatonnes of Needmore Shale + 0.981 gigatonnes + 3.382 gigatonnes of Medina Sandstone ) = Total Target Gigatonnes
  - ii. 8,773,000,000 tonnes (8.773 total target in gigatonnes \* 10<sup>9</sup>) = conversion from gigatonnes to tonnes
  - iii. 27,608,925.19 gallons of fuel ( 8,773,000,000 total target tonnes / 317.75 gallons associated with a tonne) = target reduction in gallons of fuel
  - iv. 657,355.36 barrels of oil (27,608,925.19 target reduction in gallons of fuel / 42 gallons to a barrel) = Average Reduction Target in Number of Barrels conserved
  - v. \$66,392,891.54 [(657,355.36 average reduction target in number of barrels conserved \* \$101 per barrel)] = average savings from reduction techniques associated with strategy by 2020

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<sup>205</sup> “Petroleum and other Liquids.” U.S. Energy Information Agency. EIA. Gov Web. 16 Nov 2011 <<http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RCLC1&f=D>>

- vi. \$6,035,717 [(\$66,392,891.54 average savings from reduction techniques associated with strategy by 2020 / 11 years)]=average annual savings from 2010-2020
  - vii. 80—\$2,011,906 average annual reduction in fuel costs
  - viii. 84—\$2,011,906 average annual reduction in fuel costs
  - ix. 88—\$2,011,906 average annual reduction in fuel costs
4. Input savings/costs by sector into REMI PI+ model and run impacts.
  5. Export impacts and analyze.

### 3.3.6 Planting Forests in Maryland

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy.
  - a. **Planting Forests in Maryland**
    - i. X3203—Industry sales, Support activities for agriculture
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Planting Forests in Maryland**
    - i. \$7,651,200 (provided by DNR)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Planting Forests in Maryland**
    - i. 100% spent by towards activities for agriculture increasing sales of forestry growth
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Planting Forests in Maryland**
    - i. 640—Consumer spending (electricity)
    - ii. 78—Consumption reallocation (across all other consumption categories)
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Planting Forests in Maryland**
    - i. Number of trees planted by 2020=43,030
    - ii. Average energy savings per tree=\$20.00 (see urban trees)
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Planting Forests in Maryland**
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).
  - a. **Planting Forests in Maryland**
    - i. \$860,600 [(43,030 total trees to be planted by 2020 \* \$20.00 energy saving per tree)]=Total savings by 2020 in energy costs
    - ii. \$78,236.36 [(\$860,000 total savings by 2020 from newly planted trees / 11 years of program)]=average annual energy savings attributed to program
    - iii. 640—\$78,236.36 average annual energy savings
    - iv. 78—\$78,236.36 savings reallocation across other consumption categories

5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.3.7 Expanded Use of Forests and Feedstocks for Energy Production

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy.
  - a. **Expanded Use of Forests and Feedstocks for Energy Production**
    - i. EQP13—Producer’s Durable Equipment Investment (Electrical transmission, distribution, and industrial apparatus)
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Expanded Use of Forests and Feedstocks for Energy Production**
    - i. \$100,000,000 total costs from 2010-2020 (provided by DNR)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Expanded Use of Forests and Feedstocks for Energy Production**
    - i. 100% spent by government toward program startup and costs
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Expanded Use of Forests and Feedstocks for Energy Production**
    - i. X7809—Production costs, Electric power generation, transmission, and distribution
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Expanded Use of Forests and Feedstocks for Energy Production**
    - i. Annual Savings Per Year from Write up - \$1,019,700
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Expanded Use of Forests and Feedstocks for Energy Production**
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).
  - a. **Expanded Use of Forests and Feedstocks for Energy Production**
    - i. X7809— \$1,019,700.00 (applicable savings from strategy write-up)
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.3.8 Conservation of Agricultural Land for GHG Benefits

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Conservation of Agricultural Land for GHG Benefits**
    - i. 63—State Govt. Spending
2. Determine overall cost of policy implementation for each program under the policy.

- a. **Conservation of Agricultural Land for GHG Benefits**
  - i. \$46,693,142 (projected costs based on current implementation costs to date provided by MDA)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Conservation of Agricultural Land for GHG Benefits**
    - i. 100% spent by government towards agricultural land conservation
4. Input sales by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Conservation of Agricultural Land for GHG Benefits**
    - i. 104—Farm output, Total
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Conservation of Agricultural Land for GHG Benefits**
    - i. Total Acres to Be Conserved by 2020—1,062,000 (provided by MDA)
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Conservation of Agricultural Land for GHG Benefits**
    - i. Value of Real Estate for Farmland per acre<sup>206</sup>—\$1,131 per acre
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).
  - a. **Conservation of Agricultural Land for GHG Benefits**
    - i. \$109,192,909 [(((\$1,131 Value of Real Estate for Farmland per acre \* 1,062,000 Total Acres to Be Conserved by 2020)) / 11 years)]=Total Annually Additional Farm Output that Can be Achieved through Conservation
    - ii. 104—\$491,040,000.00
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.3.9 Buy Local for GHG Benefits

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Buy Local for GHG Benefits**
    - i. 63—State Govt. Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Buy Local for GHG Benefits**
    - i. \$12,346,424 (provided by MDA)
3. Distribute inputs among identified REMI PI+ sectors.

<sup>206</sup> “Cost of Net Farmland Change,” *Maryland Smart, Green & Growing*, accessed October 17, 2012.

- a. **Buy Local for GHG Benefits**
  - i. 100% spent by government towards the promotion and building of local farmer's markets in the Maryland region
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Buy Local for GHG Benefits**
    - i. 104—Farm output, Total
    - ii. 63—State Govt. Spending
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Buy Local for GHG Benefits**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Buy Local for GHG Benefits**
    - i. Average cost of Farmer's Market Association<sup>207</sup>—\$37.50
    - ii. Total Farmer's Markets Active in Maryland<sup>208</sup>—43
    - iii. Number of Vendors on Average at Each Market<sup>209</sup>—12
    - iv. Average Customers Visiting a Farmer's Market Weekly<sup>210</sup>—387
    - v. Number of Months Farmer's Markets are Active<sup>211</sup>—6.1
    - vi. Average Number of Weeks<sup>212</sup>—24.4
    - vii. Average Sales per Customer Trip<sup>213</sup>—\$17.30
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).
  - a. **Buy Local for GHG Benefits**
    - i. \$19,350 [(\$37.50 price for license to sell at Farmer's Market \* 12 vendors per market \* 43 markets in Maryland)]=Average annual increased revenue to state from Farmer's Market licenses
    - ii. 63—\$19,350 spending by government back into state from Farmer's Market licenses
    - iii. \$6,695.10 [(\$17.30 average sales per customer trip to Farmer's Market \* 387 average customers per week)]=average weekly purchases made at Farmer's Markets by customers at a single market

<sup>207</sup> Aaron Adalja, James C. Hanson, and Amy G. Crone, "Assessing the Need for a Statewide Farmers' Market Association in Maryland," *Fact Sheet 934*, (2011), University of Maryland Extension and Maryland Department of Agriculture.

<sup>208</sup> Ibid.

<sup>209</sup> Ibid.

<sup>210</sup> "Maryland Farmers' Market," *The Official Site of the Maryland Office of Tourism*, accessed October 17, 2012.

<sup>211</sup> Ibid.

<sup>212</sup> Ibid.

<sup>213</sup> Geoffrey S. Becker, "Farmers' Markets: The USDA Role," *CRS Report for Congress RS21652*, (Updated January 3, 2006), Congressional Research Service and the Library of Congress.

- iv. \$163,360.44 [(\$6,695.10 average weekly purchases made at a Farmer's Market by customers \* 24.4 weeks the markets are in operation)]=total sales at a single market over the period of operation
  - v. \$7,024,498.92 [(\$163,360.44 total sales at a single market over the period of operation \* 43 markets in Maryland)]=total sales from all Maryland Farmer's Markets in a year
  - vi. 104—\$7,024,498.92
5. Input savings/costs by sector into REMI PI+ model and run impacts.
  6. Export impacts and analyze.

### 3.3.10 Nutrient Trading for GHG Benefits

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Nutrient Trading for GHG Benefits**
    - i. 63—State Govt. Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Nutrient Trading for GHG Benefits**
    - i. \$3,770,500 (provided by MDA, total investment needed)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Nutrient Trading for GHG Benefits**
    - i. 100% spent by government for administrative and startup costs to establish nutrient trading markets in Maryland
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Nutrient Trading for GHG Benefits**
    - i. 63—State Govt. Spending
    - ii. 99—Investment spending, Non-residential
    - iii. 106—Farm Value Added, with no effect on sales or employment
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Nutrient Trading for GHG Benefits**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Nutrient Trading for GHG Benefits**
    - i. Total Potential Realization<sup>214</sup>—\$45,000,000.00
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).

<sup>214</sup> Jones, CY, Evan Branosky, Mindy Selman, and Michelle Perez. "How Nutrient Trading Could Help Restore the Chesapeake Bay." World Resource Institute. World Resource Institute, Feb. 2010. Web. 14 Nov. 2011. <[http://pdf.wri.org/working\\_papers/how\\_nutrient\\_trading\\_could\\_help\\_restore\\_the\\_chesapeake\\_bay.pdf](http://pdf.wri.org/working_papers/how_nutrient_trading_could_help_restore_the_chesapeake_bay.pdf)>.

- a. **Nutrient Trading for GHG Benefits**
  - i. \$4,090,909.09 [(\$45,000,000.00 total potential revenue realization between 2010-2020 / 11 years)]=Average annual revenue realization
  - ii. 63—\$2,045,454.55 if half credits are purchased by state
  - iii. 99—\$2,045,454.55 if half credits are purchased by private investment
  - iv. 106—\$4,090,909.09 additional value to farms (not from sales of output or employment)
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

## C.4 Recycling

### 3.4.1 Recycling and Source Reduction

#### Investment Phase

No investment costs were specified by the agency for this policy.

#### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Recycling and Source Reduction**
    - i. X7939—Production costs, Waste management and remediation services
    - ii. 63—State Govt. Spending
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Recycling and Source Reduction**
    - i. Average Landfill capacity is 1,000 pounds per cubic year (0.5 tons)
    - ii. Total Recycled Annually (from MDE website)<sup>215</sup>—6,866,424 tons
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Recycling and Source Reduction**
    - i. Average Percentage of Recycled Waste in Maryland<sup>216</sup>—43.88% annual average
    - ii. Cubic Yard to GHG—3.3 cubic yards per GHG emission
    - iii. Total Cubic Yards Saved—3,433,212 cubic yards in landfills
    - iv. Base Cost - \$200 for license + \$52.23 per ton
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **Recycling and Source Reduction**
    - i. 1,040,367 metric tons [(3,433,212 cubic yards of landfill saved from recycling / 3.3 cubic yards per GHG emissions)]=Average Total Reduction in GHG emissions from recycling by 2020
    - ii. \$54,338,582.65 [(1,040,367 metric tons reduced that can be sold \* \$52.23 carbon permit per ton)]=Average total savings associated with landfill offset

<sup>215</sup> County Recyclables by Commodity in Tons for Calendar Year 2008. Maryland Department of the Environment (MDE). 2008. Web. 11 Nov. 2011. <[www.mde.maryland.gov/assets/document/recycling\\_chart.pdf](http://www.mde.maryland.gov/assets/document/recycling_chart.pdf)>.

<sup>216</sup> Ibid.

- iii. \$27,169,291.33 [(split by Government and Private sector)]
  - iv. \$2,716,929.13 [(\$27,169,291.33 average total savings per sector / 10 years)]
  - v. 63—\$2,716,929.13 total offset government can spend on other projects
  - vi. X7939—\$2,716,929.13 total reduction in costs to landfills
5. Input savings/costs by sector into REMI PI+ model and run impacts.
  6. Export impacts and analyze.

## C.5 Buildings

### 3.5.1 Building and Trade Codes in Maryland

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Building and Trade Codes in Maryland**
    - i. 63—State Govt. Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Building and Trade Codes in Maryland**
    - i. \$700,000 annually spent on program<sup>217</sup>
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Building and Trade Codes in Maryland**
    - i. 100% spent by government for trainings
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase<sup>218</sup>

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Building and Trade Codes in Maryland**
    - i. X933—Industry Employment, Management of companies and enterprises
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Building and Trade Codes in Maryland**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Building and Trade Codes in Maryland**
    - i. Number of additional individuals able to be trained through program—614 average annually<sup>219</sup>
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **Building and Trade Codes in Maryland**
    - i. X933—614 new individuals annually able to be trained

<sup>217</sup> “Housing and Community Development,” Maryland Department of Housing and Community Development (2011), accessed October 17, 2012.

<sup>218</sup> Impacts from this policy in the operation phase are adjusted and reduced to 3 percent. Marginally, there is a 3 percent additional costs to projects involving LEED certification and codes, therefore RESI uses this estimate from EIA to estimate the potential marginal increase from Green Building projects.

<sup>219</sup> Office of Energy Performance and Conservation, “StateStat Template,” *StateStat Maryland* (September 18, 2012), Maryland Department of General Services, accessed October 17, 2012.

5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Adjustment of 3 percent to account for jobs directly related to meeting LEED certification or Green Standards.<sup>220</sup>
7. Export impacts and analyze.

### 3.5.2 BeSMART

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **BeSMART**
    - i. 63—State Govt. Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **BeSMART**
    - i. Data provided by StateStat for the BeSMART program funding, courtesy of DHCD.<sup>221</sup>
      1. 2010—\$0
      2. 2011—\$3,454,843
      3. 2012—\$1,450,226
3. Adjustment of costs to marginally corresponding with the 3 percent that is directly accountable to meeting LEED certification.<sup>222</sup>
4. Distribute inputs among identified REMI PI+ sectors.
  - a. **BeSMART**
    - i. 100% provided by government under Federal funds to assist in residential refurbishing.
5. Input costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

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<sup>220</sup> “Estimating Renewable Energy Costs” *United States Energy Information Administration*, accessed May 21, 2013.

<sup>221</sup> Office of Energy Performance and Conservation, “StateStat Template,” *StateStat Maryland* (September 18, 2012), Maryland Department of General Services, accessed October 17, 2012.

<sup>222</sup> “Estimating Renewable Energy Costs” *United States Energy Information Administration*, accessed May 21, 2013.

## Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **BeSMART**
    - i. 82—Electricity (Commercial Sector) Fuel Costs, All Commercial Sectors
    - ii. 640—Consumer Spending (Electricity)
    - iii. 78—Consumption Reallocation
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **BeSMART**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **BeSMART**
    - i. Average energy savings supported by the BeSMART program—15-30%
    - ii. Average monthly consumption of energy by Maryland consumers (kwh)<sup>223</sup>—1,030
    - iii. Average price per kwh in Maryland<sup>224</sup>—\$0.1331
    - iv. Average monthly cost to Maryland residents for energy<sup>225</sup>—\$137.17
    - v. Number of participants in program (residential)<sup>226</sup>—8
    - vi. Number of participants in program (commercial)<sup>227</sup>—19
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **BeSMART**
    - i. 22.5%  $[(0.15+0.30)/2]$ =Average reduction after BeSMART completion
    - ii. 231.75 kwh  $[(1,030 \text{ average monthly consumption before BeSMART} * 22.5\% \text{ average reduction after BeSMART completion})]$ =Average monthly reduction in energy consumption
    - iii. \$30.85  $[(231.75 \text{ reduction of monthly consumption after BeSMART program} * \$0.1331 \text{ per kwh average cost})]$ =Average monthly savings to those in the BeSMART program
    - iv. \$246.77  $[(\$30.85 \text{ average monthly savings} * 8 \text{ residential participants in the program})]$ =Average monthly savings to residential participants in program
    - v. \$586.07  $[(\$30.85 \text{ average monthly savings} * 19 \text{ business participants in the program})]$ =Average monthly savings to the commercial sector participants in the program
    - vi. \$2,961.21  $[(\$246.77 \text{ average monthly savings to residential participants in program} * 12 \text{ months})]$ =average annual savings to residential sector
    - vii. \$7,032.87  $[(\$586.07 \text{ average monthly savings to commercial sector participants} * 12 \text{ months})]$ =average annual savings to commercial sector

<sup>223</sup> “Frequently Asked Questions: How Much Electricity Does an American Home Use?” *United States Energy Information Administration*, accessed October 17, 2012.

<sup>224</sup> *Ibid.*

<sup>225</sup> *Ibid.*

<sup>226</sup> Office of Energy Performance and Conservation, “StateStat Template,” *StateStat Maryland* (September 18, 2012), Maryland Department of General Services, accessed October 17, 2012.

<sup>227</sup> *Ibid.*

- viii. 82—\$7,032.87 annual savings to commercial sector from 2013-2020
  - ix. 640—\$2,961.21 annual savings to residential sector from 2013-2020
  - x. 78—\$2,961.21 [(Reallocation of savings to other consumption categories)]
5. Input savings by sector into REMI PI+ model and run impacts.
  6. Export impacts and analyze.

### 3.5.3 Weatherization and Energy Efficiency for Low-Income Houses Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Weatherization and Energy Efficiency for Low-Income Houses**
    - i. 63—State govt. spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Weatherization and Energy Efficiency for Low-Income Houses**<sup>228</sup>
    - i. Annual allocations for program:
      1. 2010—\$649,200
      2. 2011—\$741,377
      3. 2012—\$698,417
      4. 2013—\$700,000
      5. 2014—\$700,000
      6. 2015—\$700,000
      7. 2016—\$700,000
      8. 2017—\$700,000
      9. 2018—\$700,000
      10. 2019—\$700,000
      11. 2020—\$700,000
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Weatherization and Energy Efficiency for Low-Income Houses**
    - i. 100% from government spending for grants towards programs for energy efficiency in affordable housing
4. Input costs by sector into REMI PI+ model and run impacts.
5. Adjustment of 3 percent to capture those green jobs that area directly linked to these building/construction costs to meet green initiatives.<sup>229</sup>
6. Export impacts and analyze.

### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Weatherization and Energy Efficiency for Low-Income Houses**
    - i. 640—Consumer Spending (electricity)

<sup>228</sup> “Housing and Community Development,” Maryland Department of Housing and Community Development (2011), accessed October 17, 2012.

<sup>229</sup> “Estimating Renewable Energy Costs” *United States Energy Information Administration*, accessed May 21, 2013.

- ii. 642—Consumer Spending (fuel and oil)
- iii. 78—Consumption Reallocation
- 2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Weatherization and Energy Efficiency for Low-Income Houses**
    - i. Number of units completed<sup>230</sup>
      - 1. 2012—2,167
      - 2. 2013—2,166
      - 3. 2014—2,166
- 3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Weatherization and Energy Efficiency for Low-Income Houses**
    - i. Average Savings<sup>231</sup>=\$437 a year per unit
- 4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).
  - a. **Weatherization and Energy Efficiency for Low-Income Houses**
    - i. \$946,979 [(\$437 Average Annual Savings per Unit \* 2,167 number of units completed in 2012)]=Total savings in 2012
    - ii. \$946,542 [(\$437 Average annual savings per unit \* 2,166 number of units completed in 2013)]=Total savings in 2013
    - iii. \$946,542 [(\$437 average annual savings per unit \* 2,166 number of units completed in 2014)]=Total savings in 2014
    - iv. \$473,490 [(\$946,979 total savings in 2012 / 2 sectors to represent electricity and heating)]=Average savings across electricity and heating for retrofitted units
    - v. \$473,270 [(\$946,542 total savings in 2013 / 2 sectors to represent electricity and heating)]=Average savings across electricity and heating for retrofitted units
    - vi. \$473,270 [(\$946,542 total savings in 2014 / 2 sectors to represent electricity and heating)]=Average savings across electricity and heating for retrofitted units
    - vii. 640—\$473,490 savings in 2012
    - viii. 642—\$473,490 savings in 2012
    - ix. 78 — \$946,979 reallocation of savings in 2012 across other consumption categories
    - x. 640—\$473,270 savings in 2013
    - xi. 642—\$473,270 savings in 2013
    - xii. 78—\$946,542 reallocation of savings in 2013 across other consumption categories
    - xiii. 640—\$473,270 savings in 2014
    - xiv. 642—\$473,270 savings in 2014

<sup>230</sup> Office of Energy Performance and Conservation, “StateStat Template,” *StateStat Maryland* (September 18, 2012), Maryland Department of General Services, accessed October 17, 2012.

<sup>231</sup> Weatherization and Intergovernmental Program: Weatherization Assistance Program. EERE: EERE Server Maintenance. U.S. Department of Energy, 25 Apr. 2011. Web. 11 Nov. 2011.  
<<http://www1.eere.energy.gov/wip/wap.html>>.

- xv. 78—\$946,542 reallocation of savings in 2014 across other consumption categories
2. Input savings/costs by sector into REMI PI+ model and run impacts.
3. Export impacts and analyze.

## C.6 Land Use

### 3.6.1 Reducing GHG Emissions from the Transportation Sector through Land Use and Location Efficiency

#### Investment Phase

No investment costs were specified for this policy.

#### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Maryland Sustainable Growth Commission**
    - i. X5412—Industry Sales, Construction
  - b. **Plan Maryland**
    - i. No additional benefits or costs were specified.
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Maryland Sustainable Growth Communities**
  - b. **Plan Maryland**
    - i. No additional benefits or costs were specified.
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Maryland Sustainable Growth Commission**<sup>232</sup>
    - i. Tax Credit Given to Projects in 2010<sup>233</sup> = \$3,820,000
    - ii. Tax Credit Given to 10 Projects in 2011<sup>234</sup> = \$11,180,000
  - b. **Plan Maryland**
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2011).
  - a. **Maryland Sustainable Growth Commission**
    - i. X5412—\$3,820,000 (2010)
    - ii. X5412— \$11,180,000 (2011)
  - b. **Plan Maryland**
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

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<sup>232</sup> Please note that \$3.8 million and \$11.1 million are allocated to *Industry Sales, Construction* under 3.6.1 and also appear under 3.6.3 as investment phase *State Govt. Spending*, though are not double-counted in estimating economic impacts. This is done to capture construction-specific impacts of the SCTC program.

<sup>233</sup> Maryland Department of Planning Staff, “Maryland Smart Growth Sub-Cabinet Report on State Spending Inside and Outside of the Priority Funding Areas for Fiscal Years 2006-2009 and 2009 Annual Report,” *Maryland Smart, Green & Growing* (December 2009), Maryland Department of Planning.

<sup>234</sup> *Ibid.*

### 3.6.2 Transportation GHG Targets for Local Governments and Metropolitan Planning Organizations

#### Investment Phase

No investment costs were specified by the agency for this policy.

#### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Transportation GHG Targets for Local Governments and Metropolitan Planning Organizations**
    - i. 641—Consumer spending (gas)
    - ii. 78—Consumption reallocation (across all other consumption categories)
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Transportation GHG Targets for Local Governments and Metropolitan Planning Organizations**
    - i. Reduction by 2020- Assume that there is a 1.875% reduction annually (by 2020 we will have a 15% reduction in CO2 from this sector)
    - ii. Number of Registered Vehicles=3,382,451 (provided by MDE courtesy of MVA)
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Transportation GHG Targets for Local Governments and Metropolitan Planning Organizations**
    - i. Conversion from Metric tons into Gallons of Gas
      1. Change to kg=0.01875
    - ii. Average Annual Miles Driven By Population<sup>235</sup>=13,041
    - iii. Avg. MPG for a 4-door sedan=27
    - iv. Transfer from Gallons to KG<sup>236</sup>=1,455,647,935
    - v. Transfer to Metric Tons of Co2=1,455,647.935 (annual metric tons from driving in MD)
    - vi. Avg. Cost of Gas Per Gallon in MD=3.43
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **Transportation GHG Targets for Local Governments and Metropolitan Planning Organizations**
    - i. Assume 10% Are State Owned Fleet=338,245.1 (number of registered vehicles\*0.1)
    - ii. Total Miles Traveled in MD=4,411,054,349 (average annual miles driven by population\*Assume 10% Are State Owned Fleet)
    - iii. Number of Gallons used =163,372,383.3 (total miles traveled in MD\*avg. MPG for a 4-door sedan)

<sup>235</sup> State and Urbanized Area Statistics. U.S. Department of Transportation, 4 April. 2011. Web. 11 Nov. 2011. <<http://www.fhwa.dot.gov/ohim/onh00/onh2p11.htm>>.

<sup>236</sup> "How We Calculate Your Carbon Footprint." Carbon offsets for your carbon footprint & fighting global warming. 2011. CarbonFund.org. 14 Nov. 2011 <[http://www.carbonfund.org/site/pages/carbon\\_calculators/category/Assumptions#Transportation](http://www.carbonfund.org/site/pages/carbon_calculators/category/Assumptions#Transportation)>.

- iv. Reduction=27,293.39879 (Change to kg\*Transfer to Metric Tons of Co2)
  - v. New Metric Tons of Co2 Consumed=1,428,355 (Transfer to Metric Tons of Co2-reduction)
  - vi. Convert to kg =1,428,354,536 (New Metric Tons of Co2 Consumed\*1,000)
  - vii. Convert to Gallons=160,309,151.1 (convert to kg/8.91)
  - viii. Previous Cost to Travel Annually=560,367,274.7 (Number of Gallons used\*Avg. Cost of Gas Per Gallon in MD)
  - ix. New Cost to Travel Annually =549,860,388.3 (Convert to Gallons\*Avg. Cost of Gas Per Gallon in MD)
  - x. 641—\$10,506,886.40 (Previous Cost to Travel Annually-New Cost to Travel Annually)
  - xi. 78—\$10,506,886.40 [(reallocation of savings across all other consumption categories)]
5. Input savings/costs by sector into REMI PI+ model and run impacts.
  6. Export impacts and analyze.

### 3.6.3 Land Use Planning for GHG Benefits

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Funding Mechanisms for Smart Growth**
    - i. 63—State Govt. Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Funding Mechanisms for Smart Growth**
    - i. \$5,599,638—spending in 2010 on SCTC tax credit (provided by MDP)
    - ii. \$12,879,736—spending in 2011 on SCTC tax credit (provided by MDP)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Funding Mechanisms for Smart Growth**
    - i. 100% spent by government on SCTC tax credit
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Funding Mechanisms for Smart Growth**
    - i. X3612—Firm Employment, Construction
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Funding Mechanisms for Smart Growth**
    - i. Average Jobs Created per \$1 million investment<sup>237</sup>—72.5

<sup>237</sup> Cronyn, Joseph and Evans Paull. *Heritage Tax Credits: Maryland's Own Stimulus to Renovate Buildings for Productive Use and Create Jobs, an \$8.53 Return on Every State Dollar Invested*. The Abell Foundation 22.1(March 2009) p. 1-8.

3. Research savings data for each policy according to part of program to be affected by savings.
  - a. Funding Mechanisms for Smart Growth**
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).

- a. **Funding Mechanisms for Smart Growth**
  - i. 406.0 jobs [ $(\$5,599,638 \text{ tax credit in 2010} / \$1,000,000) * 72.5 \text{ jobs created per } \$1 \text{ million in tax credit}$ ]=average jobs created in 2010
  - ii. 933.8 jobs [ $(\$12,879,736 \text{ tax credit in 2011} / \$1,000,000) * 72.5 \text{ jobs created per } \$1 \text{ million in tax credit}$ ]=average jobs created in 2011
  - iii. 669.9 jobs  $[(406.0 + 933.8)/2 \text{ years}]$ =average annual jobs if average tax credit continues through 2020
  - iv. X3612—669.9 jobs annually
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.6.4 GHG Benefits from Priority Funding Areas and Other Growth Boundaries Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy.
  - a. **GHG Benefits from Priority Funding Areas and Other Growth Boundaries**
    - i. 63—Govt. State Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **GHG Benefits from Priority Funding Areas and Other Growth Boundaries**
    - i. \$779,000,000 annually investment on Chesapeake Bay TMDL from 2010-2017<sup>238</sup>
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **GHG Benefits from Priority Funding Areas and Other Growth Boundaries**
    - i. 100% spent by government on storm water drainage updates
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **GHG Benefits from Priority Funding Areas and Other Growth Boundaries**
    - i. X3211—Industry Sales, Water, sewage, and other systems
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **GHG Benefits from Priority Funding Areas and Other Growth Boundaries**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **GHG Benefits from Priority Funding Areas and Other Growth Boundaries**
    - i. Costs from 2017-2020 for Maintenance<sup>239</sup>—\$81,116,728
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).
  - a. **GHG Benefits from Priority Funding Areas and Other Growth Boundaries**
    - i. X3211—\$81,116,728 annually from 2017-2020
5. Input savings/costs by sector into REMI PI+ model and run impacts.

<sup>238</sup> “Chesapeake Bay TMDL,” United States Environmental Protection Agency, accessed October 17, 2012.

<sup>239</sup> “The Chesapeake Bay TMDL, Maryland’s Watershed Implementation Plan and Maryland’s 2012-2013 Milestone Goals,” Maryland Department of the Environment, accessed October 17, 2012.

6. Export impacts and analyze.

## C.7 Innovative Initiatives

### 3.7.1 Leadership-by-Example—Local Government

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - b. Leadership-by-Example—Local Government**
    - i. 63—State Govt. Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - c. Leadership-by-Example—Local Government**
    - ii. \$62,060,217 (total allocation towards program from 2010-2020, provided by MDE)
3. Distribute inputs among identified REMI PI+ sectors.
  - d. Leadership-by-Example—Local Government**
    - iii. 100% spent by government on implementation of program
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. Leadership-by-Example—Local Government**
    - i. 65—Local government spending
    - ii. X3209—Industry sales, Electrical power generation, transmission, and distribution
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. Leadership-by-Example—Local Government**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. Leadership-by-Example—Local Government**
    - i. Avg. Number of Sq. Feet Needed per Employee<sup>240</sup>—387
    - ii. Energy Consumption per Sq. Feet<sup>241</sup>—68.61
    - iii. Avg. Cost per kwh<sup>242</sup>—0.11
    - iv. Number of Local Government Employees<sup>243</sup>—241,869

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<sup>240</sup> Employment and Payrolls - Industry Series - Maryland 2009 - Employment and Payrolls - Division of Workforce Development and Adult Learning. Maryland Department of Labor, Licensing and Regulation. Maryland Department of Labor, Licensing and Regulation, 1 June 2011. Web. 11 Nov. 2011. <<http://www.dllr.state.md.us/lmi/emppay/md2010ep.shtml>>.

<sup>241</sup> Building Energy Data Book. Buildings Energy Data Book. U.S. Energy Information Administration, Mar. 2011. Web. 11 Nov. 2011. <<http://buildingsdatabook.eren.doe.gov/ChapterIntro3.aspx>>.

<sup>242</sup> A Look at Office Buildings - How Many Employees Are There. U.S. Energy Information Administration (EIA). U.S. Energy Information Administration (EIA), 3 Jan. 2001. Web. 14 Nov. 2011. <[http://www.eia.gov/emeu/consumptionbriefs/cbecs/pbawebwebsite/office/office\\_howmanyempl.htm](http://www.eia.gov/emeu/consumptionbriefs/cbecs/pbawebwebsite/office/office_howmanyempl.htm)>.

<sup>243</sup> Employment and Payrolls - Industry Series - Maryland 2009 - Employment and Payrolls - Division of Workforce Development and Adult Learning. Maryland Department of Labor, Licensing and Regulation. Maryland Department

4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2020-2025).
  - a. **Leadership-by-Example—Local Government**
    - i. 93,603,303 [(387 Avg. Number of Sq. Feet Needed per Employee \* 241,869 Local Government Employees)]=Avg. Sq Feet of Local Government Buildings
    - ii. 6,422,122,618.83 [(68.61 Units of Energy Consumed per Sq. Feet \* 93603303 Avg. Sq Feet of Local Government Buildings)]=Avg. Energy Consumption in Local Govt. Buildings in kilowatts
    - iii. \$706,433,488.07 [(6,422,122,618.83 Avg. Energy Consumption in Local Govt. Buildings \* 0.11 Cost in kWh)]=Avg. Cost of Energy Consumption in Local Govt.
    - iv. 834,875,940.45 [(6,422,122,618.83 Avg. Energy Consumption in Local Govt. Buildings \* 0.13)]=If Target is 13% for savings in kilowatts
    - v. 5,587,246,678.38 [(6,422,122,618.83 Avg. Energy Consumption in Local Govt. Buildings - 834,875,940.45 If Target is 13% for savings)]=New Energy Consumption in kilowatts
    - vi. \$614,597,134.62 [(5,587,246,678.38 New Energy Consumption \* 0.11 Cost in kwh)]=New Costs in kwh
    - vii. \$91,836,353.45 [(\$706,433,488.07 Avg. Cost of Energy Consumption in Local Govt. - \$614,597,134.62 New Costs)]=New Savings
    - viii. X3209—\$91,836,353.45 annual reduction in sales for energy
    - ix. 65—\$91,836,353.45 annual reallocation of spending by local government
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.7.2 Leadership-by-Example—Federal Government Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **Leadership-by-Example—Federal Government**
    - i. 94—Federal Govt. Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Leadership-by-Example—Federal Government**
    - i. \$40,049,749 (provided by MDE, budget for 2010-2020)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Leadership-by-Example—Federal Government**
    - ii. 100% spent by government on Lead-by-Example initiatives
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

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of Labor, Licensing and Regulation, 1 June 2011. Web. 11 Nov. 2011.  
<<http://www.dllr.state.md.us/lmi/emppay/md2010ep.shtml>>.

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1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. Leadership-by-Example—Federal Government**
    - i. X6409—Exogenous final demand, Electric power generation, distribution, and transmission
    - ii. 94—Federal Govt. Spending
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. Leadership-by-Example—Federal Government**
    - i. Energy Saved—13.00%
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. Leadership-by-Example—Federal Government**
    - i. Avg. Number of Sq. Feet Needed per Employee<sup>244</sup>—387
    - ii. Energy Consumption per Sq. Feet<sup>245</sup>—68.61
    - iii. Avg. Cost per kwh<sup>246</sup>—0.11
    - iv. Federal Employees in MD<sup>247</sup>—139,927
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2020-2025).
  - a. Leadership-by-Example—Federal Government**
    - i. \$587,156.93 [((68.61 units of energy consumed per sq. feet \* 75000 sq. feet) \* 0.11 per kwh)]=Avg. Cost per 75,000 Sq. Feet
    - ii. \$76,330.40 [(\$587,156.93 Avg. Cost per 75,000 Sq. Feet \* 13.00% Energy Saved)]=Reduction
    - iii. \$510,826.53 [(\$587,156.93 Avg. Cost per 75,000 Sq. Feet - \$76,330.40 Reduction)]=Avg. Annual Savings
    - iv. 54,151,749 [(139,927 Federal Employees in MD \* 387 Sq. Feet per employee)]=Estimated Number of Sq. Feet
    - v. 3,715,521,464.23 [(54,151,749 Estimated Number of Sq. Feet \* 68.61 units of energy consumed per sq. feet)]=Avg. Used in Federal Building per Sq. Feet
    - vi. \$423,940,999.07 [(3,715,521,464.23 Avg. Used in Federal Building per Sq. Feet \* 0.11 Avg. Cost per kwh)]=Avg. Cost per kwh

<sup>244</sup> Employment and Payrolls - Industry Series - Maryland 2009 - Employment and Payrolls - Division of Workforce Development and Adult Learning. Maryland Department of Labor, Licensing and Regulation. Maryland Department of Labor, Licensing and Regulation, 1 June 2011. Web. 11 Nov. 2011. <<http://www.dlir.state.md.us/lmi/emppay/md2010ep.shtml>>.

<sup>245</sup> Building Energy Data Book. Buildings Energy Data Book. U.S. Energy Information Administration, Mar. 2011. Web. 11 Nov. 2011. <<http://buildingsdatabook.eren.doe.gov/ChapterIntro3.aspx>>.

<sup>246</sup> A Look at Office Buildings - How Many Employees Are There. U.S. Energy Information Administration (EIA). U.S. Energy Information Administration (EIA), 3 Jan. 2001. Web. 14 Nov. 2011. <[http://www.eia.gov/emeu/consumptionbriefs/cbecs/pbawebiste/office/office\\_howmanyempl.htm](http://www.eia.gov/emeu/consumptionbriefs/cbecs/pbawebiste/office/office_howmanyempl.htm)>.

<sup>247</sup> Employment and Payrolls - Industry Series - Maryland 2009 - Employment and Payrolls - Division of Workforce Development and Adult Learning. Maryland Department of Labor, Licensing and Regulation. Maryland Department of Labor, Licensing and Regulation, 1 June 2011. Web. 11 Nov. 2011. <<http://www.dlir.state.md.us/lmi/emppay/md2010ep.shtml>>.

- vii.  $483,017,790.40 [(3,715,521,464.23 \text{ Avg. Used in Federal Building per Sq. Feet} * 13.00\% \text{ Energy Saved})]=\text{Avg. Savings}$
  - viii.  $3,232,503,674 [(3,715,521,464.23 \text{ Avg. Used in Federal Building per Sq. Feet} - 483,017,790.40 \text{ Avg. Savings})]=\text{New Amount Used}$
  - ix.  $\$368,828,669.19 [(3,232,503,674 \text{ New Amount Used} * 0.11 \text{ Avg. Cost per kwh})]=\text{Total Cost of New Amount}$
  - x.  $\$55,112,329.88 [(\$423,940,999.07 \text{ Avg. Cost per kwh} - \$368,828,669.19 \text{ Total Cost of New Amount})]=\text{Avg. Annual Savings}$
  - xi. X6409—\$55,112,329.88 reduction in energy demand from federal government installations in Maryland
  - xii. 94—\$55,112,329.88 reallocation of spending by federal government from reduced energy costs
- 5. Input savings/costs by sector into REMI PI+ model and run impacts.
  - 6. Export impacts and analyze.

### **3.7.3 Leadership-by-Example—Maryland Colleges and Universities Investment Phase**

- 1. Determine relevant REMI PI+ sectors for each program under the policy.
  - a. Leadership-by-Example—Maryland Colleges and Universities**
    - i. 63—State Govt. Spending
- 2. Determine overall cost of policy implementation for each program under the policy.
  - a. Leadership-by-Example—Maryland Colleges and Universities**
    - i. \$38,686,850 (provided by MDE, budget from 2010-2020)
- 3. Distribute inputs among identified REMI PI+ sectors.
  - a. Leadership-by-Example—Maryland Colleges and Universities**
    - i. 100% spent by government on Lead-by-Example initiatives
- 4. Input sales/costs by sector into REMI PI+ model and run impacts.
- 5. Export impacts and analyze.

### **Operation Phase**

- 1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. Leadership-by-Example—Maryland Colleges and Universities**
    - i. X3209—Industry sales, Electric power generation, transmission, and distribution
    - ii. 63—State Govt. Spending
- 2. Determine part of program to be affected by savings (from strategy write-up).
  - a. Leadership-by-Example—Maryland Colleges and Universities**
    - i. Number of MD Public Universities—64,222
- 3. Research savings data for each policy according to part of program to be affected by savings.
  - a. Leadership -by-Example—Maryland Colleges and Universities**
    - i. Avg. Number of Sq. Feet Needed per Employee<sup>248</sup>—387

<sup>248</sup> Employment and Payrolls - Industry Series - Maryland 2009 - Employment and Payrolls - Division of Workforce Development and Adult Learning. Maryland Department of Labor, Licensing and Regulation. Maryland Department

- ii. Energy Consumption per Sq. Feet<sup>249</sup>—68.61
- iii. Avg. Cost per kwh<sup>250</sup>—0.11
- 4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2020-2025).
  - a. Leadership-by-Example—Maryland Colleges and Universities**
    - i. 24,853,914 [(64,222 MD Public Universities \* 387 Sq. Feet Needed per Employee)]=Avg. Sq feet in Universities
    - ii. 1,705,227,040 [(24,853,914 Avg. Sq. Feet in Universities \* 68.61 Units of Energy Consumed per Sq. Feet)]=Avg. Electricity Used in Universities
    - iii. \$187,574,974.35 [(1,705,227,040 Avg. Electricity Used in Universities \* \$0.11 Cost in kwh)]=Avg. Cost
    - iv. 0.215 [((0.1 + 0.33) / 2)]=Avg. Reduction Target by 2020 from Universities
    - v. 0.026875 [(0.215 Avg. Reduction Target by 2020 from Universities / 8)]=Target Reduction Annually
    - vi. 45,827,976.69 [(1,705,227,040 Avg. Electricity Used in Universities \* 0.026875 Target Reduction Annually)]=Savings Annually
    - vii. 1,659,399,063 [(1,705,227,040 Avg. Electricity Used in Universities - 45,827,976.69 Savings Annually)]=Avg. Annual Savings
    - viii. \$182,533,896.91 [(1,659,399,063 Avg. Annual Savings \* \$0.11 Cost in kwh)]=Avg. Cost After Reduction
    - ix. \$5,041,077.44 [(\$187,574,974.35 Avg. Cost - \$182,533,896.91 Avg. Cost After Reduction)]=Avg. Annual Savings
    - x. X3209—\$5,041,077.44 annual reduction in energy sales to energy sector
    - xi. 64—\$5,041,077.44 government reallocation of funds from energy savings
- 5. Input savings by sector into REMI PI+ model and run impacts.
- 6. Export impacts and analyze.

### 3.8.4 GHG Early Voluntary Reductions

#### Investment Phase

- 1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. GHG Early Voluntary Reductions**
    - i. 63—State Govt. Spending
- 2. Determine overall cost of policy implementation for each program under the policy.
  - a. GHG Early Voluntary Reductions**
    - i. \$15,000 annually (provided by MDE)
- 3. Distribute inputs among identified REMI PI+ sectors.

of Labor, Licensing and Regulation, 1 June 2011. Web. 11 Nov. 2011.

<<http://www.dlrr.state.md.us/lmi/emppay/md2010ep.shtml>>.

<sup>249</sup> Building Energy Data Book. Buildings Energy Data Book. U.S. Energy Information Administration, Mar. 2011. Web. 11 Nov. 2011. <<http://buildingsdatabook.eren.doe.gov/ChapterIntro3.aspx>>.

<sup>250</sup> A Look at Office Buildings - How Many Employees Are There. U.S. Energy Information Administration (EIA). U.S. Energy Information Administration (EIA), 3 Jan. 2001. Web. 14 Nov. 2011.

<[http://www.eia.gov/emeu/consumptionbriefs/cbecs/pbawebpage/office/office\\_howmanyempl.htm](http://www.eia.gov/emeu/consumptionbriefs/cbecs/pbawebpage/office/office_howmanyempl.htm)>.

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- a. **GHG Early Voluntary Reductions**
  - i. 100% spent by government for administrative costs
- 4. Input sales/costs by sector into REMI PI+ model and run impacts.
- 5. Export impacts and analyze.

### Operation Phase

- 1. Determine relevant REMI PI+ sectors.
  - a. **GHG Early Voluntary Reductions**
    - i. X7809—Production costs, Electric power generation, transmission, and distribution
- 2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **GHG Early Voluntary Reductions**
    - i. Annual Reduction Target by 2020—1.03 million metric tons
    - ii. Number of years of auctions—4 years
    - iii. Number of years until Target—8 years
    - iv. Average Reductions per year—128,750 allowances annually
- 3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **GHG Early Voluntary Reductions**
    - i. Proceeds From Auctions<sup>251</sup>—\$169,600,423.80 (total to date)
    - ii. Allowances Sold to Date<sup>252</sup>— 68,507,184
- 4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **GHG Early Voluntary Reductions**
    - i.  $\$42,400,105.95 [(\$169,600,423.80 \text{ total proceeds from auctions to date} / 4 \text{ years})]=\text{annual cost from sales of allowances}$
    - ii.  $\$2.48 [(\$169,600,423.80 \text{ total proceeds from auctions to date} / 68,507,184 \text{ total carbon allowances sold to date})]=\text{average cost of carbon allowances}$
    - iii.  $17,126,796 [(68,507,184 \text{ total carbon allowances sold to date} / 4 \text{ years})]=\text{average carbon credits sold annually}$
    - iv.  $16,998,046 [(17,126,796 \text{ average carbon credits sold annually}—128,750 \text{ proposed annual reduction target})]=\text{average annual carbon credit to be purchased under reductions}$
    - v.  $\$42,081,364.86 [(16,998,046 \text{ average annual carbon credits purchased under reduction target} * \$2.48 \text{ average cost per carbon credit allowance})]=\text{average cost to firm for carbon credits under new reduction target}$
    - vi.  $\$318,741.09 [(\$42,400,105.95 \text{ current average annual carbon credit costs} - \$42,081,364.86 \text{ average carbon credit costs under target reduction policy})]=\text{savings to firms from reductions}$

<sup>251</sup> MD Proceeds by Auction. Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Welcome. Regional Greenhouse Gas Initiative CO2 Budget Trading Program, 2011. Web. 14 Nov. 2011. <[http://rggi.org/docs/MD\\_Proceeds\\_by\\_Auction.pdf](http://rggi.org/docs/MD_Proceeds_by_Auction.pdf)>.

<sup>252</sup> Ibid.

- vii. X7809—\$318,741.09 annual reduction in production costs from early reduction strategies
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.7.4 GHG Early Voluntary Reductions

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy.
  - a. **GHG Early Voluntary Reductions**
    - i. 63—State Government Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **GHG Early Voluntary Reductions**
    - i. \$15,000 annually (provided by MDE)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **GHG Early Voluntary Reductions**
    - i. 100% spent by government on administrative costs
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI PI+ sectors.
  - a. **GHG Early Voluntary Reductions**
    - i. X7809—Production costs, Electrical power distribution, transmission, and generation
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **GHG Early Voluntary Reductions**
    - i. Annual Reduction Target by 2020—1.03 million metric tons
    - ii. Number of years of auctions—4 years
    - iii. Number of years until Target—8 years
    - iv. Average Reductions per year—128,750 allowances annually
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **GHG Early Voluntary Reductions**
    - i. Proceeds From Auctions<sup>253</sup>—\$169,600,423.80 (total to date)
    - ii. Allowances Sold to Date<sup>254</sup>— 68,507,184
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).

<sup>253</sup> MD Proceeds by Auction. Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Welcome. Regional Greenhouse Gas Initiative CO2 Budget Trading Program, 2011. Web. 14 Nov. 2011. <[http://rggi.org/docs/MD\\_Proceeds\\_by\\_Auction.pdf](http://rggi.org/docs/MD_Proceeds_by_Auction.pdf)>.

<sup>254</sup> MD Proceeds by Auction. Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Welcome. Regional Greenhouse Gas Initiative CO2 Budget Trading Program, 2011. Web. 14 Nov. 2011. <[http://rggi.org/docs/MD\\_Proceeds\\_by\\_Auction.pdf](http://rggi.org/docs/MD_Proceeds_by_Auction.pdf)>.

- a. **GHG Early Voluntary Reductions**
  - i. \$42,400,105.95 [(\$169,600,423.80 total proceeds from auctions to date / 4 years)] = annual cost from sales of allowances
  - ii. \$2.48 [(\$169,600,423.80 total proceeds from auctions to date / 68,507,184 total carbon allowances sold to date)] = average cost of carbon allowances
  - iii. 17,126,796 [(68,507,184 total carbon allowances sold to date / 4 years)] = average carbon credits sold annually
  - iv. 16,998,046 [(17,126,796 average carbon credits sold annually—128,750 proposed annual reduction target)] = average annual carbon credit to be purchased under reductions
  - v. \$42,081,364.86 [(16,998,046 average annual carbon credits purchased under reduction target \* \$2.48 average cost per carbon credit allowance)] = average cost to firm for carbon credits under new reduction target
  - vi. X7809—\$318,741.09 [(\$42,400,105.95 current average annual carbon credit costs - \$42,081,364.86 average carbon credit costs under target reduction policy)] = savings to firms annually from reductions
5. Input savings by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.7.5 State of Maryland Initiative to Lead by Example Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **High Performance Buildings**
    - i. 99—Investment spending, Non-residential
    - ii. 68—State Govt. Spending (including non-pecuniary amenity aspects)
  - b. **Green Maryland Act of 2010**
    - i. No investment costs were specified by the agency for this program.
  - c. **Green Buildings**
    - i. 47—Non-residential capital investment
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **High Performance Buildings**<sup>255</sup>
    - i. \$33,219,574 (spending in 2010, per MD Statestat data)
    - ii. \$43,563,417 (spending in 2011, per MD Statestat data)
    - iii. \$36,156,867 (spending in 2012, per MD Statestat data)
  - b. **Green Maryland Act of 2010**
    - i. No investment costs were specified by the agency for this program.
  - c. **Green Buildings**
    - i. \$193,650,429 (total spending over 2010-2013)<sup>256</sup>

<sup>255</sup> Office of Energy Performance and Conservation, “StateStat Template,” *StateStat Maryland* (September 18, 2012), Maryland Department of General Services, accessed October 17, 2012.

<sup>256</sup> Office of Energy Performance and Conservation, “StateStat Template,” *StateStat Maryland* (September 18, 2012), Maryland Department of General Services, accessed October 17, 2012.

3. Distribute inputs among identified REMI PI+ sectors.
  - a. **High Performance Buildings**
    - i. 49.8% for government administrative costs/responsibilities
    - ii. 50.1% spread among investment spending, non-residential
  - b. **Green Maryland Act of 2010**
    - i. No investment costs were specified by the agency for this program.
  - c. **Green Buildings**
    - i. 100% private sector spending for implementation
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Adjust for 3 percent of costs only being attributed to green building initiatives.<sup>257</sup>
6. Export impacts and analyze.

### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **High Performance Buildings**
    - i. X10540—Electrical Fuel Costs (Individual Industry), Elementary and secondary schools; Junior colleges, colleges, universities, and professional schools; Other educational services
    - ii. X10564— Electrical Fuel Costs (Individual Industry), Civic, social, professional, and similar organizations
  - b. **Green Maryland Act of 2010**
    - i. No operation costs/benefits specified.
  - c. **Green Buildings**
    - i. X6409—Exogenous final demand (amount), Electric power generation, distribution, transmission
    - ii. 63—State Govt. Spending
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **High Performance Buildings**
  - b. **Green Maryland Act of 2010**
    - i. No operation costs/benefits specified.
  - c. **Green Buildings**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **High Performance Buildings**
    - i. Average Energy Savings for retrofitted buildings<sup>258</sup>
      1. 2010—\$13,618,966
      2. 2011-2012—\$21,504,572
  - b. **Green Maryland Act of 2010**
  - c. **Green Buildings**
    - i. Avg. Savings from Green Buildings<sup>259</sup> = 30%

<sup>257</sup> “Estimating Renewable Energy Costs” *United States Energy Information Administration*, accessed May 21, 2013.

<sup>258</sup> Office of Energy Performance and Conservation, “StateStat Template,” *StateStat Maryland* (September 18, 2012), Maryland Department of General Services, accessed October 17, 2012.

- ii. Avg. Cost to Build a Green Building= \$4 per sq foot
  - iii. Avg. use of energy in a commercial building<sup>260</sup>=1,153,191.49
  - iv. Avg. Cost per kwh<sup>261</sup>=\$0.11
  - v. Avg. Savings=\$39,473.75
  - vi. Number of Buildings Proposed<sup>262</sup>=37
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).
- a. **High Performance Buildings**
    - i. 2010
      1. X10540—\$6,809,493 reduction in energy costs from retrofit
      2. X10564—\$6,809,493 reduction in energy costs from retrofit
    - ii. 2011-2020
      1. X10540—\$10,752,286 reduction in energy costs from retrofit
      2. X10564—\$10,752,286 reduction in energy costs from retrofit
  - b. **Green Maryland Act of 2010**
  - c. **Green Buildings**
    - i. \$131,579.15 (1,153,191.49 Avg. Use in kWh in a commercial building annually \* \$0.11 Avg, Cost per kWh for electricity) = Average Annual Electricity Costs for a Commercial Building
    - ii. \$39,473.75 (\$131,579.15 Average Annual Electricity Costs for a Commercial Building \* 30% reduction associated with Green Buildings) = Average Annual Savings for a Green Building in Energy
    - iii. \$1,460,528.55 (\$39,473.75 Average Annual Savings for a Green Building \* 37 Proposed Green Buildings to be Built) = Average Annual Savings for Proposed Strategy
    - iv. X6409—\$1,460,528.55 average annual reduction in energy demand from buildings
    - v. 63—\$1,460,528.55 average annual increase in funds from energy reduction state can spend towards other projects
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.7.6 State of Maryland Carbon and Footprint Initiatives Investment Phase

No investment costs were specified by the agency for this policy.

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<sup>259</sup> Kats, Gregory H. "Green Building Costs and Financial Benefits." NH Partnership for High Performance Schools - Home. <http://www.nhphps.org/docs/documents/GreenBuildingspaper.pdf>, 2003. Web. 11 Nov. 2011. <<http://www.nhphps.org/>>.

<sup>260</sup> Building Energy Data Book. Buildings Energy Data Book. U.S. Energy Information Administration, Mar. 2011. Web. 11 Nov. 2011. <<http://buildingsdatabook.eren.doe.gov/ChapterIntro3.aspx>>.

<sup>261</sup> SEDS | State Energy Data System. U.S. Energy Information Administration (EIA). U.S. Energy Information Administration (EIA), 2009. Web. 16 Nov. 2011. <[http://www.eia.gov/state/seds/hf.jsp?incfile=sep\\_prices/com/pr\\_com\\_MD.html&mstate=Maryland](http://www.eia.gov/state/seds/hf.jsp?incfile=sep_prices/com/pr_com_MD.html&mstate=Maryland)>.

<sup>262</sup> Maryland Green Building Council 2010 Annual Report. Maryland Green Building Council. Maryland Department of General Services, 2011. Web. 11 Nov. 2011. <<http://www.dgs.maryland.gov/pdfs/2010GreenBldgReport.pdf>>.

### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Maryland Environment Footprint**
    - i. X6409—Exogenous final demand, Electric power generation, distribution, and transmission
    - ii. 68—Government spending (including non-pecuniary spending)
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Maryland Environment Footprint**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Maryland Environment Footprint**
    - i. Electric Use in 2008 (kWh)<sup>263</sup>=1,732,064,108
    - ii. Electric Use in 2009 (KwH)<sup>264</sup>=1,455,031,107
    - iii. Cost per KwH<sup>265</sup>=0.11
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **Maryland Environment Footprint**
    - i. 277,033,001 [(1,732,064,108 kilowatt Electric Use in 2008 (kWh) - 1,455,031,107 Electric Use in 2009 (KwH))] = Savings in Electric Used Annually in kilowatts
    - ii. \$31,609,465.41 [(277,033,001 kilowatts Savings in Electric Used Annually (kWh) \* \$0.11 Cost per kWh in Maryland)] = Average Annual Savings associated with cost of electric
    - iii. X6409—\$31,609,465.41 annual reduction in demand for energy
    - iv. 68—\$31,609,465 reallocation of savings from energy to new programs
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.7.7 Job Creation and Economic Development

#### Investment Phase

No investment costs were specified by the agency for this policy.

#### Operation Phase

All impacts from the operation of this program would be captured throughout the GGRA in the creation of jobs or training to meet the new demand for green jobs.

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<sup>263</sup> Maryland Environmental Footprint. Maryland: Smart, Green and Growing. Maryland Environmental Service, Spring 2010. Web. 16 Nov. 2011. <[http://www.green.maryland.gov/carbon\\_footprint\\_page.html](http://www.green.maryland.gov/carbon_footprint_page.html)>.

<sup>264</sup> Ibid.

<sup>265</sup> SEDS | State Energy Data System. U.S. Energy Information Administration (EIA). U.S. Energy Information Administration (EIA), 2009. Web. 16 Nov. 2011.

<[http://www.eia.gov/state/seds/hf.jsp?incfile=sep\\_prices/com/pr\\_com\\_MD.html&mstate=Maryland](http://www.eia.gov/state/seds/hf.jsp?incfile=sep_prices/com/pr_com_MD.html&mstate=Maryland)>.

### 3.7.8 Public Health Initiatives Related to Climate Change

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy (taken from REMI PI+ Excel file).
  - a. **State Climate Change Environmental Health and Protection Advisory Council**
    - i. 68—Govt. Spending (including non-pecuniary aspects)
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **State Climate Change Environmental Health and Protection Advisory Council**
    - i. \$1,250,000 from 2010-2011 (from Center for Disease Control grant to DHMH)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **State Climate Change Environmental Health and Protection Advisory Council**
    - i. 100% spent by government in creation of tracking system
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **State Climate Change Environmental Health and Protection Advisory Council**
    - i. 662—Consumer spending, Health insurance, income loss, worker's comp
    - ii. 78—Consumption reallocation (across all other consumption categories)
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **State Climate Change Environmental Health and Protection Advisory Council**
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **State Climate Change Environmental Health and Protection Advisory Council**
    - i. Avg. Cost of an ER visit for Asthma attacks<sup>266</sup>—\$512
    - ii. Number of those in MD diagnosed with Asthma<sup>267</sup>—11,474
    - iii. Number of Deaths from Asthma in 2009<sup>268</sup>—221
    - iv. Average Funeral Costs in Maryland<sup>269</sup>—\$4,500

<sup>266</sup> Collins, Mary, and Judy Chen. "Under-Controlled Asthma™s Economic Impact | Feature Articles | Perspectives | Payer Solutions." IMS Health. IMS Health, Spring 2010. Web. 14 Nov. 2011. <<http://www.imshealth.com/portal/site/imshealth/menuitem.a46c6d4df3db4b3d88f611019418c22a/?vgnnextoid=da12b0ac2e6e6210VgnVCM10000ed152ca2RCRD>>.

<sup>267</sup> Asthma Hospitalizations in Maryland. Family Health Administration. Department of Health and Mental Hygiene, Aug. 2011. Web. 14 Nov. 2011. <<http://fha.maryland.gov/pdf/mch/DataBrief-3-AsthmaHospitalizationsinMaryland2011.pdf>>.

<sup>268</sup> Asthma Mortality in Maryland. Family Health Administration. Department of Health and Mental Hygiene, Aug. 2011. Web. 14 Nov. 2011. <<http://fha.maryland.gov/pdf/mch/DataBrief2-AsthmaMortalityinMaryland2011.pdf>>.

4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. **State Climate Change Environmental Health and Protection Advisory Council**
    - i. \$5,874,688 [(11,474 Number of those in MD diagnosed with Asthma \* 512 Avg. Cost of an ER visit for Asthma attacks)]=Cost to MD Households Annually
    - ii. 662—\$5,874,688 average reduction in health expenses from system
    - iii. 78—\$5,874,688 savings reallocation across all other consumption categories
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.7.9 Title V Permits for GHG Sources

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy.
  - a. **Title V Permits for GHG Sources**
    - i. 63—State Govt. Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **Title V Permits for GHG Sources**
    - i. \$40,000 annually (provided by MDE)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **Title V Permits for GHG Sources**
    - i. 100% spent by government on administrative costs
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

2. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Title V Permits for GHG Sources**
    - i. X7809— Production costs, Electric power generation, transmission, and distribution
    - ii. 63—State Govt. Spending
3. Determine part of program to be affected by savings (from 6.1.8 write-up).
  - a. **Title V Permits for GHG Sources**
    - i. Minimum air pollution sources to obtain permit—17,000 sources
    - ii. Minimum possible annually—100 tons per year of CO<sub>2</sub> equivalent
4. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Title V Permits for GHG Sources**

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<sup>269</sup> Mary, Stephenson J., and Donna Brinsfield. "Funeral Planning." University of Maryland Cooperative Extension Fact Sheet. University of Maryland Cooperative Extension. Web. 14 Nov. 2011. <<http://extension.umd.edu/publications/pdfs/fs409.pdf>>.

- i. Fees associated with Compliance<sup>270</sup>—\$52.23 per ton + \$200.00 base fee annually
  - ii. Number of Agencies currently holding permits<sup>271</sup>—120
  - iii. Total Minimum for Any Air Pollutant<sup>272</sup>—100 tons
  - iv. Total Minimum for Nitrogen Oxides<sup>273</sup>—25 tons
  - v. Total Minimum for Volatile Organic Components<sup>274</sup>—37.5 tons (varies by county, average)
  - vi. Total Minimum for Hazardous Air Pollutants (average)<sup>275</sup>—17.5 tons (single is 10 tons, and combination of variety is 25 tons)
5. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
- a. **Title V Permits for GHG Sources**
    - i. \$650,760.00 [(120 current permit holders \* (\$52.23 per ton \* 100 ton minimum + \$200.00 base fee)]=annual revenue to government from companies compliance with Clean Air Act
    - ii. \$180,690.00 [(120 current permit holders \* (\$52.23 per ton \* 25 ton minimum + \$200.00 base fee)]=annual revenue to government from companies compliance with Nitrogen Oxide Permit
    - iii. \$259,035.00 [(120 current permit holders \* (\$52.23 per ton \* 37.5 ton minimum + \$200.00 base fee)]=annual revenue to government from companies compliance with Volatile Organic Component Permit
    - iv. \$133,683.00 [(120 current permit holders \* (\$52.23 per ton \* 17.5 ton minimum + \$200.00 base fee)]=annual revenue to government from companies compliance with Hazardous Air Pollutants Permit
    - v. \$306,042.00 [(\$650,760.00 annual revenue if all apply under any air pollutant + \$180,690.00 annual revenue if all apply under nitrogen oxide permit + \$259,035.00 annual revenue if all apply under volatile organic component permit + \$133,683.00 annual revenue if all apply under hazardous air pollutants permit) / [(4 different types of permits)]=average possible annual minimum revenue from Title V permits
    - vi. X7809—\$306,042 annual increase in production costs attributable to permits
    - vii. 63—\$306,042 increased spending for various government projects from the revenue of permits sold

<sup>270</sup> “Title V Fee Sheet” The Department of the Environment. 14 Nov. 2011

<<http://www.mde.state.md.us/programs/Permits/AirManagementPermits/TitleVProgramInformation/Pages/title5feesheet.aspx>>

<sup>271</sup> “Issued Part 70 Permits” The Department of the Environment. 14 Nov. 2011

<<http://www.mde.state.md.us/programs/Permits/AirManagementPermits/TitleVProgramInformation/Pages/title5issuedpermits.aspx>>

<sup>272</sup> “Chronology of Maryland’s Part 70 Permit Program” The Department of the Environment. 14 Nov. 2011

<<http://www.mde.state.md.us/programs/Permits/AirManagementPermits/TitleVProgramInformation/Pages/title5factsheet.aspx>>

<sup>273</sup> Ibid.

<sup>274</sup> Ibid.

<sup>275</sup> Ibid.

6. Input savings/costs by sector into REMI PI+ model and run impacts.
7. Export impacts and analyze.

### 3.7.10 Outreach and Public Education

#### Investment Phase

No investment costs were specified by the agency for this policy.

#### Operation Phase

1. Determine relevant REMI PI+ sectors (taken from REMI PI+ Excel file).
  - a. **Outreach and Public Education**
    - i. 63—State Govt. Spending
2. Determine part of program to be affected by savings (from strategy write-up).
  - a. **Outreach and Public Education**
    - i. Staffing costs annually—\$12,500 (provided by MDE)
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. **Outreach and Public Education**
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2010-2020).
  - a. **Outreach and Public Education**
    - i. 63—\$12,500 annually
5. Input savings/costs by sector into REMI PI+ model and run impacts.
6. Export impacts and analyze.

### 3.7.11 GHG Prevention of Significant Deterioration Permitting Program

#### Investment Phase

1. Determine relevant REMI PI+ sectors for each program under the policy.
  - a. **GHG Prevention of Significant Deterioration Permitting Program**
    - i. 63—State Govt. Spending
2. Determine overall cost of policy implementation for each program under the policy.
  - a. **GHG Prevention of Significant Deterioration Permitting Program**
    - i. \$40,000 annually (provided by MDE)
3. Distribute inputs among identified REMI PI+ sectors.
  - a. **GHG Prevention of Significant Deterioration Permitting Program**
    - i. 100% spent by government on administrative costs associated with program
4. Input sales/costs by sector into REMI PI+ model and run impacts.
5. Export impacts and analyze.

#### Operation Phase

1. Determine relevant REMI PI+ sectors.
  - a. **GHG Prevention of Significant Deterioration Permitting Program**
    - i. X7809—Production costs, Electric power generation, transmission, and distribution
    - ii. 63—State Govt. Spending

2. Determine part of program to be affected by savings (from strategy write-up).
  - a. GHG Prevention of Significant Deterioration Permitting Program**
    - i. Company is emitting=100,000 tons
    - ii. Limit=50,000 tons
    - iii. Total Over Limit=50,000 tons (Company is emitting-Limit)
3. Research savings data for each policy according to part of program to be affected by savings.
  - a. GHG Prevention of Significant Deterioration Permitting Program**
    - i. Recent Clearing Price of Carbon Credits<sup>276</sup>=1.89 per metric ton
4. Estimate total annual increase in savings/revenue for each program and then calculate for complete study period (2011-2020).
  - a. GHG Prevention of Significant Deterioration Permitting Program**
    - i. \$94,500 (total over limit\*percent clearing price of carbon credits)  
=Revenue Received to reinvest in The State
    - ii. X7809—\$94,500 average annual increase in production costs from permit spending
    - iii. 63—\$94,500 average annual increase for government spending towards other programs
5. Export impacts and analyze.

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<sup>276</sup> "Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Auction 13." Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Welcome. 7 Sept. 2011. 11 Nov. 2011  
<[http://www.rggi.org/market/co2\\_auctions/results/auction\\_13](http://www.rggi.org/market/co2_auctions/results/auction_13)>.

## Appendix D—Occupational Data

This appendix contains information regarding the five top-gaining industries in terms of total employment for each strategy for both the investment and operation phases. RESI matched these industries with their top occupations in terms of employment on the national level. The top occupations were taken from BLS occupational industry overview data.

These occupations provide examples of some of the jobs which may experience employment gains as a result of investment or operation of each strategy. It is important to note that RESI analyzed the total employment gain rather than the direct employment gain, so some of the occupations listed in this appendix may experience an indirect or induced employment impact. In some cases, some occupations may not experience much impact at all, if any. It is important to note that REMI PI+ does not provide impacts on the occupational level, so the data contained in this appendix serves only as examples of what job titles may be affected due to each strategy.

It is also important to note that job creation during the investment phase does not necessarily assure that such jobs will be retained. In some cases, these jobs may only exist during the implementation period. On the other hand, most operational jobs will ultimately be retained rather than created after initial strategy implementation has occurred.

This appendix is meant to act as a guide for understanding the jobs associated with the industries defined in the final report. Some strategies showed gains in or retention of employment within industries which may not seem to have a direct relation to the relevant strategy. In many cases, such impacts were driven primarily by indirect and induced effects.

Industries which saw a gain from many strategies included in this report are Professional, scientific, and technical services and Public administration. Although the types of jobs contained within these sectors may not be as transparent as Construction or Retail trade, RESI used national level BLS data to demonstrate the types of jobs that exist within these industries. For many strategies, one of the goals is to stimulate green job growth. The industries defined by REMI PI+ do not offer much insight into the exact job titles within them, but consider the following: When a company must comply with certain regulations such as GHG emissions targets or caps, they will often need to hire environmental consultants, lawyers, and eventually developers to assist in cost-effective measures while remaining compliant with regulations. These jobs would typically fall under industries such as Professional, scientific and technical services and Construction.

Some strategies' operation phase revealed a significant impact on employment within Health care and social assistance and Retail trade. These total employment impacts were generally driven by either an indirect or induced effect, as mentioned previously, coming from the change in household income. For example, under the Clean Cars Program for Maryland strategy, RESI expects that many households would probably wait until after the strategy had been implemented and new technology had been introduced to purchase a new vehicle. Once the new vehicles that are compliant with the new regulations become available, car dealerships would see an increase in sales during the operation phase of the strategy. Therefore, they would need to hire new sales

representatives to meet the increased demand. This would demonstrate a possible direct effect in Retail trade. The indirect effect may be an equal or lesser effect in Health care and social assistance as a new group of people now have either an increased income or a second income and can then allocate more money toward their personal health. In addition, employers would be providing health benefits to a greater number of people. This could lead to a hiring effect in nursing for doctor's offices and hospitals as the demand for healthcare increases. This is just one example of how these strategies may affect sectors which are not directly discussed within the strategy.

The State of Maryland is home to many highly ranked higher educational institutions such as Johns Hopkins University and the University of Maryland. Students and graduates of such institutions are on the forefront of leading technological advances and medical discoveries within The State's borders on a daily basis. Employment related with many of the industries defined throughout the report as benefitting from the strategies discussed would be ideal fields for future Maryland graduates. If students were to graduate and stay within Maryland after graduation because they received a steady position, this could ultimately lead to a positive effect on The State's gross domestic product.

Please refer to the main body of the report for more information regarding impacts by strategy and phase as well as discussion of some of the potential reasons for employment gain in the top-gaining industries presented here. Please refer to Appendix B for a more detail explanation of direct, indirect, and induced impacts. The tables in Appendix D represent the top five gaining industries for each strategy and its phases in the left column, the total employment impact to the industry in the center column, and the five occupations with the highest employment in that industry in the right column.

**D.1 Energy**

**3.1.1 Regional Greenhouse Gas Initiative (RGGI)—Investment Phase**

Sales, office, administrative occupations	1.4	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	1.1	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	0.7	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	0.5	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Healthcare occupations	0.4	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.1.1 Regional Greenhouse Gas Initiative (RGGI)—Operation Phase**

Protective service occupations	37.6	<ul style="list-style-type: none"> <li>Fire fighters and inspectors</li> <li>Bailiffs, correctional officers, and jailers</li> <li>Fish and game wardens</li> <li>Animal control workers</li> <li>Private detectives and investigators</li> </ul>
Sales, office, administrative occupations	35.2	<ul style="list-style-type: none"> <li>Retail sales workers</li> <li>Advertising sales agents</li> <li>Insurance sales agents</li> <li>Sales representatives in wholesale and manufacturing</li> <li>Models, demonstrators, and product promoters</li> </ul>
Management, business, financial occupations	18.2	<ul style="list-style-type: none"> <li>Legislators</li> <li>Advertising, marketing, and sales managers</li> <li>Compliance officers</li> <li>Cost estimators</li> <li>Accountants and auditors</li> </ul>
Healthcare occupations	11.6	<ul style="list-style-type: none"> <li>Dentists</li> <li>Dietitians and nutritionists</li> <li>Physicians and surgeons</li> <li>Nurses and home health aides</li> <li>Occupational therapists</li> </ul>
Building, grounds, personal care, service occupations	10.6	<ul style="list-style-type: none"> <li>Supervisors of cleaning and maintenance workers</li> <li>Housekeeping and janitorial workers</li> <li>Pest control workers</li> <li>Landscaping and grounds keeping workers</li> <li>Pesticide handlers, sprayers, and applicators</li> </ul>

Sources: BLS, RESI

**3.1.2 GHG Reductions from Imported Power—Investment Phase**

Protective service occupations	0.0	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	0.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Legal occupations	0.0	Lawyers Judicial law clerks Judges, magistrates, and other judicial workers Paralegals and legal assistants Court reporters
Arts, design, entertainment, sports, media occupations	0.0	Artists and related workers Designers Entertainers and performers Sports and related workers Media and communications workers
Education, training, library occupations	0.0	Postsecondary teachers Preschool, primary, and secondary teachers Special education teachers Librarians Archivists, curators, and museum technicians

Sources: BLS, RESI

**3.1.2 GHG Reductions from Imported Power—Operation Phase**

Construction, extraction occupations	1.4	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Sales, office, administrative occupations	1.4	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	0.6	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Installation, maintenance, repair occupations	0.6	Computer, automated teller, and office machine repairers Radio and telecommunications equipment installers/repairers Aircraft mechanics and service technicians Automotive mechanics and service technicians Small engine mechanics
Computer, math, architect, engineer occupations	0.4	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers

Sources: BLS, RESI

**3.1.3 Federal New Source Performance Standard—Investment Phase**

Sales, office, administrative occupations	2.0	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	1.5	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	1.0	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	1.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	0.6	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.1.3 Federal New Source Performance Standard—Operation Phase**

Construction, extraction occupations	2.3	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Sales, office, administrative occupations	2.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	0.9	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Installation, maintenance, repair occupations	0.9	Computer, automated teller, and office machine repairers Radio and telecommunications equipment installers/repairers Aircraft mechanics and service technicians Automotive mechanics and service technicians Small engine mechanics
Computer, math, architect, engineer occupations	0.6	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers

Sources: BLS, RESI

**3.1.4 MACT—Investment Phase**

Sales, office, administrative occupations	0.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	0.1	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	0.1	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	0.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Construction, extraction occupations	0.1	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers

Sources: BLS, RESI

**3.1.4 MACT—Operation Phase**

Protective service occupations	26.4	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Sales, office, administrative occupations	26.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	13.4	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	8.5	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	7.8	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators

Sources: BLS, RESI

**3.1.5 Energy Efficiency in the Residential Sector—Investment Phase**

Sales, office, administrative occupations	816.5	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	614.8	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	401.0	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	395.7	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	236.5	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.1.5 Energy Efficiency in the Residential Sector—Operation Phase**

Sales, office, administrative occupations	40.5	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Healthcare occupations	25.7	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	21.1	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	11.4	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Transportation, material moving occupations	3.8	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators

Sources: BLS, RESI

**3.1.6 Energy Efficiency in the Commercial and Industrial Sectors—Investment Phase**

Sales, office, administrative occupations	25.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	19.0	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	12.3	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	12.2	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	7.2	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.1.6 Energy Efficiency in the Commercial and Industrial Sectors—Investment Phase**

Professional, scientific, and technical services	4.2	Lawyers Accountants and auditors Management analysts Architectural and civil drafters Market research analysts
Retail trade	3.6	Retail salespersons Cashiers Stock clerks and order fillers First-line supervisors/managers of retail sales workers Customer service representatives
Construction	1.1	Construction laborers Carpenters Electricians Operating engineers and other construction equipment operators Construction managers
Health care and social assistance	0.8	Registered nurses Nursing aides, orderlies, and attendants Home health aides Licensed practical and licensed vocational nurses Medical and health services managers
Administrative and support and waste management and remediation services	0.7	Janitors and cleaners, except maids and housekeeping cleaners Security guards Landscaping and grounds keeping workers Laborers and freight, stock, and material movers, hand Office clerks, general

Sources: BLS, RESI

**3.1.6 Energy Efficiency in the Commercial and Industrial Sectors—Operation Phase**

Sales, office, administrative occupations	219.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Building, grounds, personal care, service occupations	88.0	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Management, business, financial occupations	79.5	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Food preparation, serving related occupations	65.1	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Healthcare occupations	47.6	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.1.7 Energy Efficiency—Appliances and Other Products—Investment Phase**

Farm, fishing, forestry occupations	0.0	Animal breeders Agricultural inspectors Fishers and hunters Forest and conservation workers Logging workers
Community, social service occupations	-0.1	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors
Legal occupations	-0.2	Lawyers Judicial law clerks Judges, magistrates, and other judicial workers Paralegals and legal assistants Court reporters
Life, physical, social science occupations	-0.2	Agricultural and food scientists Biological scientists Conservation scientists and foresters Epidemiologists Geoscientists
Arts, design, entertainment, sports, media occupations	-0.3	Artists and related workers Designers Entertainers and performers Sports and related workers Media and communications workers

Sources: BLS, RESI

**3.1.7 Energy Efficiency—Appliances and Other Products—Operation Phase**

Sales, office, administrative occupations	9.3	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Healthcare occupations	6.0	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	4.8	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	2.5	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Transportation, material moving occupations	0.9	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators

Sources: BLS, RESI

**3.1.8 Energy Efficiency in the Power Sector—General—Investment Phase**

Computer, math, architect, engineer occupations	32.4	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers
Sales, office, administrative occupations	29.4	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Production occupations	14.9	Assemblers and fabricators Food processing workers Metal workers and plastic workers Printing workers Textile, apparel, and furnishings workers
Management, business, financial occupations	14.2	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	7.4	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians

Sources: BLS, RESI

**3.1.8 Energy Efficiency in the Power Sector—General—Operation Phase**

Construction, extraction occupations	39.9	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Sales, office, administrative occupations	39.5	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	16.7	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Installation, maintenance, repair occupations	16.1	Computer, automated teller, and office machine repairers Radio and telecommunications equipment installers/repairers Aircraft mechanics and service technicians Automotive mechanics and service technicians Small engine mechanics
Computer, math, architect, engineer occupations	10.5	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers

Sources: BLS, RESI

**3.1.9 Maryland Renewable Energy Portfolio Standard Subprogram—Investment Phase**

Sales, office, administrative occupations	211.5	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Computer, math, architect, engineer occupations	210.3	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers
Management, business, financial occupations	94.4	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Production occupations	59.6	Assemblers and fabricators Food processing workers Metal workers and plastic workers Printing workers Textile, apparel, and furnishings workers
Construction, extraction occupations	56.0	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians

Sources: BLS, RESI

**3.1.9 Maryland Renewable Energy Portfolio Standard Subprogram—Operation Phase**

Farm, fishing, forestry occupations	-0.7	Animal breeders Agricultural inspectors Fishers and hunters Forest and conservation workers Logging workers
Community, social service occupations	-2.3	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors
Legal occupations	-5.7	Lawyers Judicial law clerks Judges, magistrates, and other judicial workers Paralegals and legal assistants Court reporters
Arts, design, entertainment, sports, media occupations	-6.4	Artists and related workers Designers Entertainers and performers Sports and related workers Media and communications workers
Life, physical, social science occupations	-6.6	Agricultural and food scientists Biological scientists Conservation scientists and foresters Epidemiologists Geoscientists

Sources: BLS, RESI

**3.1.10 Incentives and Grant Subprograms to Support Renewable Energy—Investment Phase**

Protective service occupations	23.4	<ul style="list-style-type: none"> <li>Fire fighters and inspectors</li> <li>Bailiffs, correctional officers, and jailers</li> <li>Fish and game wardens</li> <li>Animal control workers</li> <li>Private detectives and investigators</li> </ul>
Healthcare occupations	5.3	<ul style="list-style-type: none"> <li>Dentists</li> <li>Dietitians and nutritionists</li> <li>Physicians and surgeons</li> <li>Nurses and home health aides</li> <li>Occupational therapists</li> </ul>
Sales, office, administrative occupations	5.2	<ul style="list-style-type: none"> <li>Retail sales workers</li> <li>Advertising sales agents</li> <li>Insurance sales agents</li> <li>Sales representatives in wholesale and manufacturing</li> <li>Models, demonstrators, and product promoters</li> </ul>
Building, grounds, personal care, service occupations	3.5	<ul style="list-style-type: none"> <li>Supervisors of cleaning and maintenance workers</li> <li>Housekeeping and janitorial workers</li> <li>Pest control workers</li> <li>Landscaping and grounds keeping workers</li> <li>Pesticide handlers, sprayers, and applicators</li> </ul>
Education, training, library occupations	2.6	<ul style="list-style-type: none"> <li>Postsecondary teachers</li> <li>Preschool, primary, and secondary teachers</li> <li>Special education teachers</li> <li>Librarians</li> <li>Archivists, curators, and museum technicians</li> </ul>

Sources: BLS, RESI

**3.1.10 Incentives and Grant Subprograms to Support Renewable Energy—Operation Phase**

Building, grounds, personal care, service occupations	16.7	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	11.3	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Sales, office, administrative occupations	7.8	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Healthcare occupations	4.9	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Arts, design, entertainment, sports, media occupations	0.9	Artists and related workers Designers Entertainers and performers Sports and related workers Media and communications workers

Sources: BLS, RESI

**3.1.11 Offshore Wind Initiatives to Support Renewable Energy—Investment Phase**

Sales, office, administrative occupations	16.4	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Computer, math, architect, engineer occupations	16.3	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers
Management, business, financial occupations	7.3	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	4.6	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Production occupations	4.3	Assemblers and fabricators Food processing workers Metal workers and plastic workers Printing workers Textile, apparel, and furnishings workers

Sources: BLS, RESI

**3.1.11 Offshore Wind Initiatives to Support Renewable Energy—Operation Phase**

Sales, office, administrative occupations	12.0	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Healthcare occupations	5.7	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Construction, extraction occupations	4.8	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Building, grounds, personal care, service occupations	4.7	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Management, business, financial occupations	2.8	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors

Sources: BLS, RESI

**D.2 Transportation**

**3.2.1 Maryland Clean Cars Subprogram—Investment Phase**

Sales, office, administrative occupations	495.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Transportation, material moving occupations	68.2	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators
Management, business, financial occupations	50.3	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Installation, maintenance, repair occupations	45.1	Computer, automated teller, and office machine repairers Radio and telecommunications equipment installers/repairers Aircraft mechanics and service technicians Automotive mechanics and service technicians Small engine mechanics
Construction, extraction occupations	43.5	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians

Sources: BLS, RESI

**3.2.1 Maryland Clean Cars Subprogram—Operation Phase**

Farm, fishing, forestry occupations	-0.7	Animal breeders Agricultural inspectors Fishers and hunters Forest and conservation workers Logging workers
Community, social service occupations	-0.7	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors
Legal occupations	-1.1	Lawyers Judicial law clerks Judges, magistrates, and other judicial workers Paralegals and legal assistants Court reporters
Life, physical, social science occupations	-1.2	Agricultural and food scientists Biological scientists Conservation scientists and foresters Epidemiologists Geoscientists
Education, training, library occupations	-3.3	Postsecondary teachers Preschool, primary, and secondary teachers Special education teachers Librarians Archivists, curators, and museum technicians

Sources: BLS, RESI

**3.2.2 Federal Medium- and Heavy-Duty GHG Standards—Investment Phase**

Farm, fishing, forestry occupations	-2.1	Animal breeders Agricultural inspectors Fishers and hunters Forest and conservation workers Logging workers
Community, social service occupations	-5.5	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors
Life, physical, social science occupations	-15.7	Agricultural and food scientists Biological scientists Conservation scientists and foresters Epidemiologists Geoscientists
Education, training, library occupations	-16.4	Postsecondary teachers Preschool, primary, and secondary teachers Special education teachers Librarians Archivists, curators, and museum technicians
Legal occupations	-17.5	Lawyers Judicial law clerks Judges, magistrates, and other judicial workers Paralegals and legal assistants Court reporters

Sources: BLS, RESI

**3.2.2 Federal Medium- and Heavy-Duty GHG Standards—Investment Phase**

Sales, office, administrative occupations	46.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Healthcare occupations	20.4	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Construction, extraction occupations	20.2	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Building, grounds, personal care, service occupations	16.5	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Management, business, financial occupations	12.4	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors

Sources: BLS, RESI

**3.2.3 Clean Fuel Standard—Investment Phase**

Farm, fishing, forestry occupations	-0.4	Animal breeders Agricultural inspectors Fishers and hunters Forest and conservation workers Logging workers
Community, social service occupations	-1.0	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors
Life, physical, social science occupations	-2.9	Agricultural and food scientists Biological scientists Conservation scientists and foresters Epidemiologists Geoscientists
Education, training, library occupations	-3.1	Postsecondary teachers Preschool, primary, and secondary teachers Special education teachers Librarians Archivists, curators, and museum technicians
Legal occupations	-3.3	Lawyers Judicial law clerks Judges, magistrates, and other judicial workers Paralegals and legal assistants Court reporters

Sources: BLS, RESI

### 3.2.3 Clean Fuel Standard—Operation Phase

Sales, office, administrative occupations	5.8	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Healthcare occupations	4.3	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	3.2	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	1.7	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Transportation, material moving occupations	0.6	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators

Sources: BLS, RESI

**3.2.4 Transportation Climate Initiative—Investment Phase**

Community, social service occupations	0.0	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors
Farm, fishing, forestry occupations	0.0	Animal breeders Agricultural inspectors Fishers and hunters Forest and conservation workers Logging workers
Life, physical, social science occupations	0.0	Agricultural and food scientists Biological scientists Conservation scientists and foresters Epidemiologists Geoscientists
Arts, design, entertainment, sports, media occupations	0.0	Artists and related workers Designers Entertainers and performers Sports and related workers Media and communications workers
Production occupations	0.0	Assemblers and fabricators Food processing workers Metal workers and plastic workers Printing workers Textile, apparel, and furnishings workers

Sources: BLS, RESI

**3.2.5 Public Transportation Initiatives—Investment Phase**

Sales, office, administrative occupations	554.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	403.1	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	271.1	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	267.8	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	161.4	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.2.5 Public Transportation Initiatives—Operation Phase**

Healthcare occupations	104.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	96.5	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Transportation, material moving occupations	76.2	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators
Food preparation, serving related occupations	44.3	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Protective service occupations	43.0	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators

Sources: BLS, RESI

**3.2.6 Initiatives to Double Transit Ridership by 2020—Investment Phase**

Sales, office, administrative occupations	1,609.0	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	1,147.2	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	784.8	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	776.9	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	469.6	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.2.6 Initiatives to Double Transit Ridership by 2020—Operation Phase**

Healthcare occupations	164.7	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	139.2	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	77.8	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Transportation, material moving occupations	25.7	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators
Construction, extraction occupations	21.3	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians

Sources: BLS, RESI

**3.2.7 Intercity Transportation Initiatives—Investment Phase**

Sales, office, administrative occupations	193.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	142.9	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	95.5	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	93.7	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	56.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.2.7 Intercity Transportation Initiatives—Operation Phase**

Transportation, material moving occupations	92.7	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators
Sales, office, administrative occupations	20.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Building, grounds, personal care, service occupations	14.1	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Healthcare occupations	9.7	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Management, business, financial occupations	6.8	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors

Sources: BLS, RESI

**3.2.8 Bike and Pedestrian Initiatives—Investment Phase**

Sales, office, administrative occupations	607.7	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	454.4	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	300.1	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	295.2	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	176.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.2.8 Bike and Pedestrian Initiatives—Operation Phase**

Healthcare occupations	0.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	0.0	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	0.0	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Construction, extraction occupations	0.0	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	0.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors

Sources: BLS, RESI

### 3.2.9 Pricing Initiatives—Investment Phase

Sales, office, administrative occupations	987.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	729.0	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	486.9	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	478.5	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	287.0	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.2.9 Pricing Initiatives—Operation Phase**

Healthcare occupations	172.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	164.2	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	58.9	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Education, training, library occupations	19.0	Postsecondary teachers Preschool, primary, and secondary teachers Special education teachers Librarians Archivists, curators, and museum technicians
Management, business, financial occupations	18.3	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors

Sources: BLS, RESI

**3.2.10 Transportation Technology Initiatives—Investment Phase**

Sales, office, administrative occupations	5.9	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	4.5	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	2.9	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	2.8	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Healthcare occupations	1.7	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.2.10 Transportation Technology Initiatives—Operation Phase**

Healthcare occupations	141.7	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	128.1	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	41.8	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Education, training, library occupations	14.7	Postsecondary teachers Preschool, primary, and secondary teachers Special education teachers Librarians Archivists, curators, and museum technicians
Community, social service occupations	10.5	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors

Sources: BLS, RESI

**3.2.11 Electric Vehicle Initiatives—Investment Phase**

Sales, office, administrative occupations	8.6	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	6.2	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	4.2	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	4.2	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Healthcare occupations	2.5	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.2.11 Electric Vehicle Initiatives—Operation Phase**

Healthcare occupations	2.7	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	2.5	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	0.8	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Education, training, library occupations	0.3	Postsecondary teachers Preschool, primary, and secondary teachers Special education teachers Librarians Archivists, curators, and museum technicians
Community, social service occupations	0.2	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors

Sources: BLS, RESI

**3.2.12 Low-Emitting Vehicles Initiatives—Investment Phase**

Sales, office, administrative occupations	6.3	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	4.7	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	3.2	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	3.1	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	1.8	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.2.12 Low-Emitting Vehicles Initiatives—Operation Phase**

Healthcare occupations	3.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	2.7	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	0.9	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Education, training, library occupations	0.3	Postsecondary teachers Preschool, primary, and secondary teachers Special education teachers Librarians Archivists, curators, and museum technicians
Community, social service occupations	0.2	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors

Sources: BLS, RESI

**3.2.14 Airport Initiatives—Investment Phase**

Sales, office, administrative occupations	151.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	112.5	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	75.8	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors
Management, business, financial occupations	73.7	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	44.0	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.2.14 Airport Initiatives—Operation Phase<sup>277</sup>**

Management, business, financial occupations	0.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Computer, math, architect, engineer occupations	0.0	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers
Life, physical, social science occupations	0.0	Agricultural and food scientists Biological scientists Conservation scientists and foresters Epidemiologists Geoscientists
Community, social service occupations	0.0	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors
Legal occupations	0.0	Lawyers Judicial law clerks Judges, magistrates, and other judicial workers Paralegals and legal assistants Court reporters

Sources: BLS, RESI

<sup>277</sup> The operation phase of this policy did not have significant impacts on the gain or loss of employment in any occupational category.

**3.2.15 Port Initiatives—Investment Phase**

Sales, office, administrative occupations	4.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	3.1	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	2.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	2.0	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Healthcare occupations	1.2	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.2.15 Port Initiatives—Operation Phase<sup>278</sup>**

Management, business, financial occupations	0.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Computer, math, architect, engineer occupations	0.0	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers
Life, physical, social science occupations	0.0	Agricultural and food scientists Biological scientists Conservation scientists and foresters Epidemiologists Geoscientists
Community, social service occupations	0.0	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors
Legal occupations	0.0	Lawyers Judicial law clerks Judges, magistrates, and other judicial workers Paralegals and legal assistants Court reporters

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Sources: BLS, RESI

<sup>278</sup> The operation phase of this policy did not have significant impacts on the gain or loss of employment in any occupational category.

**3.2.16 Freight and Freight Rail Strategies—Investment Phase**

Sales, office, administrative occupations	4.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	3.1	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	2.0	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	2.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	1.2	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.2.16 Freight and Freight Rail Strategies—Operation Phase**

Healthcare occupations	1.7	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	1.5	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	0.5	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Education, training, library occupations	0.2	Postsecondary teachers Preschool, primary, and secondary teachers Special education teachers Librarians Archivists, curators, and museum technicians
Community, social service occupations	0.1	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors

Sources: BLS, RESI

**3.2.17 Renewable Fuels Standard—Operation Phase**

Healthcare occupations	4.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	3.6	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	1.2	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Education, training, library occupations	0.4	Postsecondary teachers Preschool, primary, and secondary teachers Special education teachers Librarians Archivists, curators, and museum technicians
Community, social service occupations	0.3	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors

Sources: BLS, RESI

**3.2.18 CAFE Standards: Model Years 2008-2011—Operation Phase**

Healthcare occupations	2.5	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	2.3	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	0.7	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Education, training, library occupations	0.2	Postsecondary teachers Preschool, primary, and secondary teachers Special education teachers Librarians Archivists, curators, and museum technicians
Community, social service occupations	0.2	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors

Sources: BLS, RESI

**3.2.19 Promoting Hybrid and Electric Vehicles—Investment Phase**

Sales, office, administrative occupations	0.4	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	0.3	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	0.2	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	0.2	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Building, grounds, personal care, service occupations	0.1	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators

Sources: BLS, RESI

**3.2.19 Promoting Hybrid and Electric Vehicles—Operation Phase**

Sales, office, administrative occupations	11.6	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Healthcare occupations	7.4	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	5.8	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	3.3	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Transportation, material moving occupations	1.2	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators

Sources: BLS, RESI

**3.2.20 PAYD Insurance in Maryland—Operation Phase**

Computer, math, architect, engineer occupations	0.0	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers
Healthcare occupations	0.0	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	0.0	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Sales, office, administrative occupations	0.0	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Community, social service occupations	0.0	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors

Sources: BLS, RESI

**D.3 Agriculture and Forestry**

**3.3.1 Managing Forests to Capture Carbon—Investment Phase**

Sales, office, administrative occupations	1.4	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	1.0	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	0.7	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	0.7	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	0.4	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.3.1 Managing Forests to Capture Carbon—Operation Phase**

Farm, fishing, forestry occupations	9.3	Animal breeders Agricultural inspectors Fishers and hunters Forest and conservation workers Logging workers
Management, business, financial occupations	2.7	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Sales, office, administrative occupations	1.7	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Transportation, material moving occupations	1.1	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators
Building, grounds, personal care, service occupations	1.0	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators

Sources: BLS, RESI

**3.3.2 Creating Ecosystem Markets to Encourage GHG Emissions Reductions—Investment Phase**

Sales, office, administrative occupations	0.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	0.2	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	0.1	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	0.1	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Healthcare occupations	0.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.3.2 Creating Ecosystem Markets to Encourage GHG Emissions Reductions—Operation Phase**

Protective service occupations	110.5	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Sales, office, administrative occupations	91.6	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Construction, extraction occupations	44.6	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Healthcare occupations	42.6	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Computer, math, architect, engineer occupations	28.7	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers

Sources: BLS, RESI

**3.3.3 Increasing Urban Trees to Capture Carbon—Investment Phase**

Sales, office, administrative occupations	0.4	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	0.3	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	0.2	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	0.2	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Building, grounds, personal care, service occupations	0.1	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators

Sources: BLS, RESI

**3.3.3 Increasing Urban Trees to Capture Carbon—Operation Phase**

Sales, office, administrative occupations	50.5	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Building, grounds, personal care, service occupations	32.3	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	20.9	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Healthcare occupations	19.3	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Management, business, financial occupations	16.4	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors

Sources: BLS, RESI

**3.3.4 Creating and Protecting Wetlands and Waterway Borders to Capture Carbon—Investment Phase**

Sales, office, administrative occupations	12.7	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	9.4	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	6.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	5.9	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Healthcare occupations	3.8	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

### 3.3.4 Creating and Protecting Wetlands and Waterway Borders to Capture Carbon— Operation Phase

Food preparation, serving related occupations	11.2	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Sales, office, administrative occupations	8.0	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Building, grounds, personal care, service occupations	5.1	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Transportation, material moving occupations	1.6	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators
Management, business, financial occupations	1.6	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors

Sources: BLS, RESI

### 3.3.5 Geological Opportunities to Store Carbon—Investment Phase

Sales, office, administrative occupations	0.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Healthcare occupations	0.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Management, business, financial occupations	0.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Arts, design, entertainment, sports, media occupations	0.0	Artists and related workers Designers Entertainers and performers Sports and related workers Media and communications workers
Building, grounds, personal care, service occupations	0.0	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators

Sources: BLS, RESI

**3.3.5 Geological Opportunities to Store Carbon—Operation Phase**

Sales, office, administrative occupations	39.5	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	13.4	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Building, grounds, personal care, service occupations	11.1	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	8.6	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Installation, maintenance, repair occupations	8.0	Computer, automated teller, and office machine repairers Radio and telecommunications equipment installers/repairers Aircraft mechanics and service technicians Automotive mechanics and service technicians Small engine mechanics

Sources: BLS, RESI

**3.3.6 Planting Forests in Maryland—Investment Phase**

Farm, fishing, forestry occupations	22.4	Animal breeders Agricultural inspectors Fishers and hunters Forest and conservation workers Logging workers
Management, business, financial occupations	7.3	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Transportation, material moving occupations	7.1	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators
Building, grounds, personal care, service occupations	5.1	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Sales, office, administrative occupations	3.4	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters

Sources: BLS, RESI

### 3.3.6 Planting Forests in Maryland—Operation Phase

Sales, office, administrative occupations	0.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Healthcare occupations	0.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	0.0	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	0.0	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Transportation, material moving occupations	0.0	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators

Sources: BLS, RESI

**3.3.7 Biomass for Energy Production—Investment Phase**

Sales, office, administrative occupations	41.4	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	30.7	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	20.9	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	20.2	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	12.0	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.3.7 Biomass for Energy Production—Operation Phase**

Construction, extraction occupations	1.2	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Sales, office, administrative occupations	1.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	0.5	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Installation, maintenance, repair occupations	0.4	Computer, automated teller, and office machine repairers Radio and telecommunications equipment installers/repairers Aircraft mechanics and service technicians Automotive mechanics and service technicians Small engine mechanics
Computer, math, architect, engineer occupations	0.3	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers

Sources: BLS, RESI

**3.3.8 Conservation of Agricultural Land for GHG Benefits—Investment Phase**

Sales, office, administrative occupations	18.9	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	14.3	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	9.3	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	9.2	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	5.5	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.3.8 Conservation of Agricultural Land for GHG Benefits—Operation Phase**

Farm, fishing, forestry occupations	459.5	Animal breeders Agricultural inspectors Fishers and hunters Forest and conservation workers Logging workers
Management, business, financial occupations	193.7	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Sales, office, administrative occupations	85.9	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Transportation, material moving occupations	41.4	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators
Building, grounds, personal care, service occupations	36.5	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators

Sources: BLS, RESI

**3.3.9 Buy Local for GHG Benefits—Investment Phase**

Sales, office, administrative occupations	5.0	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	3.9	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	2.4	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	2.4	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Healthcare occupations	1.4	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

### 3.3.9 Buy Local for GHG Benefits—Operation Phase

Farm, fishing, forestry occupations	29.4	Animal breeders Agricultural inspectors Fishers and hunters Forest and conservation workers Logging workers
Management, business, financial occupations	12.5	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Sales, office, administrative occupations	5.6	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Transportation, material moving occupations	2.7	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators
Building, grounds, personal care, service occupations	2.4	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators

Sources: BLS, RESI

**3.3.10 Nutrient Trading for GHG Benefits—Investment Phase**

Sales, office, administrative occupations	1.6	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	1.2	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	0.8	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	0.8	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	0.4	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.3.10 Nutrient Trading for GHG Benefits—Operation Phase**

Sales, office, administrative occupations	12.3	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Construction, extraction occupations	11.2	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Protective service occupations	7.3	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	5.8	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	3.2	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**D.4 Recycling**

**3.4.1 Recycling and Source Reduction—Operation Phase**

Transportation, material moving occupations	2.9	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators
Community, social service occupations	0.0	Counselors Social workers Community and social service specialists Clergy Religious activities and education directors
Farm, fishing, forestry occupations	-0.1	Animal breeders Agricultural inspectors Fishers and hunters Forest and conservation workers Logging workers
Arts, design, entertainment, sports, media occupations	-0.2	Artists and related workers Designers Entertainers and performers Sports and related workers Media and communications workers
Production occupations	-0.3	Assemblers and fabricators Food processing workers Metal workers and plastic workers Printing workers Textile, apparel, and furnishings workers

Sources: BLS, RESI

**D.5 Buildings**

**3.5.1 Building Codes—Investment Phase**

Sales, office, administrative occupations	3.3	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	2.4	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	1.6	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	1.6	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	0.9	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

### 3.5.1 Building Codes—Operation Phase

Sales, office, administrative occupations	14.3	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	9.6	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	3.9	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Computer, math, architect, engineer occupations	3.5	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers
Building, grounds, personal care, service occupations	2.7	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators

Sources: BLS, RESI

**3.5.2 BeSMART—Investment Phase**

Sales, office, administrative occupations	0.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	0.1	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	0.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	0.0	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Healthcare occupations	0.0	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.5.2 BeSMART—Operation Phase**

Management, business, financial occupations	0.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	0.0	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Food preparation, serving related occupations	0.0	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Sales, office, administrative occupations	0.0	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	0.0	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators

Sources: BLS, RESI

**3.5.3 Weatherization and Energy Efficiency for Low-Income Houses—Investment Phase**

Sales, office, administrative occupations	1.3	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	1.1	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	0.7	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	0.6	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	0.4	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.5.3 Weatherization and Energy Efficiency for Low-Income Houses—Operation Phase**

Healthcare occupations	0.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	0.1	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	0.1	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Management, business, financial occupations	0.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Education, training, library occupations	0.0	Postsecondary teachers Preschool, primary, and secondary teachers Special education teachers Librarians Archivists, curators, and museum technicians

Sources: BLS, RESI

**D.6 Land Use**

**3.6.1 Reducing Transportation Issues through Smart Growth—Operation Phase**

Construction, extraction occupations	6.1	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Sales, office, administrative occupations	1.7	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	0.9	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Installation, maintenance, repair occupations	0.8	Computer, automated teller, and office machine repairers Radio and telecommunications equipment installers/repairers Aircraft mechanics and service technicians Automotive mechanics and service technicians Small engine mechanics
Transportation, material moving occupations	0.5	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators

Sources: BLS, RESI

**3.6.2 GHG Targets for Local Government’s Transportation and Land Use Planning—Operation Phase**

Sales, office, administrative occupations	10.3	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Healthcare occupations	6.3	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	5.0	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	2.9	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Transportation, material moving occupations	1.1	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators

Sources: BLS, RESI

**3.6.3 Land Use Planning GHG Benefits—Investment Phase**

Sales, office, administrative occupations	7.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	5.7	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	3.4	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	3.3	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Healthcare occupations	2.0	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.6.3 Land Use Planning GHG Benefits—Operation Phase**

Construction, extraction occupations	49.8	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Sales, office, administrative occupations	14.5	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	7.2	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Installation, maintenance, repair occupations	6.4	Computer, automated teller, and office machine repairers Radio and telecommunications equipment installers/repairers Aircraft mechanics and service technicians Automotive mechanics and service technicians Small engine mechanics
Transportation, material moving occupations	4.0	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Subway and streetcar operators

Sources: BLS, RESI

**3.6.4 Growth Boundary GHG Benefits—Investment Phase**

Protective service occupations	1,690.9	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Sales, office, administrative occupations	982.9	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	455.7	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	446.2	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Construction, extraction occupations	242.3	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians

Sources: BLS, RESI

**3.6.4 Growth Boundary GHG Benefits—Operation Phase**

Construction, extraction occupations	189.9	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Sales, office, administrative occupations	154.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Production occupations	59.1	Assemblers and fabricators Food processing workers Metal workers and plastic workers Printing workers Textile, apparel, and furnishings workers
Management, business, financial occupations	58.2	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Installation, maintenance, repair occupations	49.2	Computer, automated teller, and office machine repairers Radio and telecommunications equipment installers/repairers Aircraft mechanics and service technicians Automotive mechanics and service technicians Small engine mechanics

Sources: BLS, RESI

**D.7 Innovative Initiatives**

**3.7.1 Leadership-by-Example—Local Government—Investment Phase**

Sales, office, administrative occupations	33.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Construction, extraction occupations	23.8	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Protective service occupations	18.7	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	14.7	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Food preparation, serving related occupations	9.0	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers

Sources: BLS, RESI

**3.7.1 Leadership-by-Example—Local Government—Operation Phase**

Sales, office, administrative occupations	51.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	31.9	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Building, grounds, personal care, service occupations	26.8	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	19.4	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Construction, extraction occupations	12.8	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians

Sources: BLS, RESI

**3.7.2 Leadership-by-Example—Federal Government—Investment Phase**

Sales, office, administrative occupations	16.4	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	12.3	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	8.0	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	7.9	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	4.7	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.7.2 Leadership-by-Example—Federal Government—Operation Phase**

Sales, office, administrative occupations	206.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	174.9	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	105.3	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	78.5	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Healthcare occupations	68.8	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.7.3 Leadership-by-Example—Maryland University Lead-by-Example Initiatives—Investment Phase**

Sales, office, administrative occupations	15.8	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	11.9	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Construction, extraction occupations	7.7	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Management, business, financial occupations	7.7	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	4.5	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.7.3 Leadership-by-Example—Maryland University Lead-by-Example Initiatives—  
Operation Phase**

Sales, office, administrative occupations	16.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	15.4	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	8.4	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	5.6	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	5.0	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators

Sources: BLS, RESI

**3.7.4 Voluntary Stationary Source Reductions—Investment Phase**

Sales, office, administrative occupations	0.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	0.1	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	0.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	0.0	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Building, grounds, personal care, service occupations	0.0	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators

Sources: BLS, RESI

**3.7.4 Voluntary Stationary Source Reductions—Operation Phase**

Construction, extraction occupations	0.1	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Sales, office, administrative occupations	0.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	0.2	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Installation, maintenance, repair occupations	0.2	Computer, automated teller, and office machine repairers Radio and telecommunications equipment installers/repairers Aircraft mechanics and service technicians Automotive mechanics and service technicians Small engine mechanics
Computer, math, architect, engineer occupations	0.1	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers

Sources: BLS, RESI

**3.7.5 State of Maryland Initiatives to Lead by Example—Investment Phase**

Sales, office, administrative occupations	1.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	0.6	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	0.4	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Computer, math, architect, engineer occupations	0.4	Actuaries Software developers and programmers Database and system administrators Computer support specialists Aerospace, agricultural, biomedical, and other engineers
Healthcare occupations	0.3	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.7.5 State of Maryland Initiatives to Lead by Example—Operation Phase**

Sales, office, administrative occupations	56.5	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	34.6	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Building, grounds, personal care, service occupations	28.3	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	20.2	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Construction, extraction occupations	14.8	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians

Sources: BLS, RESI

**3.7.6 State of Maryland Carbon and Footprint Initiatives—Operation Phase**

Sales, office, administrative occupations	129.0	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	102.7	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	62.9	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	47.8	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Healthcare occupations	39.6	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.7.7 Job Creation and Economic Development Initiatives Related to Climate Change—  
Operation Phase**

*All jobs would be accounted for in previous GGRA programs through green job training to meet new demand.*

Sources: BLS, RESI

**3.7.8 Public Health Initiatives Related to Climate Change—Investment Phase**

Sales, office, administrative occupations	1.1	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	0.8	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	0.5	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Construction, extraction occupations	0.5	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians
Healthcare occupations	0.3	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists

Sources: BLS, RESI

**3.7.8 Public Health Initiatives Related to Climate Change—Operation Phase**

Sales, office, administrative occupations	6.6	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Healthcare occupations	3.6	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Building, grounds, personal care, service occupations	3.0	Supervisors of cleaning and maintenance workers Housekeeping and janitorial workers Pest control workers Landscaping and grounds keeping workers Pesticide handlers, sprayers, and applicators
Food preparation, serving related occupations	2.0	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers
Transportation, material moving occupations	1.0	Aircraft cargo handling supervisors Air traffic controllers Ambulance drivers and attendants Driver/Sales workers and truck drivers Retail sales workers

Sources: BLS, RESI

**3.7.9 Title V Permits for GHG Sources—Investment Phase**

Sales, office, administrative occupations	0.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	0.1	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	0.1	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	0.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Construction, extraction occupations	0.1	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians

Sources: BLS, RESI

**3.7.9 Title V Permits for GHG Sources—Operation Phase**

Protective service occupations	0.9	<ul style="list-style-type: none"> <li>Fire fighters and inspectors</li> <li>Bailiffs, correctional officers, and jailers</li> <li>Fish and game wardens</li> <li>Animal control workers</li> <li>Private detectives and investigators</li> </ul>
Sales, office, administrative occupations	0.8	<ul style="list-style-type: none"> <li>Retail sales workers</li> <li>Advertising sales agents</li> <li>Insurance sales agents</li> <li>Sales representatives in wholesale and manufacturing</li> <li>Models, demonstrators, and product promoters</li> </ul>
Management, business, financial occupations	0.4	<ul style="list-style-type: none"> <li>Legislators</li> <li>Advertising, marketing, and sales managers</li> <li>Compliance officers</li> <li>Cost estimators</li> <li>Accountants and auditors</li> </ul>
Building, grounds, personal care, service occupations	0.3	<ul style="list-style-type: none"> <li>Supervisors of cleaning and maintenance workers</li> <li>Housekeeping and janitorial workers</li> <li>Pest control workers</li> <li>Landscaping and grounds keeping workers</li> <li>Pesticide handlers, sprayers, and applicators</li> </ul>
Healthcare occupations	0.3	<ul style="list-style-type: none"> <li>Dentists</li> <li>Dietitians and nutritionists</li> <li>Physicians and surgeons</li> <li>Nurses and home health aides</li> <li>Occupational therapists</li> </ul>

Sources: BLS, RESI

**3.7.10 Outreach and Public Education—Investment Phase**

Sales, office, administrative occupations	0.0	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Management, business, financial occupations	0.0	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Protective service occupations	0.0	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Healthcare occupations	0.0	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Food preparation, serving related occupations	0.0	Cooks Supervisors of food preparation workers Bartenders Waiters and waitresses Dishwashers

Sources: BLS, RESI

**3.7.11 GHG Prevention of Significant Deterioration Permitting Program—Investment Phase**

Sales, office, administrative occupations	0.2	Retail sales workers Advertising sales agents Insurance sales agents Sales representatives in wholesale and manufacturing Models, demonstrators, and product promoters
Protective service occupations	0.1	Fire fighters and inspectors Bailiffs, correctional officers, and jailers Fish and game wardens Animal control workers Private detectives and investigators
Management, business, financial occupations	0.1	Legislators Advertising, marketing, and sales managers Compliance officers Cost estimators Accountants and auditors
Healthcare occupations	0.1	Dentists Dietitians and nutritionists Physicians and surgeons Nurses and home health aides Occupational therapists
Construction, extraction occupations	0.1	Supervisors of construction trade workers Carpenters Brick masons, block masons, and stonemasons Construction equipment operators Electricians

Sources: BLS, RESI

**3.7.11 GHG Prevention of Significant Deterioration Permitting Program—Operation Phase**

Protective service occupations	0.2	<ul style="list-style-type: none"> <li>Fire fighters and inspectors</li> <li>Bailiffs, correctional officers, and jailers</li> <li>Fish and game wardens</li> <li>Animal control workers</li> <li>Private detectives and investigators</li> </ul>
Sales, office, administrative occupations	0.2	<ul style="list-style-type: none"> <li>Retail sales workers</li> <li>Advertising sales agents</li> <li>Insurance sales agents</li> <li>Sales representatives in wholesale and manufacturing</li> <li>Models, demonstrators, and product promoters</li> </ul>
Management, business, financial occupations	0.1	<ul style="list-style-type: none"> <li>Legislators</li> <li>Advertising, marketing, and sales managers</li> <li>Compliance officers</li> <li>Cost estimators</li> <li>Accountants and auditors</li> </ul>
Healthcare occupations	0.1	<ul style="list-style-type: none"> <li>Dentists</li> <li>Dietitians and nutritionists</li> <li>Physicians and surgeons</li> <li>Nurses and home health aides</li> <li>Occupational therapists</li> </ul>
Building, grounds, personal care, service occupations	0.1	<ul style="list-style-type: none"> <li>Supervisors of cleaning and maintenance workers</li> <li>Housekeeping and janitorial workers</li> <li>Pest control workers</li> <li>Landscaping and grounds keeping workers</li> <li>Pesticide handlers, sprayers, and applicators</li> </ul>

Sources: BLS, RESI

## Appendix E—References by Subject Area

### E.1 Energy

2009 County Business Patterns. Censtats Database. NAICS, 2009. Web. 11 Nov. 2011.  
<<http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl>>.

A Guide to Energy-Efficient Heating and Cooling. ENERGY STAR. United States Environmental Protection Agency, Aug. 2009. Web. 16 Nov. 2011.  
<[http://www.energystar.gov/ia/partners/publications/pubdocs/HeatingCoolingGuide%20FINAL\\_9-4-09.pdf](http://www.energystar.gov/ia/partners/publications/pubdocs/HeatingCoolingGuide%20FINAL_9-4-09.pdf)>.

Appliances. SMECO - Southern Maryland Electric Cooperative. Rebates for New Appliances. Web. 16 Nov. 2011. <<https://www.smeco.coop/save/appliance/>>.

"Average Energy Prices in the Washington-Baltimore Area." U.S. Bureau of Labor Statistics. 27 Sept. 2011. 11 Nov. 2011 <[http://www.bls.gov/ro3/apwb.htm#wb\\_energy\\_table1](http://www.bls.gov/ro3/apwb.htm#wb_energy_table1)>.

"Average Home Heating Oil Prices." U.S. Energy Information Agency. EIA. Gov. Web. 16 Nov 2011. <<http://www.eia.gov/>>

Barnitt, Robb A. "In-Use Performance Comparison of Hybrid Electric, CNG & Diesel." National Renewable Energy Laboratory (NREL) Home Page. U.S. Department of Energy, June 2008. Web. 14 Nov. 2011. <<http://www.nrel.gov/vehiclesandfuels/fleettest>>.

"Clean Energy Production Tax Credit." Maryland Energy Administration. Accessed October 17, 2012. <http://energy.maryland.gov/Business/CleanEnergyTaxCredit.html>.

Commercial and Industrial Rebate Program. Allegheny Energy, Inc. Allegheny Energy, Inc., 25 June 2011. Web. 16 Nov. 2011.  
<<http://www.alleghenypower.com/EngConserv/MDBus/Lighting.asp>>.

Delmarva - Appliance Rebate Program. Delmarva Power. Pepco Holdings Inc., 2011. Web. 16 Nov. 2011. <<http://homeenergysavings.delmarva.com/md/appliance-rebate>>.

Early Reduction CO2 Allowance Awards. Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program. Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program, 18 Dec. 2009. Web. 16 Nov. 2011.  
<[http://www.rggi.org/docs/md\\_proceeds\\_by\\_auction.pdf](http://www.rggi.org/docs/md_proceeds_by_auction.pdf)>.

EERE State Activities and Partnerships: Energy Consumption in Maryland Homes. U.S. DOE Energy Efficiency and Renewable Energy (EERE) Home Page. U.S. DOE Energy Efficiency and Renewable, 15 Aug. 2008. Web. 16 Nov. 2011.  
<<http://apps1.eere.energy.gov/states/residential.cfm/state=MD>>.

Energy Savings Program - Delmarva Power. Energy Savings Program - Delmarva Power. Pepco Holdings Inc., 2010. Web. 16 Nov. 2011.  
<<https://cienergyefficiency.delmarva.com/Lighting.aspx>>.

Energy Solutions for Business Lighting & Controls | BGE Smart Energy Savers Program. Smart Energy Savers Programs | BGE Smart Energy Savers Program. Baltimore Gas and Electric, 2010. Web. 16 Nov. 2011. <<https://www.bgesmartenergy.com/business/energy-solutions-business/lighting-controls>>.

“Frequently Asked Questions: How Much Electricity Does an American Home Use?” United States Energy Information Administration. Accessed October 17, 2012.  
<http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3>.

Fuel Cost Comparison: Wood vs. Natural Gas. Forester's Coop. Forester's Coop. Web. 16 Nov. 2011. <[http://www.forco-op.com/project/wood\\_fuel\\_comp.pdf](http://www.forco-op.com/project/wood_fuel_comp.pdf)>.

Innovation. Performance. Savings. ENERGY STAR. United States Department of Energy, 2011. Web. 16 Nov. 2011.  
<[http://www.energystar.gov/ia/partners/manuf\\_res/CFL\\_PRG\\_FINAL.pdf](http://www.energystar.gov/ia/partners/manuf_res/CFL_PRG_FINAL.pdf)>.

Jane E. Lawton Conservation Loan Program (JELLP). Maryland Energy Administration. Maryland Energy Administration. Web. 16 Nov. 2011.  
<<http://energy.maryland.gov/govt/janeelawton.html>>.

Lighting and Appliances Appliance Rebates | BGE Smart Energy Savers Program. Smart Energy Savers Programs | BGE Smart Energy Savers Program. Baltimore Gas and Electric, 2010. Web. 16 Nov. 2011. <<https://www.bgesmartenergy.com/residential/lighting-appliances/appliance-rebates>>.

Lowest Diesel Fuel Prices in the Last 24 Hours. Maryland Gas Prices - Find Cheap Gas Prices in Maryland. 2011. Web. 14 Nov. 2011.  
<<http://www.marylandgasprices.com/index.aspx?fuel=D>>.

Maryland | Retail Means Jobs. Retail Means Jobs | Retail Supports 1 in 4 American Jobs | 42 Million Strong. PricewaterhouseCoopers LLP, July-Aug. 2011. Web. 11 Nov. 2011.  
<<http://www.retailmeansjobs.com/data/MD/0>>.

"Maryland Auto Outlook." Wwww.mdauto.org. 9 Aug. 2011. Maryland Automobile Dealers Association. 11 Nov. 2011  
<<http://www.mdauto.org/admin/publications/AutoOutlookQuarter22011.pdf>>.

Maryland Energy Administration. “Maryland Governor Martin O’Malley Celebrates the Completion of the Largest Solar Farm in the State.” Press release, Emmitsburg, Maryland, 2012.

Maryland Energy Administration. "Maryland Offshore Wind Energy Act of 2012 Facts & Figures." Press release, Annapolis, Maryland, 2012.

"Maryland Energy Consumption Data." Redux Energy: Sustainable Geospatial Products and Services Network. 11 Nov. 2011. Maryland Energy Portal - Maryland's Carbon Footprint. 11 Nov. 2011 <[http://www.eredux.com/states/state\\_detail.php?id=1129](http://www.eredux.com/states/state_detail.php?id=1129)>.

Maryland Home Energy Loan Program. Maryland Home Energy Loan Program. Maryland Clean Energy Centre, 2010. Web. 16 Nov. 2011.  
<<http://www.mcecloans.com/Module/Ext/ExtInfo.aspx?ModulePageAdmin=0fe789d7-d5fc-4297-9917-db58ccb8a660&&ModulePageVisitor=4b0b3b8a-4f4a-4192-98e8-4f0e35b75d90>>.

Maryland QuickFacts from the US Census Bureau. State and County QuickFacts. U.S. Census Bureau, 13 Oct. 2011. Web. 11 Nov. 2011.  
<<http://quickfacts.census.gov/qfd/states/24000.html>>.

Maryland Save Energy Now. Maryland Energy Administration. Maryland Energy Administration. Web. 16 Nov. 2011. <<http://energy.maryland.gov/sen/index.html>>.

MEA-Project Sunburst. Maryland Energy Administration. Maryland Energy Administration, 2011. Web. 16 Nov. 2011. <<http://energy.maryland.gov/govt/sunburst.html>>.

Motavalli, Jim. "In a Blackout, Nissan, Mitsubishi and Toyota E.V.'s Could Function as Generators - NYTimes.com." Automobiles - Wheels Blog - NYTimes.com 1 Sept. 2011. 22 Nov. 2011 <<http://wheels.blogs.nytimes.com/2011/09/01/in-a-blackout-nissan-mitsubishi-and-toyota-e-v-s-could-function-as-generators/>>.

Natural Gas Weekly Update. U.S. Energy Information Administration (EIA). U.S. Energy Information Administration, 9 Nov. 2011. Web. 14 Nov. 2011.  
<<http://www.eia.gov/oog/info/ngw/ngupdate.asp>>.

Princeton Energy Resources International, LLC, and Exter Associates, Inc. "The Potential for Biomass Cofiring in Maryland." Maryland Powerplant Research Program. Mar. 2006. Maryland Department of Natural Resources (DNR). 11 Nov. 2011  
<[http://esm.versar.com/pprp/bibliography/PPES\\_06\\_02/PPES\\_06\\_02.pdf](http://esm.versar.com/pprp/bibliography/PPES_06_02/PPES_06_02.pdf)>.

"Project Sunburst." Maryland Energy Administration. Accessed October 17, 2012.  
<http://energy.maryland.gov/Govt/sunburst.html>.

"Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Auction 13." Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Welcome. 7 Sept. 2011. 11 Nov. 2011  
<[http://www.rggi.org/market/co2\\_auctions/results/auction\\_13](http://www.rggi.org/market/co2_auctions/results/auction_13)>.

Reported E85 Prices. E85 Prices. E85 Prices, 2011. Web. 14 Nov. 2011.  
<<http://e85prices.com/>>.

Residential Clean Energy Grant Program. Maryland Energy Administration. Maryland Energy Administration, 2011. Web. 16 Nov. 2011.  
<<http://energy.maryland.gov/Residential/cleanenergygrants/index.html#updates>>.

Search for Cars That Don't Need Gas. Fuel Economy. Fuel Economy, 2011. Web. 14 Nov. 2011.  
<<http://www.fueleconomy.gov/feg/byfueltype.htm>>.

StateStat. Maryland StateStat Report. Department of Housing & Community Development, July 2011. Web. 11 Nov. 2011.  
<[http://www.statestat.maryland.gov/reports/20110825\\_DHCD\\_Template.pdf](http://www.statestat.maryland.gov/reports/20110825_DHCD_Template.pdf)>.

Strong Finish to 2011 Natural Gas Storage Injection Season. U.S. Energy Information Administration (EIA). U.S. Energy Information Administration (EIA), Oct. 2011. Web. 14 Nov. 2011. <<http://www.eia.gov/>>.

Weatherization and Intergovernmental Program: Weatherization Assistance Program. EERE: EERE Server Maintenance. U.S. Department of Energy, 25 Apr. 2011. Web. 11 Nov. 2011. <<http://www1.eere.energy.gov/wip/wap.html>>.

” Windswept Grant Program.” Maryland Energy Administration. Accessed October 17, 2012.  
<http://energy.maryland.gov/windswept/index.html>.

## **E.2 Transportation**

2002 Economic Census: Vehicle Inventory and Use Survey; Geographic Area Series. Sept. 2004. US Census Bureau. 14 Nov. 2011 <<http://www.census.gov/prod/ec02/ec02tv-md.pdf>>.

2009 National Household Travel. National Household Travel Survey. U.S. Department of Transportation, 2009. Web. 14 Nov. 2011. <<http://nhts.ornl.gov/2009/pub/stt.pdf>>.

2010 Annual Report. Rabbittransit-Welcome. Rabbittransit, 2011. Web. 14 Nov. 2011.  
<[http://www.rabbittransit.org/docs/2010\\_Annual\\_Report.pdf](http://www.rabbittransit.org/docs/2010_Annual_Report.pdf)>.

AAA Association Communication, "Your Driving Costs." Last modified 2012. Accessed October 2012. <http://newsroom.aaa.com/wp-content/uploads/2012/04/YourDrivingCosts2012.pdf>.

Allison Hybrid H 40 EP | H 50 EP. Allisontransmission.com. 2011. Allison Transmission. 14 Nov. 2011  
<<http://www.allisontransmission.com/servlet/DownloadFile?Dir=publications/pubs&FileToGet=SA5983EN.pdf>>

Auto Insurance. Insurance Information Institute. U.S. Department of Labor, Bureau of Labor Statistics; National Association of Realtors, 2011. Web. 11 Nov. 2011.  
<<http://www.iii.org/media/facts/statsbyissue/auto/>>.

Average Annual Miles per Driver by Age Group. 4 April 2011. U.S. Department of Transportation (USDOT), Federal Highway Administration (FHWA), Office of Highway Policy Information (OHPI). Web. 11 Nov. 2011.  
<<http://www.fhwa.dot.gov/ohim/onh00/bar8.htm>>.

Average Energy Prices in the Washington-Baltimore Area. Mid-Atlantic Information Office. 27 Sept. 2011. U.S. Bureau of Labor Statistics (BLS). 11 Nov. 2011  
<[http://www.bls.gov/ro3/apwb.htm#wb\\_energy\\_table1](http://www.bls.gov/ro3/apwb.htm#wb_energy_table1)>.

“Average Home Heating Oil Prices.” U.S. Energy Information Agency. EIA. Gov. Web. 16 Nov 2011. <<http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RCLC1&f=D> >

Average Fuel Economy Standards for Light Trucks. Department of Transportation. 14 Nov. 2011  
<<http://www.nhtsa.gov/DOT/NHTSA/Rulemaking/Rules/Associated%20Files/2006FinalRule.pdf>>

Baker, Michael, and Cambridge Systematics. "Maryland Climate Action Plan Draft 2012." Maryland Department of Transportation. Maryland Department of Transportation, 11 Apr. 2011. Web. 16 Nov. 2011.  
<[http://www.mdot.maryland.gov/Planning/Plans\\_Programs\\_Reports/Documents/Climate\\_Change\\_2011\\_Appendix.pdf](http://www.mdot.maryland.gov/Planning/Plans_Programs_Reports/Documents/Climate_Change_2011_Appendix.pdf)>.

"Baltimore Ready to Install 9 Electric Vehicle Charging Stations." General Services / Press Releases. 2010. City of Baltimore, Maryland - Official Website. 14 Nov. 2011  
<<http://baltimorecity.gov/Government/AgenciesDepartments/GeneralServices/PressReleases/tabid/1028/articleType/ArticleView/articleId/1143/Baltimore-Ready-to-Install-9-Electric-Vehicle-Charging-Stations.aspx>>.

Barnitt, Robb A. "In-Use Performance Comparison of Hybrid Electric, CNG & Diesel." National Renewable Energy Laboratory (NREL) Home Page. U.S. Department of Energy, June 2008. Web. 14 Nov. 2011. <<http://www.nrel.gov/vehiclesandfuels/fleettest>>.

Bicycle Helmets. American College of Emergency Physicians. American College of Emergency Physicians, 2011. Web. 11 Nov. 2011. <<http://www.acep.org/content.aspx?id=25986>>.

Bureau of Transportation Statistics. “Table 4-23: Average Fuel Efficiency of U.S. Light Duty Vehicles.” Research and Innovative Technology Administration. Accessed October 17, 2012.  
[http://www.bts.gov/publications/national\\_transportation\\_statistics/html/table\\_04\\_23.htm](http://www.bts.gov/publications/national_transportation_statistics/html/table_04_23.htm).

Car Loan Calculator | Monthly Payments | Incentives - Cars.com. New Cars, Used Cars, Car Reviews, Car Finance Advice - Cars.com. 2011. Cars.com. 14 Nov. 2011  
<<http://www.cars.com/finance/>>.

Chronology of Maryland's Part 70 Permit Program. The Department of the Environment. 14 Nov. 2011  
<<http://www.mde.state.md.us/programs/Permits/AirManagementPermits/TitleVProgramInformation/Pages/title5factsheet.aspx>>

Civilian Labor Force, Employment & Unemployment by Place of Residence (LAUS) - Maryland - Division of Workforce Development and Adult Learning. Welcome to the Maryland Department of Labor, Licensing and Regulation. Maryland Department of Labor, Licensing and Regulation, 21 Oct. 2011. Web. 14 Nov. 2011.  
<<http://www.dllr.state.md.us/lmi/laus/maryland.shtml>>.

"Clean Fuels Standard." Northeast States for Coordinated Air Use Management. Accessed October 17, 2012. <http://www.nescaum.org/topics/clean-fuels-standard>.

Colleges - Miles and Minutes. 2011. Baltimore Collegetown Network. 14 Nov. 2011  
<<http://www.baltimorecollegetown.org/colleges/miles-and-minutes/>>.

Csere, Csaba. "How Automakers Will Meet 2016 CAFE Standards - Feature - Car and Driver." Car Reviews - 2011 Car Reviews and 2012 New Cars at Car and Driver. May 2011. Car and Driver. 11 Nov. 2011 <<http://www.caranddriver.com/features/how-automakers-will-meet-2016-cafe-standards>>.

"Daily Garage." Parking. Baltimore/Washington International Thurgood Marshall Airport, 2011. Web. 19 Aug. 2011.

Daily Fuel Gauge Report—national, state and local average prices for gasoline, diesel and E-85. 11 Nov. 2011. Oil Price Information Service (OPIS). 11 Nov. 2011  
<<http://fuelgaugereport.aaa.com/?redirectto=http://fuelgaugereport.opisnet.com/index.asp>>.

Data - Prices. Maryland. Nov. 2011. U.S. Energy Information Administration (EIA). 14 Nov. 2011 <<http://www.eia.gov/state/state-energy-profiles-data.cfm?sid=MD#Prices>>.

Departmental Mission Statement. Department of Transportation. University of Maryland, 2011. Web. 14 Nov. 2011.  
<<http://www.transportation.umd.edu/images/about/pdfs/ANNUAL%20REPORT%20FY%2011.pdf>>.

Documents—Resource Types—SFpark. SFpark. Municipal Transportation Agency, 2011. Web. 16 Nov. 2011. <<http://sfpark.org/resource-type/documents/>>.

Dresser, Michael. "New cars may ease MARC crowding - Baltimore Sun." Featured Articles From The Baltimore Sun. 20 Aug. 2008. The Baltimore Sun. 14 Nov. 2011 <[http://articles.baltimoresun.com/2008-08-20/news/0808190131\\_1\\_marc-new-cars-passenger-cars](http://articles.baltimoresun.com/2008-08-20/news/0808190131_1_marc-new-cars-passenger-cars)>.

"Electric Vehicle Charging Stations." 2010. EVsRoll.com. 14 Nov. 2011 <[http://www.evscroll.com/Electric\\_Vehicle\\_Charging\\_Stations.html](http://www.evscroll.com/Electric_Vehicle_Charging_Stations.html)>.

Employment and Payrolls - Industry Series - Maryland 2009 - Employment and Payrolls - Division of Workforce Development and Adult Learning. Maryland Department of Labor, Licensing and Regulation. Maryland Department of Labor, Licensing and Regulation, 1 June 2011. Web. 11 Nov. 2011. <<http://www.dllr.state.md.us/lmi/emppay/md2010ep.shtml>>.

Environmental Protection Agency, "Greenhouse Gas Equivalencies Calculator." Last modified 2012. Accessed October 2012. <http://www.epa.gov/cleanenergy/energy-resources/calculator.html>.

"EPA and NHTSA Propose First-Ever Program to Reduce Greenhouse Gas Emissions and Improve Fuel Efficiency of Medium- and Heavy-Duty Vehicles | US EPA." Transportation and Climate. Oct. 2010. US Environmental Protection Agency (EPA). 14 Nov. 2011 <<http://www.epa.gov/oms/climate/regulations/420f10901.htm>>.

Express Bus Monthly Pass | Maryland Transit Administration. Maryland Transit Administration. Department of Transportation, 2011. Web. 11 Nov. 2011. <<https://mta.maryland.gov/pass-store/express-bus-monthly-pass>>.

Facts About Bicycling as a Commute Option. California Bicycling Information from Bike Link. Web. 14 Nov. 2011. <<http://www.californiabikecommute.com/>>.

Freight Railroads in Maryland. Association of American Railroads. 2009. Web. 11 Nov. 2011. <<http://www.aar.org/Railroads-States/Maryland-2009.pdf>>.

Free Wheelin' Bike Program. City of Annapolis, MD - Official Website. City of Annapolis, MD, 2011. Web. 11 Nov. 2011. <<http://www.annapolis.gov/government/departments/Transportation/BikeAnnapolis/FreeWheelin.aspx>>.

Fuel Efficiency. CSX Corporation. Web. 11 Nov. 2011. <<http://www.csx.com/index.cfm/about-csx/projects-and-partnerships/fuel-efficiency/>>.

Governor's Delivery Unit. Maryland StateStat. Maryland StateStat, 2011. Web. 11 Nov. 2011. <<http://www.statestat.maryland.gov/gdutransit.asp>>.

Green Port of Baltimore. Air Quality. Maryland Department of Transportation; Port Administration. 11 Nov. 2011 <<http://mpa.maryland.gov/content/air-quality.php>>.

"How We Calculate Your Carbon Footprint." Carbon offsets for your carbon footprint & fighting global warming. 2011. CarbonFund.org. 14 Nov. 2011 <[http://www.carbonfund.org/site/pages/carbon\\_calculators/category/Assumptions#Transportation](http://www.carbonfund.org/site/pages/carbon_calculators/category/Assumptions#Transportation)>.

ISDH: ISDH Home. IN.gov: Home. IN.gov. Web. 14 Nov. 2011. <[http://www.in.gov/isdh/files/Idling\\_Brochure.](http://www.in.gov/isdh/files/Idling_Brochure.)>.

Issued Part 70 Permits. The Department of the Environment. 14 Nov. 2011 <http://www.mde.state.md.us/programs/Permits/AirManagementPermits/TitleVProgramInformation/Pages/title5issuedpermits.aspx>

Journal of Public Transportation. 4th ed. Vol. 10. Ser. 2007. Guaranteed Ride Home Programs. Federal Transportation Administration. Web. 14 Nov. 2011. <<http://www.nctr.usf.edu/jpt/pdf/JPT%2010-4%20Menczer.pdf>>.

KFH Group, Inc. "Harford County Transportation Development Plan." Harford County. June 2007. Office of Planning, Maryland Transit Administration (MTA). 14 Nov. 2011 <<http://www.harfordcountymd.gov/services/community/doc/985.pdf>>.

Lowest Diesel Fuel Prices in the Last 24 Hours. Maryland Gas Prices - Find Cheap Gas Prices in Maryland. 2011. Web. 14 Nov. 2011. <<http://www.marylandgasprices.com/index.aspx?fuel=D>>.

MARC Growth and Investment Plan. Maryland Transit Administration. Maryland Transit Administration, Sept. 2007. Web. 14 Nov. 2011. <<http://mta.maryland.gov/sites/default/files/marcplanfull.pdf>>.

MARC Parking Details | Maryland Transit Administration. Home | Maryland Transit Administration. Nov. 2011. Maryland Transit Administration (MTA). 14 Nov. 2011 <<http://mta.maryland.gov/marc-parking-details>>.

MARC Station Information | Maryland Transit Administration. Home | Maryland Transit Administration. Maryland Transit Administration, 14 Nov. 2011. Web. 14 Nov. 2011. <<http://mta.maryland.gov/marc-station-information>>.

MARC Train Service Order Form. CommuterDirect.com®. 2011. MARC. 14 Nov. 2011 <[https://www.commuterpage.com/orderforms/transitorders\\_v3.cfm?sysid=12](https://www.commuterpage.com/orderforms/transitorders_v3.cfm?sysid=12)>.

"MARC Train System Parking Information." Maryland Transit Administration. Department of Transportation, Aug. 2010. Web. 19 Aug. 2011.

- Maryland Auto Outlook. Www.mdauto.org. 9 Aug. 2011. Maryland Automobile Dealers Association. 11 Nov. 2011  
<<http://www.mdauto.org/admin/publications/AutoOutlookQuarter22011.pdf>>.
- Maryland Moves. Baltimore Metropolitan Council. Baltimore Metropolitan Council for the Regional Transportation Board May 2006. Web. 16 Nov. 2011.  
<<http://www.baltometro.org/eNews/MM-5-06.pdf>>.
- Maryland Transit Administration, "Red Line Financial Plan Synopsis." Last modified 2012. Accessed October 2012.  
[http://www.baltimoreredline.com/images/stories/redline\\_documents/preliminary\\_engineering/04\\_financial\\_plan/01\\_Financial\\_Plan\\_Synopsis.pdf](http://www.baltimoreredline.com/images/stories/redline_documents/preliminary_engineering/04_financial_plan/01_Financial_Plan_Synopsis.pdf).
- Maryland Transit Administration, "Purple Line Financial Plan." Last modified 2012. Accessed October 2012. [http://dlslibrary.state.md.us/publications/JCR/2010/2010\\_61\(PL\).pdf](http://dlslibrary.state.md.us/publications/JCR/2010/2010_61(PL).pdf).
- Maryland QuickFacts from the US Census Bureau. State and County QuickFacts. U.S. Census Bureau, 13 Oct. 2011. Web. 11 Nov. 2011.  
<<http://quickfacts.census.gov/qfd/states/24000.html>>.
- MdTA Toll Facilities. MdTA Index. Maryland Transportation Authority, 2011. Web. 14 Nov. 2011. <<http://www.mta.maryland.gov/TollFacilities/facilities.html>>.
- Maryland Department of Transportation. "Draft 2012 Implementation Plan—Appendix." Maryland Climate Action Plan. 2011. Accessed October 17, 2012.  
[http://www.mdot.maryland.gov/Office%20of%20Planning%20and%20Capital%20Programming/Plans\\_Programs\\_Reports/Documents/Climate\\_Change\\_2011\\_Appendix.pdf](http://www.mdot.maryland.gov/Office%20of%20Planning%20and%20Capital%20Programming/Plans_Programs_Reports/Documents/Climate_Change_2011_Appendix.pdf).
- Menczer, William B. Journal of Public Transportation. 4th ed. Vol. 10. Ser. 2007. Guaranteed Ride Home Programs. Federal Transportation Administration. Web. 14 Nov. 2011.  
<<http://www.nctr.usf.edu/jpt/pdf/JPT%2010-4%20Menczer.pdf>>.
- Monthly Statistical Report. BWI Airport. BWI Airport, 01 Aug. 2011. Web. 14 Nov. 2011.  
<<http://www.bwiairport.com/files/assets/stats/August%202011.pdf#zoom=100>>.
- Motavalli, Jim. "In a Blackout, Nissan, Mitsubishi and Toyota E.V.'s Could Function as Generators - NYTimes.com." Automobiles - Wheels Blog - NYTimes.com 1 Sept. 2011. 22 Nov. 2011 <<http://wheels.blogs.nytimes.com/2011/09/01/in-a-blackout-nissan-mitsubishi-and-toyota-e-v-s-could-function-as-generators/>>.
- Motor Vehicle Administration. "2011 Car Sales Statistics." Department of Transportation. Accessed October 17, 2012. <http://www.mva.maryland.gov/About-MVA/statistics/11sum.htm>.

- National Transit Information. National Transit Database. National Transit Database, 2011. Web. 14 Nov. 2011.  
<<http://www.ntdprogram.gov/ntdprogram/cs?action=showRegionAgencies&region=3>>.
- Natural Gas Weekly Update. U.S. Energy Information Administration (EIA). U.S. Energy Information Administration, 9 Nov. 2011. Web. 14 Nov. 2011.  
<<http://www.eia.gov/oog/info/ngw/ngupdate.asp>>.
- “New cars may ease MARC crowding.” The Baltimore Sun. The Baltimore Sun, 20 Aug. 2008. Web. 19 Aug. 2011.
- New Hybrid Crane to Reduce the Carbon Footprint. About MAERSK. 31 March 2011. MAERSK. 11 Nov. 2011.  
<<http://www.maersk.com/AboutMaersk/News/Pages/20110331-154630.aspx>>.
- O'Malley, Martin, Anthony Brown, and Beverly Swaim-Staley. Maryland Department of Transportation, "Maryland Climate Action Plan." Last modified 2012. Accessed October 2012. [http://www.mdot.maryland.gov/Office of Planning and Capital Programming/Plans\\_Programs\\_Reports/Documents/Climate\\_Change\\_2011\\_Appendix.pdf](http://www.mdot.maryland.gov/Office of Planning and Capital Programming/Plans_Programs_Reports/Documents/Climate_Change_2011_Appendix.pdf).
- Parking. Baltimore Washington International Thurgood Marshall Airport. 11 Nov. 2011  
< <http://www.bwiairport.com/en/parking/information-rates/daily-garage>>.
- Pathways to Reduced Transportation CO2 in the Year 2050. Cornell University. 11 Nov. 2011  
<<http://www.cee.cornell.edu/academics/graduate/loader.cfm?csModule=security/getfile&PageID=84226>>.
- Port of Baltimore. 2009. Ports America - Home. PortsAmerica.com 11 Nov. 2011  
<<http://www.portsamerica.com/baltimore-maryland.html>>.
- Project Benefits. Maryland Hybrid Truck Initiative (MHTI) a U.S. DOE Clean Cities project. 14 Nov. 2011 <<http://www.marylandhti.com/project-benefits/>>.
- Rail Track Mileage and Number of Class I Rail Carriers, United States, 1830-2008. The Geography of Transport Systems. Web. 14 Nov. 2011.  
< <http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/usrail18402003.html>>.
- RabbitEXPRESS—Fares and Accommodations. Rabbittransit - Welcome! York County Transportation Authority, 2011. Web. 14 Nov. 2011.  
<<http://www.rabbittransit.org/express/pages/cashfarechart.html>>.
- Regular Fares | Maryland Transit Administration. Home | Maryland Transit Administration. Maryland Transit Administration, 14 Nov. 2011. Web. 14 Nov. 2011.  
<<http://mta.maryland.gov/regular-fares>>.

**Refined Economic Impact Analysis for the GGRA 2012 Plan—Appendices C through E**  
RESI of Towson University

Reported E85 Prices. E85 Prices. E85 Prices, 2011. Web. 14 Nov. 2011.  
<<http://e85prices.com/>>.

Residence Halls at a Glance. Department of Resident Life | University of Maryland, College Park. Department of Resident Life | University of Maryland, College Park, 2011. Web. 14 Nov. 2011. <<http://www.resnet.umd.edu/hallsatglance/>>.

"Riding Public Transit Saves Individuals \$9,242 Annually." APTA Homepage. 1 Dec. 2010. American Public Transportation Association (APTA). 14 Nov. 2011  
<[http://www.apta.com/mediacenter/pressreleases/2010/Pages/100112\\_Transit\\_Savings.aspx](http://www.apta.com/mediacenter/pressreleases/2010/Pages/100112_Transit_Savings.aspx)>.

RITA | BTS | Table 4-15: Bus Fuel Consumption and Travel. RITA | Bureau of Transportation Statistics (BTS). Bureau of Transportation, 26 Apr. 2010. Web. 14 Nov. 2011.  
<[http://www.bts.gov/publications/national\\_transportation\\_statistics/html/table\\_04\\_15.html](http://www.bts.gov/publications/national_transportation_statistics/html/table_04_15.html)>.

"RITA | ITS | Benefits: The Texas Traffic Light Synchronization program reduced delays by 24.6 percent by updating traffic signal control equipment and optimizing signal timing." RITA | ITS | Welcome to the Costs Database. 10 Aug. 2005. U.S. Department of Transportation (USDOT). 11 Nov. 2011  
<<http://www.itscosts.its.dot.gov/its/benecost.nsf/ID/D0DCC197DC7382BE852573D8006F7EDA?OpenDocument>>.

Saka, Anthony A., Dennis K. Agboh, Simon Ndiritu, and Richard A. Glassco. "An Estimation of Mobile Emissions Reduction." RITA | National Transportation Library. National Transportation Centre, Mar. 2000. Web. 14 Nov. 2011.  
<<http://ntl.bts.gov/lib/16000/16800/16888/PB2000105915.pdf>>.

Search for Cars That Don't Need Gas. Fuel Economy. Fuel Economy, 2011. Web. 14 Nov. 2011.  
<<http://www.fueleconomy.gov/feg/byfueltype.htm>>.

Shoup, Donald C. "Cruising for Parking." Transport Policy. Donald C. Shoup, 24 July 2006. Web. 11 Nov. 2011. <<http://shoup.bol.ucla.edu/>>.

Staff Bios | Georgetown Climate Center. Georgetown Climate Center |. Georgetown Climate Center. Web. 14 Nov. 2011. <<http://www.georgetownclimate.org/about-us/staff-bios>>.

Starcrest Consulting Group, LLC. "Rubber Tired Gantry (RTG) Crane Load Factor Study." Nov. 2009. Port of Los Angeles; Port of Long Beach. 14 Nov. 2011  
<<http://www.polb.com/civica/filebank/blobdload.asp?BlobID=6915>>.

"State & Urbanized Area Statistics - Our Nation's Highways - 2000." Home | Federal Highway Administration. 4 Apr. 2011. Federal Highway Administration (FHWA). 11 Nov. 2011  
<<http://www.fhwa.dot.gov/ohim/onh00/onh2p11.htm>>.

Regional Economic  
Studies Institute



- Strong Finish to 2011 Natural Gas Storage Injection Season. U.S. Energy Information Administration (EIA). U.S. Energy Information Administration (EIA), Oct. 2011. Web. 14 Nov. 2011. <<http://www.eia.gov/>>.
- Task Force on Renewable Alternative Fuels. State of Maryland. 31 Dec. 2007. Web. 14 Nov. 2011. <<http://www.mda.state.md.us/pdf/altfuelsreport.pdf>>.
- Taxi Fares in Major U.S. Cities. Schaller Consulting Home Page. Schaller Consulting, Jan. 2006. Web. 14 Nov. 2011. <<http://www.schallerconsult.com/taxi/fares1.htm>>.
- The Federal Reserve Bank of Minneapolis, "Consumer Price Index." Last modified 2012. [http://www.minneapolisfed.org/community\\_education/teacher/calc/hist1913.cfm](http://www.minneapolisfed.org/community_education/teacher/calc/hist1913.cfm).
- Tile V Fee Sheet. The Department of the Environment. 14 Nov. 2011 <<http://www.mde.state.md.us/programs/Permits/AirManagementPermits/TitleVProgramInformation/Pages/title5feesheet.aspx>>
- Transit Fare. City of Annapolis, MD - Official Website. The City of Annapolis, MD, 14 Nov. 2011. Web. 14 Nov. 2011. <<http://www.annapolis.gov/Government/Departments/Transportation/TransitFare.aspx>>.
- Truck and Locomotive Idling Solutions. South East Diesel Collaborative, 25 June 2008. Web. 14 Nov. 2011. <<http://www.southeastdiesel.org/Presentations%20for%203rd%20Annual%20Meeting/Da%20y%20Idle%20Reduct%20Tech-%20anthony%20erb.pdf>>.
- Truck Stop Electrification. California Energy Commission. California Energy Commission, June 2006. Web. 16 Nov. 2011. <<http://www.energy.ca.gov/2006publications/CEC-600-2006-001/CEC-600-2006-001-FS.PDF>>.
- United States Environmental Protection Agency. 2011. "Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles: EPA Response to Comments Document for Joint Rulemaking." August 2011. Accessed October 17, 2012. <http://www.epa.gov/oms/climate/documents/420r11004.pdf>.
- "U.S. EPA Sensitive Population Grant for the City of Baltimore and the City of Annapolis (Fire Trucks and Ambulances)." Maryland Department of the Environment (MDE). 14 Nov. 2011 <[http://www.mde.state.md.us/programs/Air/MobileSources/DieselVehicleInformation/DieselRetrofitProjects/Pages/balto\\_annapcity\\_retrofit.aspx](http://www.mde.state.md.us/programs/Air/MobileSources/DieselVehicleInformation/DieselRetrofitProjects/Pages/balto_annapcity_retrofit.aspx)>.

United States Census Bureau. “ACS Demographic and Housing Estimates: 2010 American Community Survey 1-Year Estimates.” American FactFinder, (Maryland and Baltimore City, Maryland). Accessed October 17, 2012.  
[http://factfinder2.census.gov/bkmk/table/1.0/en/ACS/10\\_1YR/DP05/0400000US24|0500000US24510](http://factfinder2.census.gov/bkmk/table/1.0/en/ACS/10_1YR/DP05/0400000US24|0500000US24510).

United States Census Bureau’s Center for Economic Studies. “OnTheMap.” Longitudinal Employer-Household Dynamics. Accessed October 17, 2012.  
<http://onthemap.ces.census.gov/>.

United States Department of Labor, "Bureau of Labor Statistics." Last modified 2012. Accessed October 2012. <http://data.bls.gov/timeseries/APU000074714>.

Welcome to the Annapolis Official CVB Website: Getting Around Annapolis. Welcome to the Annapolis Official CVB Website: Home. Annapolis and the Chesapeake Bay, 2011. Web. 11 Nov. 2011. <<http://www.visitannapolis.org/visitor-info/getting-here/getting-around-annapolis/index.aspx>>.

Welcome to the Annapolis Official CVB Website: Visitors Center. Welcome to the Annapolis Official CVB Website: Home. Annapolis and the Chesapeake Bay, 2011. Web. 14 Nov. 2011. <<http://www.visitannapolis.org/visitor-info/visitors-center/index.aspx>>.

Wetlands Restoration/Constructed Wetlands. Brookhaven National Laboratory. 14 Nov. 2011 <<http://www.bnl.gov/erd/peconic/factsheet/wetlands.pdf>>.

### **E.3 Agriculture & Forestry**

5 Star Grant Program | Wetlands | Office of Wetlands, Oceans, and Watersheds | US EPA. US Environmental Protection Agency. EPA, 05 Mar. 2011. Web. 11 Nov. 2011. <<http://www.epa.gov/owow/wetlands/restore/5star/>>.

Adalja, Aaron, James C. Hanson, and Amy G. Crone. “Assessing the Need for a Statewide Farmers’ Market Association in Maryland.” Fact Sheet 934, 2011. University of Maryland Extension and Maryland Department of Agriculture.  
[http://agresearch.umd.edu/CANRP/Localfood/files/2011\\_UME\\_FS%20934.pdf](http://agresearch.umd.edu/CANRP/Localfood/files/2011_UME_FS%20934.pdf).

Becker, Geoffrey S. “Farmers’ Markets: The USDA Role.” CRS Report for Congress RS21652, Updated January 3, 2006. Congressional Research Service and the Library of Congress.  
<http://www.nationalaglawcenter.org/assets/crs/RS21652.pdf>.

“Chesapeake Bay TMDL.” United States Environmental Protection Agency. Accessed October 17, 2012. <http://www.epa.gov/chesapeakebaytmdl/>.

“The Chesapeake Bay TMDL, Maryland’s Watershed Implementation Plan and Maryland’s 2012-2013 Milestone Goals.” Maryland Department of the Environment. Accessed October 17, 2012.  
[http://www.mde.state.md.us/PROGRAMS/WATER/TMDL/CHESAPEAKEBAYTMDL/Pages/programs/waterprograms/tmdl/cb\\_tmdl/index.aspx](http://www.mde.state.md.us/PROGRAMS/WATER/TMDL/CHESAPEAKEBAYTMDL/Pages/programs/waterprograms/tmdl/cb_tmdl/index.aspx).

Constructed Wetlands for Wastewater Treatment and Wildlife Habitat | Constructed Wetlands | US EPA. US Environmental Protection Agency. USEPA, 1993. Web. 11 Nov. 2011.  
<<http://www.epa.gov/owow/wetlands/construc/>>.

“Cost of Net Farmland Change.” Maryland Smart, Green & Growing. Accessed October 17, 2012. <http://www.green.maryland.gov/mdgpi/12a.asp>.

Dougherty, Rebecca. March 2011. “2010 Maryland State Parks Economic Impact and Visitor Study.” Department of Business and Economic Development. Accessed October 17, 2012. <http://www.dnr.state.md.us/publiclands/pdfs/economicimpactstudy2010.pdf>.

Ecosystem Services Working Group Final Report. Maryland Department of Natural Resources. Maryland Department of Natural Resources, Oct. 2011. Web. 14 Nov. 2011.  
<<http://www.dnr.state.md.us/dnrnews/pdfs/ESWGFfinalReportOct2011.pdf>>.

Guiding Principles for Constructed Treatment Wetlands: Providing for Water Quality and Wildlife Habitat | Constructed Wetlands | US EPA. Home | Water | US EPA. USEPA, Sept.-Oct. 2011. Web. 11 Nov. 2011.  
<[http://water.epa.gov/type/wetlands/constructed/constructed\\_index.cfm](http://water.epa.gov/type/wetlands/constructed/constructed_index.cfm)>.

“Housing and Community Development.” Maryland Department of Housing and Community Development, 2011. Accessed October 17, 2012.  
<http://www.dbm.maryland.gov/agencies/operbudget/Documents/2012/Proposed/houscomm.pdf>.

Jones, CY, Evan Branosky, Mindy Selman, and Michelle Perez. "How Nutrient Trading Could Help Restore the Chesapeake Bay." World Resource Institute. World Resource Institute, Feb. 2010. Web. 14 Nov. 2011.  
<[http://pdf.wri.org/working\\_papers/how\\_nutrient\\_trading\\_could\\_help\\_restore\\_the\\_chesapeake\\_bay.pdf](http://pdf.wri.org/working_papers/how_nutrient_trading_could_help_restore_the_chesapeake_bay.pdf)>.

Land Values 2011 Summary. National Agricultural Statistics Services. United States Department of Agriculture, 4 Aug. 2011. Web. 16 Nov. 2011.  
<<http://usda01.library.cornell.edu/usda/current/AgriLandVa/AgriLandVa-08-04-2011.pdf>>.

Maryland | Retail Means Jobs. Retail Means Jobs | Retail Supports 1 in 4 American Jobs | 42 Million Strong. PricewaterhouseCoopers LLP, July-Aug. 2011. Web. 11 Nov. 2011.  
<<http://www.retailmeansjobs.com/data/MD/0>>.

- Maryland Department of Planning Staff. “Maryland Smart Growth Sub-Cabinet Report on State Spending Inside and Outside of the Priority Funding Areas for Fiscal Years 2006-2009 and 2009 Annual Report.” Maryland Smart, Green & Growing, December 2009. Maryland Department of Planning.  
[http://planning.maryland.gov/PDF/OurProducts/Publications/AnnualReports/SG\\_Sub\\_Cab\\_2010.pdf](http://planning.maryland.gov/PDF/OurProducts/Publications/AnnualReports/SG_Sub_Cab_2010.pdf).
- Maryland Genuine Progress Indicator. Maryland: Smart, Green and Growing. Maryland: Smart, Green and Growing. Web. 14 Nov. 2011.  
<<http://www.green.maryland.gov/mdgpi/8a.asp>>.
- “Maryland Farmers’ Market.” The Official Site of the Maryland Office of Tourism. Accessed October 17, 2012. <http://visitmaryland.org/events/pages/marylandfarmersmarkets.aspx>.
- Maryland QuickFacts from the US Census Bureau. State and County QuickFacts. U.S. Census Bureau, 13 Oct. 2011. Web. 11 Nov. 2011.  
<<http://quickfacts.census.gov/qfd/states/24000.html>>.
- MD Proceeds by Auction. Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Welcome. Regional Greenhouse Gas Initiative CO2 Budget Trading Program, 2011. Web. 14 Nov. 2011. <[http://rggi.org/docs/MD\\_Proceeds\\_by\\_Auction.pdf](http://rggi.org/docs/MD_Proceeds_by_Auction.pdf)>.
- Nowak, David J., Susan M. Stein, Paula B. Randler, Eric J. Greenfield, Sara J. Comas, Mary A. Carr, and Ralph J. Alig. “Sustaining America’s Urban Trees and Forests: A Forests on the Edge Report.” General Technical Report NRS-62, June 2010. Newton Square, Pennsylvania: United States Department of Agriculture.  
[http://www.fs.fed.us/openspace/fote/reports/nrs-62\\_sustaining\\_americas\\_urban.pdf](http://www.fs.fed.us/openspace/fote/reports/nrs-62_sustaining_americas_urban.pdf).
- Office of Energy Performance and Conservation. “StateStat Template.” StateStat Maryland, September 18, 2012. Maryland Department of General Services. Accessed October 17, 2012. [http://www.statestat.maryland.gov/reports/20120918\\_DGS\\_Template.pdf](http://www.statestat.maryland.gov/reports/20120918_DGS_Template.pdf).
- So Maryland, So Good Farm Guide. Southern Maryland Agricultural Development Commission, 2011. Web. 11 Nov. 2011. <<http://www.smadc.com/farmguide/FarmGuideWEB.pdf>>.
- This Week in Petroleum. U.S. Energy Information Administration (EIA). EIA, 09 Nov. 2011. Web. 11 Nov. 2011. <<http://38.96.246.204/oog/info/twip/twip.asp>>.
- Wetland Publications. Environmental Laboratory. U.S. Army Corps of Engineers, Environmental, Apr.-May 2006. Web. 11 Nov. 2011.  
<<http://el.ercd.usace.army.mil/wetlands/wlpubs.html>>.

#### E.4 Recycling

"Maryland Auto Outlook." Www.mdauto.org. 9 Aug. 2011. Maryland Automobile Dealers Association. 11 Nov. 2011  
<<http://www.mdauto.org/admin/publications/AutoOutlookQuarter22011.pdf>>.

Average Annual Miles per Driver by Age Group. 4 April 2011. U.S. Department of Transportation (USDOT), Federal Highway Administration (FHA), Office of Highway Policy Information (OHPI). Web. 11 Nov. 2011.  
<<http://www.fhwa.dot.gov/ohim/onh00/bar8.htm>>.

County Recyclables by Commodity in Tons for Calendar Year 2008. Maryland Department of the Environment (MDE). 2008. Web. 11 Nov. 2011.  
<[www.mde.maryland.gov/assets/document/recycling\\_chart.pdf](http://www.mde.maryland.gov/assets/document/recycling_chart.pdf)>.

Csere, Csaba. "How Automakers Will Meet 2016 CAFE Standards - Feature - Car and Driver." Car Reviews - 2011 Car Reviews and 2012 New Cars at Car and Driver. May 2011. Car and Driver. 11 Nov. 2011 <<http://www.caranddriver.com/features/how-automakers-will-meet-2016-cafe-standards>>.

#### E.5 Buildings

Building Energy Data Book. Buildings Energy Data Book. U.S. Energy Information Administration, Mar. 2011. Web. 11 Nov. 2011.  
<<http://buildingsdatabook.eren.doe.gov/ChapterIntro3.aspx>>.

Code Enforcement Bureau. Baltimore County, MD Government Home Page. Code Enforcement Bureau, 17 June 2011. Web. 11 Nov. 2011.  
<[http://www.baltimorecountymd.gov/agencies/permits/pdmfaq/pdmfaq\\_cdenfo.html#q3](http://www.baltimorecountymd.gov/agencies/permits/pdmfaq/pdmfaq_cdenfo.html#q3)>

Construction and Building Inspectors. U.S. Bureau of Labor Statistics. Bureau of Labor Statistics, 17 Dec. 2009. Web. 11 Nov. 2011. <<http://www.bls.gov/oco/ocos004.htm>>.

Department of Housing and Community Development. "Response to Department of Legislative Services (DLS): Operating Budget Analysis." State of Maryland. Accessed October 17, 2012. <http://dbm.maryland.gov/agencies/operbudget/FY2013Testimony/S00.pdf>.

"Guide to Integrating Renewable Energy in Federal Construction." U.S. Energy Information Administration, Apr. 2013. Web. 21 May 2013.  
<[http://www1.eere.energy.gov/femp/reconstructionguide/budgeting\\_costs.html](http://www1.eere.energy.gov/femp/reconstructionguide/budgeting_costs.html)>

Housing Statistics: Year End 2010. Maryland Association of Realtors Homepage. Maryland Association of Realtors, 2010. Web. 11 Nov. 2011.  
<<http://www.mdrealtor.org/LinkClick.aspx?fileticket=aGcV7fnZEBk%3d&tabid=161&mid=543>>.

Kats, Gregory H. "Green Building Costs and Financial Benefits." NH Partnership for High Performance Schools - Home.  
[Http://www.nhphps.org/docs/documents/GreenBuildingspaper.pdf](http://www.nhphps.org/docs/documents/GreenBuildingspaper.pdf), 2003. Web. 11 Nov. 2011. <<http://www.nhphps.org/>>.

Listokin, David, and David Hattis. "Building Codes and Housing." 2004. Web. 11 Nov. 2011.  
<[http://www.huduser.org/rbc/pdf/building\\_codes.pdf](http://www.huduser.org/rbc/pdf/building_codes.pdf)>.

Maryland Green Building Council 2010 Annual Report. Maryland Green Building Council. Maryland Department of General Services, 2011. Web. 11 Nov. 2011.  
<<http://www.dgs.maryland.gov/pdfs/2010GreenBldgReport.pdf>>.

StateStat. Maryland StateStat Report. Department of Housing & Community Development, July 2011. Web. 11 Nov. 2011.  
<[http://www.statestat.maryland.gov/reports/20110825\\_DHCD\\_Template.pdf](http://www.statestat.maryland.gov/reports/20110825_DHCD_Template.pdf)>.

## **E.6 Land Use**

2000 Census of Population and Housing. U.S. Census Bureau, April 2004. Web. 11 Nov. 2011.  
<<http://www.census.gov/prod/cen2000/phc3-us-pt1.pdf>>.

Housing Statistics: Year End 2010. Maryland Association of Realtors Homepage. Maryland Association of Realtors, 2010. Web. 11 Nov. 2011.  
<<http://www.mdrealtor.org/LinkClick.aspx?fileticket=aGcV7fnZEBk%3d&tabid=161&mid=543>>.

How We Calculate. Carbonfund.org. Web. 11 Nov. 2011.  
< [http://www.carbonfund.org/site/pages/carbon\\_calculators/category/Assumptions](http://www.carbonfund.org/site/pages/carbon_calculators/category/Assumptions)>.

Maryland QuickFacts from the US Census Bureau. State and County QuickFacts. U.S. Census Bureau, 13 Oct. 2011. Web. 11 Nov. 2011.  
<<http://quickfacts.census.gov/qfd/states/24000.html>>.

PlanMaryland Revised Draft—September 2011 Highlights. Plan Maryland, 21 Sept. 2011. Web. 11 Nov. 2011. <  
<http://plan.maryland.gov/PDF/draftPlan/PlanMarylandHighlightsSept2011.pdf>>.

Profile of Selected Housing Characteristics: 2000. U.S. Census Bureau. Web. 11 Nov. 2011.  
< [http://factfinder.census.gov/servlet/QTTTable?\\_bm=y&-geo\\_id=04000US24&-qr\\_name=DEC\\_2000\\_SF3\\_U\\_DP4&-ds\\_name=DEC\\_2000\\_SF3\\_U&-redoLog=false](http://factfinder.census.gov/servlet/QTTTable?_bm=y&-geo_id=04000US24&-qr_name=DEC_2000_SF3_U_DP4&-ds_name=DEC_2000_SF3_U&-redoLog=false)>.

State and Urbanized Area Statistics. U.S. Department of Transportation, 4 April. 2011. Web. 11 Nov. 2011. < <http://www.fhwa.dot.gov/ohim/onh00/onh2p11.htm>>.

The Sustainable Communities Tax Credit. Maryland Sustainable Growth Commission. Web. 11 Nov. 2011. < <http://www.governor.maryland.gov/documents/sustainablecredits.pdf>>.

**Regional Economic  
Studies Institute**

USA QuickFacts from the US Census Bureau. State and County QuickFacts. U.S. Census Bureau, 13 Oct. 2011. Web. 11 Nov. 2011.  
<<http://quickfacts.census.gov/qfd/states/00000.html>>.

### **E.7 Innovative Initiatives**

2009 County Business Patterns. Censtats Database. NAICS, 2009. Web. 11 Nov. 2011.  
<<http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl>>.

A Look at Office Buildings - How Many Employees Are There. U.S. Energy Information Administration (EIA). U.S. Energy Information Administration (EIA), 3 Jan. 2001. Web. 14 Nov. 2011.  
<[http://www.eia.gov/emeu/consumptionbriefs/cbecs/pbawebbsite/office/office\\_howmanympl.htm](http://www.eia.gov/emeu/consumptionbriefs/cbecs/pbawebbsite/office/office_howmanympl.htm)>.

Ask Green America - Recycled Paper FAQ. Ask Green America - Knowledgebase Login. Green Irene, 2011. Web. 11 Nov. 2011.  
<[http://askgreenamerica.custhelp.com/app/answers/detail/a\\_id/1340/~recycled-paper-fa](http://askgreenamerica.custhelp.com/app/answers/detail/a_id/1340/~/recycled-paper-fa)>

Asthma Hospitalizations in Maryland. Family Health Administration. Department of Health and Mental Hygiene, Aug. 2011. Web. 14 Nov. 2011.  
<<http://fha.maryland.gov/pdf/mch/DataBrief-3-AsthmaHospitalizationsinMaryland2011.pdf>>.

Asthma Mortality in Maryland. Family Health Administration. Department of Health and Mental Hygiene, Aug. 2011. Web. 14 Nov. 2011. <<http://fha.maryland.gov/pdf/mch/DataBrief2-AsthmaMortalityinMaryland2011.pdf>>.

Asthma Hospitalizations in Maryland. Family Health Administration. Department of Health and Mental Hygiene, Aug. 2011. Web. 14 Nov. 2011.  
<<http://fha.maryland.gov/pdf/mch/DataBrief-3-AsthmaHospitalizationsinMaryland2011.pdf>>.

Asthma Mortality in Maryland. Family Health Administration. Department of Health and Mental Hygiene, Aug. 2011. Web. 14 Nov. 2011. <<http://fha.maryland.gov/pdf/mch/DataBrief2-AsthmaMortalityinMaryland2011.pdf>>. Collins, Mary, and Judy Chen. "Under-Controlled Asthma™s Economic Impact | Feature Articles | Perspectives | Payer Solutions." IMS Health. IMS Health, Spring 2010. Web. 14 Nov. 2011.  
<<http://www.imshealth.com/portal/site/imshealth/menuitem.a46c6d4df3db4b3d88f611019418c22a/?vgnnextoid=da12b0ac2e6e6210VgnVCM100000ed152ca2RCRD>>.

Collins, Mary, and Judy Chen. "Under-Controlled Asthma <sup>TM</sup>s Economic Impact | Feature Articles | Perspectives | Payer Solutions." IMS Health. IMS Health, Spring 2010. Web. 14 Nov. 2011.

<<http://www.imshealth.com/portal/site/imshealth/menuitem.a46c6d4df3db4b3d88f611019418c22a/?vgnnextoid=da12b0ac2e6e6210VgnVCM100000ed152ca2RCRD>>.

Commercial Sector. Buildings Energy Data Book. Buildings Energy Data Book, Mar. 2011. Web. 14 Nov. 2011. <<http://buildingsdatabook.eren.doe.gov/ChapterIntro3.aspx>>.

“Creating Green Jobs, Clean Energy & a Sustainable Future for Maryland: A Report to Governor Martin O’Malley.” Maryland Smart, Green & Growing, July 2010. Green Jobs & Industry Task Force.

[http://www.choosemaryland.org/aboutdbed/Documents/Publications/GreenJobsTaskForceREPORT\\_FINAL.pdf](http://www.choosemaryland.org/aboutdbed/Documents/Publications/GreenJobsTaskForceREPORT_FINAL.pdf).

Employment and Payrolls - Industry Series - Maryland 2009 - Employment and Payrolls - Division of Workforce Development and Adult Learning. Maryland Department of Labor, Licensing and Regulation. Maryland Department of Labor, Licensing and Regulation, 1 June 2011. Web. 11 Nov. 2011.

<<http://www.dllr.state.md.us/lmi/emppay/md2010ep.shtml>>.

Employment and Payrolls - Industry Series - Maryland 2009 - Employment and Payrolls - Division of Workforce Development and Adult Learning. Maryland Department of Labor, Licensing and Regulation. Maryland Department of Labor, Licensing and Regulation, 1 June 2011. Web. 11 Nov. 2011.

<<http://www.dllr.state.md.us/lmi/emppay/md2010ep.shtml>>.

“Guide to Integrating Renewable Energy in Federal Construction.” U.S. Energy Information Administration, Apr. 2013. Web. 21 May 2013.

<[http://www1.eere.energy.gov/femp/reconstructionguide/budgeting\\_costs.html](http://www1.eere.energy.gov/femp/reconstructionguide/budgeting_costs.html)>

Mary, Stephenson J., and Donna Brinsfield. "Funeral Planning." University of Maryland Cooperative Extension Fact Sheet. University of Maryland Cooperative Extension. Web. 14 Nov. 2011. <<http://extension.umd.edu/publications/pdfs/fs409.pdf>>.

Mary, Stephenson J., and Donna Brinsfield. "Funeral Planning." University of Maryland Cooperative Extension Fact Sheet. University of Maryland Cooperative Extension. Web. 14 Nov. 2011. <<http://extension.umd.edu/publications/pdfs/fs409.pdf>>.

Maryland Environmental Footprint. Maryland: Smart, Green and Growing. Maryland Environmental Service, Spring 2010. Web. 16 Nov. 2011.

<[http://www.green.maryland.gov/carbon\\_footprint\\_page.html](http://www.green.maryland.gov/carbon_footprint_page.html)>.

OfficeMax 50% Recycled Multipurpose Paper. Office Supplies, Office Furniture & Office Technology at OfficeMax. Office Supplies, Office Furniture & Office Technology at

**Regional Economic  
Studies Institute**

OfficeMax, 2011. Web. 14 Nov. 2011. <<http://www.officemax.com/office-supplies/paper/recycled-paper/product-prod2110264>>

OfficeMax 50% Recycled Multipurpose Paper. Office Supplies, Office Furniture & Office Technology at OfficeMax. OfficeMax, 2011. Web. 11 Nov. 2011.  
<<http://www.officemax.com/office-supplies/paper/copy-multipurpose-paper/product-ARS22305>>.

SEDS | State Energy Data System. U.S. Energy Information Administration (EIA). U.S. Energy Information Administration (EIA, 2009. Web. 16 Nov. 2011.  
<[http://www.eia.gov/state/seds/hf.jsp?incfile=sep\\_prices/com/pr\\_com\\_MD.html&mstate=Maryland](http://www.eia.gov/state/seds/hf.jsp?incfile=sep_prices/com/pr_com_MD.html&mstate=Maryland)>.

Water on Tap. US Environmental Protection Agency. US Environmental Protection Agency. Web. 11 Nov. 2011. <<http://www.epa.gov/>>.