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Residential, Commercial, and Industrial Technical Work Group

Summary List of Recommended Priority Policy Options for Analysis

Option No.	Policy Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2020 (Million $)	Cost-Effective-ness ($/t$CO_2$e)	Level of Support
		2012	2020	Total 2008–2020			
RCI -1	Improved Building Codes for Energy Efficiency (to be combined with RCI-6)	0.6	2.7	15.1	TBD	TBD	Pending
RCI -2	Demand-Side Management (DSM)/Energy Efficiency Programs, Funds, or Goals for Electricity and Natural Gas (including expansion of existing programs and peak load reduction)	TBD	TBD	TBD	TBD	TBD	Pending
RCI -3	Low-cost loans for energy efficiency	TBD	TBD	TBD	TBD	TBD	Pending
RCI -4	Improved design, construction, appliances, and lighting in new and existing state and local government buildings, "Government Lead-by-example"	0.3	1.2	7.3	-397	-55	Pending
RCI -5	Energy Efficiency and Environmental Impacts Awareness and Instruction in School Curricula (4.2)	NA	NA	NA	NA	NA	Pending
RCI -6	Promotion and Incentives for Improved Design and Construction (e.g. LEED, green buildings, or minimum % improvement better than code) in the Private Sector (to be combined with RCI-1)	1.7	4.9	32.5	TBD	TBD	Pending
RCI -7	More Stringent Appliance/Equipment Efficiency Standards *(state-level, or advocate for regional or federal-level standards)* (3.1)	0.1	0.2	1.2	-132	-111	Pending
RCI -8	Rate structures and Technologies to Promote Reduced GHG Emissions (including inverted block rates) (5.3)	TBD	TBD	TBD	TBD	TBD	Pending
RCI -9	*Transferred to ES TWG*	NA	NA	NA	NA	NA	Pending

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RCI -10	Energy Efficiency Resource Standard (EERS)	3.4	13.6	81.6	-4,319	-53	Pending
RCI-11	Phase out incandescent light bulbs in state	0.1	0.0	0.4	-24	-56	Pending
	Sector Total After Adjusting for Overlaps	TBD	TBD	TBD	TBD	TBD	
	Reductions From Recent Actions	TBD	TBD	TBD	TBD	TBD	
	Sector Total Plus Recent Actions	TBD	TBD	TBD	TBD	TBD	

Note: The numbering used to denote the above policy options is for reference purpose only; it does not reflect prioritization among these important policy options. Numbering of recommended priority policy options for analysis has been changed to reflect MWG modifications (recommended priority policy options RCI-4 and RCI-5 were merged; RCI-8 moved to the TLU TWG, and the remaining policies moved up in number).

The following straw proposals reflect consensus positions of the RCI TWG and do not necessarily represent the views of the individual members.

RCI-1. Improved Building and Trade Codes for Energy Efficiency

To be combined with RCI-6

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Policy Description

High Performance Building codes for energy and efficiency specify minimum energy efficiency requirements for new buildings or for existing buildings undergoing a major renovation and/or additions. According to the EPA, December 2004, in the United States buildings account for 39% of the total energy use, 12% of the water consumption, 68% of the electricity consumption and 38% of the total carbon dioxide emissions. Given the long lifetime of most buildings, amending state and/or local building codes to include minimum energy efficiency requirements and periodically updating energy efficiency codes could provide long-term GHG savings. Implementation of building energy codes, particularly when outside of urban centers, can require additional resources.

This policy involves increasing standards for the minimum performance of new and substantially renovated commercial and residential buildings. Other aspects of the policy design include:

- Undertaking a comprehensive review of existing State and local building and trades codes in Maryland to determine where increased energy efficiency can be achieved.
- Developing a training and certification program for code officials and contractors on energy efficiency and related Green building and trade codes, and in code enforcement.
- Providing tools to state and local governments for measurement and tracking of cost savings.
- Establishing specific goals for the size of building to be included, e.g. using Montgomery County Bill 17-06 as a model.
- Allowing compliance flexibility. New and substantially renovated buildings can utilize a combination of increased energy efficiency, switching to low and no carbon based fuels for previously carbon based end-uses, off-site purchases on grid supplied “green power” and/or installing on-site off-grid power generating equipment.
- Working with financial institutions to develop loan tools for these programs including non-traditional off-grid low and carbon neutral energy sources.

Other potential elements of this policy include:

- Requiring high-efficiency appliances in new construction and retrofits.
- Strengthening regional partnerships like NEEP (Northeast Energy Efficiency Partnership) to assure consistency and economies of scale, or adopting CA or ASHRAE standards.

Any rule considered by Maryland should include future incorporation by reference language in the statute or regulation to avoid having to re-open the rule each time the referenced body changes or improves its code.

Potential measures supporting this option can include consumer education, improved enforcement of building codes, training and certification for builders and contractors, and development of a clearinghouse for information on and to provide access to software tools to calculate the impact of energy efficiency and solar technologies on building energy performance.

Policy Design

Goals:

- Increasing standards such as the minimum performance of new and substantially renovated commercial and residential buildings of at least 15 % by 2010 and 50% by 2020 and 100%, carbon neutral, by 2030.
- Mandating the periodic and regular (no less than every 3 years) review and adoption of State and local building and trades codes, particularly energy efficiency requirements, to ensure best management practices. At least every three years, the state will review (with opportunity for public comment) and adopt the more stringent of the ICC or ASHRAE standards for energy efficiency.
- Developing a training and certification program for code officials and contractors on energy efficiency and related Green building and trade codes.

Timing: See above goals. The building and trade related code, permitting and enforcement changes to take place during calendar year 2008.

Parties Involved:

- The Maryland Department of Housing and Community Development (DHCD) and Municipal and County code officials.
- Maryland Municipal League and Maryland Association of Counties.
- Maryland Home Builders and Realtors Associations.
- Non-affiliated private builders, engineers and tradesman.
- Citizen, consumer and community organizations.
- Electric, water and sewer utilities.
- Environmental advocacy organizations.
- Public Service Commission.

Other: Indoor air quality standards, construction waste management and recycling plans and HVAC and lighting standards, including but not limited to energy efficiency and occupant health and safety, would be developed to complement energy efficiency codes.

Implementation Mechanisms

- **Education, Training, Certification and Technical Assistance:** Education, training and certification is expected to be a major component of improving building and trade codes. It will be necessary to develop enhanced State mandated training, education and certification for code officials, builders and tradesmen. Education and outreach are important so that consumers and constituents understand the benefits and cost savings for these programs. The training and certification program for code officials and contractors would be based on the State's (MDE) Sediment and Erosion Control "Green Card" training and certification program. It should be designed in concert with a LEED certification program but be less intensive and oriented towards a blue collar work force. Funding should be set aside for training and education of building inspectors.
- **Review of existing building and trades codes:** The state should undertake a comprehensive review of existing State and local building and trades codes in Maryland to determine where increased energy efficiency can be achieved.
- **Size-specific goals:** Specific goals by building size can be developed. For example: 1. a new building with a least 10,000 square feet gross floor area (GFA); 2. a renovation or reconstruction of an existing building with at least 10,000 square feet GFA that alters more then 50% of the buildings GFA; and 3. An addition that doubles the buildings footprint and adds at least 10,000 square feet of GFA. See Montgomery County Bill 17-06. (See also State of Washington using the threshold of 5,000 square feet).
- **Compliance Flexibility:** The 2030 carbon neutral goal, based on Architecture 2030, can be reached for new and substantially renovated buildings by utilizing a combination of increased energy efficiency, switching to low and no carbon based fuels for previously carbon based end-uses, off-site purchases on grid supplied "green power" and/or installing on-site off-grid power generating equipment.
- **Statewide Code and Inspections Program.** Understanding the importance of local government adoption and control over code enforcement, there should be a minimum standard established statewide for related codes, permitting and inspection.
- **Utility Involvement and Assistance:** Consider using utility resources to help implement energy codes. This can include energy audits, reviewing and promoting energy codes, interconnection rules, tariffs and connection charges that encourage the construction and rehabilitation of buildings that incorporate energy efficiency.
- **Permitting and Fee Advantages.** Provide programs that speed the permit approval process and reduce the permit and impact fees related to construction to provide incentives to consumers and builders. This could include reduced building permit fees, reduced water and sewer fees and reduced impact fees.
- **Rewards Programs:** Develop systems and programs that reward "beyond code" energy efficiency and emissions reduction improvements, including "green mortgages," and additional floor area ratio and/or zoning density for construction that meets or exceeds

energy efficiency programs. Work with financial institutions to develop loan tools for these programs, including non-traditional off-grid low and carbon neutral energy sources.

- **Property Tax Incentives:** Property tax adjustments that waive or decrease a portion or all of the taxes associated with new construction that meets or exceeds energy efficiency programs.
- **Increased Tax Incentives:** Develop incentives for building energy efficiency improvements.

Related Policies/Programs in Place

- **Building Codes:** Maryland has adopted the 2006 edition of the International Building Code (IBC) and International Energy Conservation Code (IECC). Many local governments, including the City of Annapolis, have adopted the 2006 edition of the International Energy Efficiency Code.
- **Legislative Action:** Local governments (see Montgomery County Bill 17-06 and Green Schools Focus, the City of Baltimore adopted, the City of Annapolis proposed) have proposed and adopted standards for building energy and efficiency.

Type(s) of GHG Reductions

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Reduction in GHG emissions (largely CO_2) from avoided electricity production or on-site fuel combustion

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Estimated GHG Reductions and Net Costs or Cost Savings

This analysis consists of two components: energy savings from adoption and enforcement of new codes and energy savings from voluntary efforts to implement improvements that go beyond code. As a result, the data sources, quantification methods, and key assumptions will be specified separately for each component. Additionally, these two policies have been linked such that the energy consumption reductions from the new code adoption and enforcement component are reflected in the baseline energy consumption used to determine the level of beyond code improvements that are required to achieve the overall energy reduction goal.

	GHG Reductions ($MMtCO_2e$)			Gross Costs (Million $)	Gross Benefits (Million $)	Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/t$CO_2$e)
	2012	2020	Total 2008-2020				
RCI–1 Total	0.6	2.7	15.1	TBD	-1,148	TBD	TBD
Building Codes - Residential	0.1	0.2	1.4	TBD	-108	TBD	TBD
Beyond Codes - Residential	0.4	2.1	11.0	TBD	-834	TBD	TBD
Building Codes - Commercial	0.0	0.0	0.4	TBD	-29	TBD	TBD
Beyond Codes - Commercial	0.1	0.4	2.3	TBD	-176	TBD	TBD

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Data Sources:

General

Building Codes Assistance Project (BCAP), personal communications with Nils Petermann

Adoption and Enforcement of New Codes

Benefits:

BCAP Code Status Detail. Found at: http://www.bcap-energy.org/code_status.php?STATE_AB=MD.

Maryland Additional State Info. Found at: http://www.energycodes.gov/implement/state_codes/state_stat_more.php?state_AB=MD

NESEA. "Zero Energy: This Year's Crop," presented by Betsy Pettit of Building Science Consulting, 2007, http://www.buildingscienceconsulting.com/resources/presentations/NESEA/2007/2007_NESEA_Pettit_sec.pdf (accessed on January 2, 2008)

R. G. Lucas of Pacific Northwest National Laboratory. "Analysis of Energy Saving Impacts of New Residential Energy Codes for the Gulf Coast", Table 3. Annual Energy Costs (Space Heating and Cooling Only) of Whole Building Alternatives – House with Slab-on-Grade Foundation, Page 5, January 2007. http://www.energycodes.gov/pdf/pnnl16265.pdf (accessed January 2, 2008)

M. A. Halverson, K. Gowri, and E. E. Richman of Pacific Northwest National Laboratory. "Analysis of Energy Saving Impacts of New Commercial Energy Codes for the Gulf Coast", Appendix B. Table B-1. Office Results for New Orleans, Page 33, December 2006. http://www.energycodes.gov/pdf/pnnl16282.pdf (accessed January 6, 2008)

Costs:

RSMeans Construction Bookstore, QuickCost Estimator, http://www.rsmeans.com/calculator/index.asp (accessed January 6, 2008).

Beyond Code Improvements

Benefits:

Gregory H. Kats, “Green Building Costs and Financial Benefits”, 2003, Figure 2, Page 4, http://www.cap-e.com/ewebeditpro/items/O59F3481.pdf (accessed January 7, 2008).

Architecture 2030 Website. http://www.architecture2030.org/2030_challenge/targets.html (accessed January 6, 2008).

World Business Council for Sustainable Development, "Energy Efficiency in Buildings: Summary Report," Figure 22. Costing Green: A Comprehensive Cost Database and Budgeting Methodology. October 2007. Page 31.

R. G. Lucas of Pacific Northwest National Laboratory. "Analysis of Energy Saving Impacts of New Residential Energy Codes for the Gulf Coast", Table 3. Annual Energy Costs (Space Heating and Cooling Only) of Whole Building Alternatives – House with Slab-on-Grade Foundation, Page 5, January 2007. http://www.energycodes.gov/pdf/pnnl16265.pdf (accessed January 2, 2008)

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Costs:

RSMeans Construction Bookstore, QuickCost Estimator, http://www.rsmeans.com/calculator/index.asp (accessed January 6, 2008).

Quantification Methods:

Adoption and Enforcement of New Codes

Benefits: The timing of the implementation of future building codes was determined. Then, the percentage of new and renovated homes and buildings to be built to the new building codes instead of 2006 IECC was determined, along with the incremental energy savings associated with meeting each of the future building codes. After the energy savings was broken out by fuel type, the greenhouse gas emission reductions were calculated using emissions factors for each fuel type. The avoided costs by fuel type were also calculated.

Costs: Incremental construction cost percentages were multiplied by the average cost of Maryland homes and office buildings to determine the incremental cost per building for different levels of energy savings associated with different programs.

Beyond Code Improvements

Benefits: The remaining energy savings required from beyond code measures was calculated. Then, participation levels and programs were selected to meet the energy savings goals. After the energy savings was broken out by fuel type, the greenhouse gas emission reductions were calculated using emissions factors for each fuel type. The avoided costs by fuel type were also calculated.

Costs: Incremental construction cost percentages were multiplied by the average cost of Maryland homes and office buildings to determine the incremental cost per building for different levels of energy savings associated with different programs.

Key Assumptions:

This analysis assumes that there are two goals: 1) to establish a 3-year cycle for building code updates and 2) to encourage voluntary participation in beyond code improvements to achieve the overall energy reduction goals.

The overarching goal of "increasing standards such as the minimum performance of new and substantially renovated commercial and residential buildings of at least 15 % by 2010 and 50% by 2020 and 100%, carbon neutral, by 2030" is assumed to be equivalent to "decreasing energy use of new and substantially renovated commercial and residential buildings by 15% by 2010 and 50% by 2020."

The assumed energy reduction goal ramp in that applies to all of the components and to both the Residential and Commercial sectors is as follows:

Year	Target
2009	7.5%
2010	15.0%
2011	18.5%
2012	22.0%
2013	25.5%
2014	29.0%
2015	32.5%
2016	36.0%
2017	39.5%
2018	43.0%
2019	46.5%
2020	50.0%

The analysis of costs and GHG benefits are limited to energy efficiency measures. Alternative means of reaching the goals (switching to low and no carbon based fuels for previously carbon-based end-uses, off-site purchases on grid supplied "green power" and/or installing on-site off-grid power generating equipment) are not modeled.

Analysis of GHG benefits and costs for implementing goals by size of building are not modeled.

As we are assuming that a portion of the new homes and buildings do not comply with the building code upgrades, a portion of the new homes and buildings will not be upgrading to future building codes or going beyond code.

Adoption and Enforcement of New Codes

This analysis also assumes that improvements are incremental to a scenario where only 2006 IECC is adopted and no future building code improvements beyond this are adopted. The benefits and costs for new homes are derived from the fact that these homes are built to building codes in the future that are more stringent than the 2006 IECC. The benefits and costs for renovated homes are derived in the same way; instead of being renovated to 2006 IECC, these homes will be renovated to more stringent codes in the future.

A new building is defined as any building that is built between 2009 and 2020. A renovated building is defined as any building that undergoes major renovations between 2009 and 2020.

For ease of analysis, we are assuming that the energy reductions from implementing 2006 IECC are similar to the energy reductions from implementing IBC 2006. This is supported by an email from Mark Halverson of the Pacific Northwest National Laboratory stating, “The IBC is a building code and not an energy code. The IBC references the IECC for energy issues and so unless a state or local jurisdiction makes modification to the IBC (which many do), they will end up with the corresponding version of the IECC.”

Additionally, we are assuming that building codes are implemented in the same year that they are released and adopted. Mark Halverson of the Pacific Northwest National Laboratory noted that building codes are currently being adopted by particularly aggressive states in the year they are released or even before they are released. Vermont is a good example of a state where this is occurring. If builders are kept in the loop on potential updates during the course of the multi-year planning stage and the updates are not so stringent that there are barriers to implementation, quick implementation is possible.

Benefits:

Assumption	Residential Sector	Commercial Sector	Notes
Number of New Homes/Buildings	289,940	6,784	Scaled from regional data using population
Ratio of New vs. Renovated Homes/Buildings	1.00	1.00	Placeholder assumption
Building Code Compliance Rate	70%	70%	Placeholder assumption
Number of New and Renovated Homes/Buildings Participating in Building Code Upgrades	106,553 (18%)	3,166 (23%)	Calculated assumption
Avg. Energy Use	0.0961 bbtu/home/yr	0.00008 bbtu/sq. ft./yr	Calculation of energy use divided by projected number of homes/buildings

Assumption	Residential Sector	Commercial Sector	Notes
Avg Square Footage per Building	NA	11,829	Calculation of projected square footage of buildings divided by the projected number of buildings
Current Stock vs. New Stock Energy Savings	20%	16%	Calculated using Gulf Coast studies on building codes
Energy Savings for New and Renovated Homes/Buildings from Future Building Codes (as compared to 2006 IECC)	2009 IECC: 7% 2012 IECC: 19% 2015 IECC: 22% 2018 IECC: 25%	2009 IECC: 8% 2012 IECC: 15% 2015 IECC: 17% 2018 IECC: 19%	Placeholder assumptions from Colorado
Proportion of Energy Savings by Fuel Type	54% Electricity 46% Natural Gas	52% Electricity 48% Natural Gas	Based on the breakout in the Inventory & Forecast
Emissions Factors	Electricity Average: 235 tCO_2e/Bbtu Natural Gas: 54 tCO_2e/Bbtu		Electricity from NC (placeholder) Natural Gas: EPA 2003 US GHG inventory, Appendix A
T&D Electricity Loss	10%		Placeholder assumption
Avoided Energy Costs	Electricity: $23,690/Bbtu (2006$) Natural Gas: $8,189/Bbtu (2006$)		Maryland-specific; calculated based on BG&E and Pepco price schedules for qualifying facilities purchased power, weighed for on-peak and off-peak usage, and for the fraction of Maryland's electricity supplied by each of the three utilities.
Proportion of Energy Savings Being Achieved by Component	8%	9%	Calculated

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Costs:

Assumption	Residential Sector	Commercial Sector	Notes
Real Discount Rate	5%		Placeholder assumption
Capital Recovery Factor for Levelization	7.53% Interest Rate: 7% Period: 30 yrs	8.22% Interest Rate: 8% Period: 30 yrs	Calculated assumption
Avg Construction Cost of a Home/Building	$721,243	$1,218,240	Using a cost estimator and a range of Maryland-specific zip codes
Incremental Costs from Building Code Improvements	2009 IECC: 0.2% 2012 IECC: 0.5% 2015 IECC: 1.5% 2018 IECC: 2.0%	2009 IECC: 0.2% 2012 IECC: 0.5% 2015 IECC: 1.5% 2018 IECC: 2.0%	Placeholder assumption

Beyond Code Improvements

Existing programs such as Energy Star, LEED (including LEED certification, silver, gold, and platinum levels) and Architecture 2030 (including goals for 2010, 2015 and 2020) were considered when analyzing this component.

For simplicity, we have assumed that all of the homes and buildings that build to beyond code standards in a given year will have the same energy savings goals (i.e., 100% of homes that participate in beyond code will be built to LEED Gold in 2015).

Benefits:

Assumption	Residential Sector	Commercial Sector	Notes
Number of New Homes/Buildings	289,940	6,784	Scaled from regional data using population
Ratio of New vs. Renovated Homes/Buildings	1.00	1.00	Placeholder assumption
Number of New and Renovated Homes/Buildings Participating in Beyond Code Upgrades	427,661	9,045	Calculated assumption
Reach of Beyond Code Upgrades	74%	67%	Calculated assumption
Average Energy Reduction	40% per home	40% per building	Calculated assumption
Avg. Energy Use	0.0961 bbtu/home/yr	0.00008 bbtu/sq. ft./yr	Calculation of energy use divided by projected number of homes/buildings
Avg Square Footage per Building	NA	11,829	Calculation of projected square footage of buildings divided by the projected number of buildings
Current Stock vs. New Stock Energy Savings	20%	16%	Calculated using Gulf Coast studies on building codes
Energy Savings Trajectory	2009-2011: 30%, consistent with LEED Silver 2012-2017: 40%, consistent with LEED Gold 2018-2020: 50%, consistent with LEED Platinum		Trajectory required to reach the energy savings goals

Assumption	Residential Sector	Commercial Sector	Notes
Proportion of Energy Savings Being Achieved by Component	92%	91%	Calculated
Emissions Factors, T&D Electricity Loss, Avoided Energy Costs, and Proportion of Energy Savings by Fuel Type	Same assumptions as used for Adoption and Enforcement of New Codes		

Costs:

Assumption	Residential Sector	Commercial Sector	Notes
Incremental Costs Associated with the Energy Savings from Different Programs	LEED Silver: 2.5% LEED Gold: 4.5% LEED Platinum: 9.0%		
Real Discount Rate, Capital Recovery Factor for Levelization, Avg Construction Cost of a Home/Building	Same assumptions as used for Adoption and Enforcement of New Codes		

Key Uncertainties

- Cost of code implementation, cost of construction and life cycle cost and savings quantification.

Additional Benefits and Costs

- Resource conservation, including water
- Indoor comfort and air quality improvements, with related improvements in health and productivity.
- Savings to consumers and business on energy bills. Benefits to the low income by reducing utility costs.

- Electricity system benefits: reduced peak demand, reduced capital and operating costs, improved utilization and performance of electricity system
- Reducing pollutants from emissions, improved health from fewer pollutants and particulates and reduced water use for cooling.
- Green collar employment expansion and economic development.
- Reducing dependence on imported fuel sources
- Reducing energy price increases and volatility

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Feasibility Issues

Jim Magliano of the Maryland Department of Housing and Community Development mentioned that a 3-year cycle for updates could be challenging to implement given that smaller counties may not have the administrative staff to keep up with frequent code changes. Additionally, a greater number of cycles with less substantial updates may result in a loss of attentiveness by smaller counties. Fewer updates that are each more impactful may be more feasible.

Status of Group Approval

Pending – [until MWG moves to final agreement at Meeting #5 or #6]

Level of Group Support

TBD – [blank until MWG Meeting #5]

Barriers to Consensus

TBD – [blank until final vote by the MWG/MCCC]

RCI-2. Demand-Side Management (DSM)/Energy Efficiency Programs, Funds, or Goals for Electricity and Natural Gas (Including Expansion of Existing Programs and Peak Load Reduction)

Policy Description

This option focuses on increasing investment in electricity and natural gas demand-side management (DSM) programs through programs run by the Maryland Energy Administration, energy service companies (ESCOs), utilities, or others, in order to meet the goals of overall reduction in energy consumption as well as a reduction in peak load demands. Decreasing consumption will have immediate impacts on greenhouse gas emissions. DSM activities may be designed to work in tandem with other recommended strategies that can also encourage efficiency gains.

This policy involves the creation of a Public Benefit Fund (PBF) with the goal of increasing the funding and scope of existing energy efficiency programs. Implementation of energy efficiency programs could also include the following elements:

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- Establishment of ongoing, high-level statewide resource planning in coordination with the Public Service Commission.
- Development of a detailed potential study for Maryland, which would characterize the energy usage patterns and provide program strategies to meet the technical/economical achievable energy savings opportunities available.
- Aggressive marketing of and advertisement for energy efficiency programs.
- Scaling-up of training and education in energy efficiency measures.
- Use of tax policy to facilitate implementation of energy efficiency measures.
- Facilitation of the whole process of implementing energy efficiency measures by: overcoming information hurdles; subsidizing energy auditing and implementation costs; setting up recycling/scrapping programs of old appliances; reduction of overall transaction costs.

Policy Design

Goals:

- Together with RCI-10, achieve a 15% reduction in per capita electricity and natural gas use by 2015. The budget for this policy shall be up to $100 million per year.

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- 100% capture of achievable cost-effective energy efficiency by 2025. (need potential study to figure out this goal)

- Individual targets for different sectors to be defined in wedges, by how much each sector can potentially contribute to the overall goal.

Timing: Early action to begin with increased funding in current state programs in 2008

Parties Involved: Maryland Energy Administration, Public Service Commission, utility companies, generators and distributors, advocacy groups, Energy Service Companies, and local governments

Other: Supporting measures include providing training for contractors, builders, and other specialists in expectation of increased demand (see RCI-5) and encouraging local governments to adopt energy efficiency targets (see RCI-4).

Implementation Mechanisms

- Establishment of ongoing, high-level statewide resource planning in coordination with the Public Service Commission.
- Development of a detailed potential study for Maryland, which would characterize the energy usage patterns and provide program strategies to meet the technical/economical achievable energy savings opportunities available.
- Facilitation of the whole process of implementing energy efficiency measures by: overcoming information hurdles; setting up recycling/scrapping programs of old appliances; reduction of overall transaction costs.
- Develop an administrative framework for coordination and oversight of energy efficiency programs. MEA could be the administrative entity for the implementation of the PBF. The administrative body would develop a transparent contracting and procurement process for the selection of a variety of implementation contractors including energy service companies, nonprofit agencies, utilities and other third parties.
- Scale-up current successful energy efficiency programs to increase coverage where appropriate rather than create redundant additional programs.
- Invest in consumer education and program marketing.
- Expand energy audit programs for all sectors and offer incentives and assistance for building and production facilities owners to follow up on audit recommendations. These incentives can be tax deductions for conducted audits, days off from work for employees attending their home energy audit, and other mechanisms that reduce transaction costs.
- Use of smart thermostats and other control systems to avoid needs for increased peak load capacities. (See RCI-8.)
- Provide incentives to address potential "lost opportunities" in new construction, equipment and appliance replacement, and retrofits.
- Promote the purchase of ENERGY STAR® appliances and compact fluorescent lamps (CFLs) by sales tax exemptions. (See also RCI-7 and RCI-11.)

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- Implement energy labeling for new homes and encourage/mandate it for existing homes for further sales or leases.
- Review efficiency best practices for specific industries and conduct training on these practices.
- Provide incentives for investment in energy efficiency for owners of multi-family housing (See RCI-3.)
- Possible funding sources: proceeds of RGGI allowance auctions, Environmental Trust Fund, or a new public benefits charge

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Related Policies/Programs in Place

Empower Maryland sets statewide goal of reducing per capita energy use by 15% electricity use by 2015.

Regional Greenhouse Gas Initiative (RGGI) auction proceeds may be dedicated to Energy efficiency

Energy Service Companies (ESCOs) in Maryland offer Energy Performance Contracting to government agencies and the commercial sector. Performance contracting is a self-financing mechanism for improvements for energy efficiency. In the commercial sector, the money that businesses save through less energy consumption is leveraged to pay to the ESCO for financing, installing, operating, and maintaining the energy efficiency measures. After a predetermined period of time of paying the ESCO via the energy bill, all of the energy savings revert to the business owner. $395 million have been loaned since 1995. Maryland state agencies finance EPCs through a private sector financial institution and energy savings from the installed projects are paid from state agency operating budgets to the financial institution. ESCOs that implement state energy projects guarantee the energy savings to the state agency.

On the industry side, MEA has provided limited free energy assessments for Maryland industries through the Industrial Energy Assessment, in partnership with the University of Maryland and the US Department of Energy.

The Maryland Energy Administration has several programs in place to help finance energy efficiency improvements (see RCI-3).

Type(s) of GHG Reductions

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Reduction in GHG emissions (largely CO_2) from avoided electricity production or on-site fuel combustion

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Estimated GHG Reductions and Net Costs or Cost Savings

	GHG Reductions ($MMtCO_2e$)			Gross Costs (Million $)	Gross Benefits (Million $)	Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)
	2012	2020	Total 2008-2020				
RCI – 2 Total	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Electric DSM	TBD	TBD	TBD	TBD	TBD	TBD	TBD
NG DSM	TBD	TBD	TBD	TBD	TBD	TBD	TBD

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Data Sources:

- *Energy efficiency potential:*
  - MaryPIRG Foundation 2005. Power Plants and Global Warming: Impacts on Maryland and Strategies for Reducing Emissions
  - ACEEE 2004. The Technical, Economic and Achievable Potential for Energy-Efficiency in the U.S. – A Meta-Analysis of Recent Studies, available at www.aceee.org/conf/04ss/rnemeta.pdf
  - Synapse Energy Economics 2004. A Responsible Electricity Future: An Efficient, Cleaner and Balanced Scenario for the US Electricity System
  - ACEEE 2005. Examining the Potential for Energy Efficiency to Help Address the Natural Gas Crisis in the Midwest
  - Optimal Energy, Inc., et al. 2006. Natural Gas Energy Efficiency Resource Development Potential in New York
  - GDS Associates, Inc. 2006. The Maximum Achievable Cost Effective Potential for Gas DSM in Utah for the Questar Gas Company Service Area
- *Cost of energy efficiency measures in Maryland:*
  - PEPCo and BGE filings
- *Experience in other states on cost of energy efficiency:*
  - Bill Prindle 2007. "Energy Efficiency: The First Fuel in the Race for Clean and Secure Energy," Presentation at the NAPEE Southeast Energy Efficiency Workshop on September 28, 2007, available at http://www.epa.gov/solar/pdf/southeast_28sep07/prindle_new_napee_presentation_atlanta_9_28_07.pdf
  - ACEEE 2004. Five Years In: An Examination of the First Half-Decade of Public Benefits Energy Efficiency Policies, April 2004

- Gene Fry, "Massachusetts Electric Utility Energy Efficiency Database", Massachusetts Department of Telecommunications and Energy, 2003 edition
- Heschong Mahone Group, Inc. 2005. New York Energy $martSM Program Cost-Effectiveness Assessment, prepared for NYSERDA, June 2005
- Western Governor's Association (WGA) 2006. The Energy Efficiency Task Force Report to the Clean and Diversified Energy Advisory Committee of the Western Governors Association, January, 2006
- GDS Associates, Inc. 2007. Electric Energy Efficiency Potential Study for Central Electric Power Cooperative, Inc. Final Report. Updated September 21, 2007

- *Cost of saved natural gas*
  - Southwest Energy Efficiency Project 2006. Natural Gas Demand-Side Management Programs: A National Survey, available at www.swenergy.org
- *Avoided cost of fuels*
  - US EIA 2007. Annual Energy Outlook 2007, Assumptions to the AEO, Electricity Market Module. Available at: http://www.eia.doe.gov/oiaf/aeo/assumption/index.html.

Quantification Methods:

(1) Develop energy savings targets after 2015 for RCI-2, RCI-3 and RCI-10

(2) Develop a ramp-in rate of energy savings target each year until 2015 and after 2015 through 2020 for RCI-2, RCI-3, and RCI-10 (note the study period ends in 2020 while the policy goal states the final target year is 2025).

(3) Estimate energy reduction based on the percentage reduction goal in per capita electricity and natural gas each year until 2015 for RCI-2, RCI-3, and RCI-10. (The target for RCI-2 is set to the incremental energy savings required to achieve 15% by 2015 reduction goal, over and above RCI-10's contribution to the overall goal.)

(4) Estimate the total cost of electricity and natural gas savings

(5) Estimate the GHG emissions reduction through the electric energy efficiency measures.

Key Assumptions:

- *Discount Rate:* Same assumptions as used for RCI-1.
- *Avoided cost:* Same assumptions as used for RCI-1.
- *Target electricity and natural gas efficiency savings until 2015*: The following table provides a placeholder assumption on energy savings target each year until 2015 (for RCI-2, RCI-3, and RCI-10).

Deleted: *<#>RGGI Allowance Auction Proceeds¶*
<#>Center for Integrative Environmental Research, University of Maryland, College Park 2007. Economic and Energy Impacts from Maryland's Potential Participation in the Regional Greenhouse Gas Initiative: A Study Commissioned by the Maryland Department of the Environment, available at http://www.cier.umd.edu/RGGI/ ¶
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Deleted: <#>Estimate annual RGGI allowance auction proceeds¶
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Year	Target
2008	1%
2009	2%
2010	3.5%
2011	5%
2012	7%
2013	9%
2014	12%
2015	15%

- *Target electricity and natural gas efficiency savings after 2015:* 1.6% per year for electricity efficiency and 1.2% per year for natural gas efficiency based on a number of DSM potential studies and experiences by leading electric and natural gas utilities.
- *Achievable Electric Efficiency Potential:* "The state has sufficient efficiency potential to reduce power demand by 14 million megawatt-hours (MWh), or 16.5 percent of total electricity demand projected for 2018. This would return electricity demand in 2018 to 2006 levels." (Source: MaryPIRG Foundation 2005)
- *Achievable Natural Gas Potential:* ACEEE 2004.
- *Cost of Electric Efficiency Measures*: 3 cents per kWh of saved electricity based on experience in other states:

Experience in Other States on the Cost of Saved Energy (CSE)

State/Utility	CSE ($kWh)	Program Year	Source
Western utilities	0.025	1978-2004	WGA 2006.
Northwest Energy	0.02	2006	Montana PSC Docket No.: D2005.5.88 07/12
New York	0.03	2004	Heschong Mahone Group, Inc. 2005.
MA IOUs	0.038	2002	Gene Fry 2003
California	0.03	n/a	ACEEE 20004
Connecticut	0.023	n/a	ACEEE 20004
New Jersey	0.03	n/a	ACEEE 20004
Vermont	0.03	n/a	ACEEE 20004
North Carolina	0.029	2006-2017	GDS Associates, Inc. 2006

Deleted: <#>*RGGI Emission Allowance Auction Proceeds:* The Maryland RGGI allowance budget is about 37 million tons. Assuming an allowance price of $3 and 100% of the allowances auctioned, a revenue stream would be $111 million annually. MD's allowance will be at 37 MMT for 2009-2014, then decrease 2.5% each year, such that by 12/31/18, its budget will be 10% lower, or about 33.3 MMT. Allowance prices are estimated to rise slightly, but, to be conservative, we use the $3 price. We also assume that the budget will continue to decrease at the same rate after 2018. ¶
<#>*Allocation of RGGI Proceeds Between Electric and Natural Gas DSM:* 70% for electric DSM and 30% for natural gas DSM ¶
Sources: www.rggi.org (for RGGI budget and IPM modeling of carbon allowance prices). See also www.cier.org.¶

- *Cost of saved natural gas:* Natural gas savings per $ of program investment is 72,700 MCF/yr per $ million based on the average cost of a number of gas DSM programs reported in SWEEP 2006. The levelized cost of saved natural gas per MMBtu will be estimated based on (1) natural gas savings per program investment above, (2) a 13 year average program lifetime, (3) a real discount rate

- *Utility Cost of Saved Energy:* the utility cost of saved energy (including incentives, marketing and admin) is assumed to be 60% of the total cost of energy efficiency. This cost does not include costs paid by participants.
- *Efficiency Measure Lifetime:* 13 years on average for electricity DSM and 18 years on average for natural gas DSM
- *Displaced Emissions*: Same assumptions as used for RCI-1.

Key Uncertainties

TBD – [as needed and approved by the TWGs]

Additional Benefits and Costs

TBD – [as needed and approved by the TWGs]

Feasibility Issues

TBD – [as needed and approved by the TWGs]

Status of Group Approval

Pending – [until MWG moves to final agreement at Meeting #5 or #6]

Level of Group Support

TBD – [blank until MWG Meeting #5]

Barriers to Consensus

TBD – [blank until final vote by the MWG/MCCC]

RCI-3. Low-cost loans for energy efficiency

Policy Description

This option refers to potential financing mechanisms that could complement the programs being considered as part of RCI-2 and RCI-11. These mechanisms include:

- revolving low-interest loan fund(s) for energy efficiency investments in distribution service areas that are not covered by existing utility programs.
- Installation of energy efficiency measures by a contractor who would assume the full initial costs, recovering them over a defined time period through the electric bill associated with the meter where the measures are installed.

The policy could help a variety of customer classes improve the energy performance of their building or residence. The action could also initially be targeted at residential customers, small businesses and low-income consumers, who often rent rather than own their property, and then. expanded to other customer classes, including larger businesses and the industrial sector.

These programs could be designed so as to offer low-income residents and other underserved customer classes, energy efficiency services with a minimum of up-front costs, and could be marketed through an aggressive campaign of targeted outreach to these sectors. Programs can be designed to work with both landlords and tenants, including small businesses. The policy design could also complement measures or ordinances that require existing buildings to be brought up to the current code at the point of sale, and with new buildings, especially those built "on spec" and/or that are "flipped" to another party at the time of their sale.

Policy Design

Goals:

- Together with RCI-2 and RCI-11 reduce energy consumption from low-income and rental properties by 15% in Maryland by the year 2015.
- Starting in 2009, require building owners to update units at the time the unit occupant changes, to meet the most recent building and appliance codes.
- Starting in 2009, require new buildings to meet the most recent building and appliance codes at the point of their sale

Timing: Per above proposed schedule.

Parties involved:

- Government housing and other state and federal government agencies
- Weatherization and energy service providers
- Owners of rental property
- Local business associations
- Community Action Agencies/Human Resource Development Councils
- Non-governmental organizations such as Habitat for Humanity

Other: New programs should build on the state's previous experience with weatherization programs. A review of past programs should be conducted.

Implementation Mechanisms

- Capture energy efficiency savings and link the savings to the meter to pay for them over time (consider PAYS and other on the bill financing mechanisms)
- Benchmark rental properties using the EnergyStar benchmarking program or equivalent. Target low performing buildings, using a combination of incentive payments from RCI-2 and financing to produce the highest possible improvements
- Complete a retrocommissioning program on rental properties whose occupants have or are expected to have long tenancies, such as housing for the elderly, low-income projects and small businesses, to bring these units up to the latest building and appliance codes by 2014
- The program could also be first targeted to eligible homes, including those whose household income is below 150 percent of the federal poverty level, and to businesses with fewer than 25 employees. Other customer sectors can be reviewed for eligibility for program in the future.
- Establish and enforce requirements that rental properties meet energy and appliance codes.
- Adopt the following standards for rental properties: at the time the rental occupancy changes, require landlords to meet EnergyStar standards, score 75 or higher on the EnergyStar benchmarking program and install appliances that meet the latest state and federal standards
- Income tax credits for rental property owners who weatherize rental properties to meet energy efficiency standards set by the program.
- Time of sale/rental disclosure of utility bills for a dwelling.
- Tenants' rights laws relating to energy efficiency, possibly including tenants' rights to request an energy audit of their rental..

Related Policies/Programs in Place

The State Agency Loan Program is a revolving loan program that provides approximately $1 million in no-interest loans to state agencies for energy efficient improvements.

The Community Energy Loan Program (CELP) funds the identification and implementation of energy efficiency improvements for local governments, schools and non-profit organizations. CELP permits borrowers to pay the loans with the cost savings generated by the improvements. CELP funds $1.5 million in new projects every year.

Home buyers in southern Maryland are eligible for an EnergyStar mortgage plan offered by the Southern Maryland Energy Cooperative if they purchase an EnergyStar home. Although the additional features of an Energy Star residence increase the sale price of the home, participating mortgage providers offer a reduction of loan origination fees, discounted interest rates, and may include cash back at closing. While this program focuses on home owners, it could be reviewed for its relevance, and considered for adoption/expansion for rental properties.

Model programs/policies in other jurisdictions:

- The New Hampshire “pay as you save” program and other on the bill financing mechanisms will be investigated.
- California’s Energy Efficiency Based Utility Allowance Schedule attempts to correct the split incentive problem on rental properties. Eligible projects must be 15% better than code for new projects, and 20% improvement, compared to previous baseline, for existing projects.
- Energy Savings Insurance (used in Canada, concept developed by Evan Mills, Lawrence Berkeley Labs). Property owners whose buildings are some percentage (10-20%) better than code earn a rebate on their insurance. In another flavor, more focused on larger buildings, an insurance policy is written to underwrite the performance of EE and guarantee its persistence over time.

Type(s) of GHG Reductions

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Reduction in GHG emissions (largely CO_2) from avoided electricity production or on-site fuel combustion

Estimated GHG Reductions and Net Costs or Cost Savings

Deleted: TBD – [CCS to list GHG reductions with input / approval from TWG]¶

	GHG Reductions ($MMtCO_2e$)			Gross Costs (Million $)	Gross Benefits (Million $)	Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/t$CO_2$e)
	2012	2020	Total 2008-2020				
RCI–3	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Data Sources:

- Relevant dockets from the New Hampshire Public Service Commission on PAYS

- PAYS paper written for NARUC in 1999
- GDS report prepared for Keyspan on PAYS
- United Illuminating (CT) on the bill financing program
- Hawaii Public Service Commission dockets on PAYS
- Existing and future Maryland building codes
- Examples of commissioning and retrocommissioning studies from PECI (Portland Energy Conservation, Inc.), Lawrence Berkeley Labs and from the National Conference on Building Commissioning.
- For the CA EE based allowance schedule, www.designedforcomfort.com has information on incentives and program details.
- *Projected retail electricity rates*
    - Center for Integrative Environmental Research, University of Maryland, College Park 2007. Economic and Energy Impacts from Maryland's Potential Participation in the Regional Greenhouse Gas Initiative: A Study Commissioned by the Maryland Department of the Environment, available at http://www.cier.umd.edu/RGGI/

Quantification Methods:

For the low-income and rental sector, estimate the rate of penetration of the program over time (with eligible households reduced by the number of households participating in existing Maryland programs), and apply target savings rates and costs to estimate savings in electricity and heating fuel use, option total cost, and option cost net of avoided electricity and fuel costs.

Key Assumptions:

- Use ESCO values for discount rate and cost of capital
- Cost of saved electricity and natural gas: See RCI-2
- Program penetration rate or energy savings target for appropriate sectors: this assumption is crucial to quantify the impacts of this policy option, but is very uncertain.
- The average consumption of electricity, gas, and other heating fuels in low-income households is similar to the average consumption in all households in Maryland.
- 5% adder for risk of default

Key Uncertainties

Assumptions with respect to buildings meeting current codes and standards (or not): Analysis is more straightforward if the baseline is assumed to be known and fixed. However, electric load and emissions data are based on actual use, which includes buildings that meet code and those which do not. One could also assume that a certain percentage of buildings do not meet codes and that their average energy use is so many percent higher than it would have been had the buildings met code. For example, EPA's cover letter for the PECI retrocommissioning guide assumes that building energy use could be improved by at least 10%.

The amount of GHG reductions achieved through this measure will overlap with those from RCI-2 and -11.

Additional Benefits and Costs

TBD – [as needed and approved by the TWGs]

Feasibility Issues

TBD – [as needed and approved by the TWGs]

Status of Group Approval

Pending – [until MWG moves to final agreement at Meeting #5 or #6]

Level of Group Support

TBD – [blank until MWG Meeting #5]

Barriers to Consensus

TBD – [blank until final vote by the MWG/MCCC]

RCI-4. Improved design, construction, appliances, and lighting in new and existing state and local government buildings, facilities and operations: "Government Lead-by-example"

Policy Description

The State of Maryland and Municipal and County Governments can provide leadership in moving the state forward by adopting policies that improve the energy efficiency of new and renovated public buildings, facilities and operations. Recognizing that governments should "lead by example" the option presented here provides energy use targets to improve the efficiency of energy use in new and existing State and local government buildings, facilities and operations. The proposed policy provides energy efficiency targets that are much higher than code standards for new state-funded and other government buildings, facilities and operations. This option sets energy-efficiency goals for the existing government building stock, as well as for new construction and major renovations of government buildings, facilities and operations.

Elements of this policy include:

- Government buildings, facilities and related operations (please note this to include wastewater and water utilities) will be in operation for many years and should be designed in a manner that meets or exceeds private sector mandated building and trade energy efficiency. Because these buildings and facilities will be in operation for many years, savings can pay for themselves in life cycle cost reductions in energy costs and improvements in workforce efficiency. All new State buildings and facilities, and renovations and additions shall be Leadership in Energy and Environmental Design (LEED) certified at the "silver" or equivalent level, and meet or exceed the energy efficiency and renewable energy goals below stated.
- Existing State and local government buildings shall be retrofitted for energy efficiency achieving 100% of cost-effective energy efficiency by the year 2015. To meet this goal, the State and local governments shall benchmark all buildings and facilities within the next 3 years.
- Evaluate and minimize GHG emissions along the entire supply chain, and incorporate consideration of comprehensive environmental impacts into state and local government purchasing and contracting practices.
- Audits of energy performance and operations of State and other government buildings (in tandem with an audit program). Audit results could be used to target and prioritize investments in improving government building energy efficiency.

- Improvement and review of efficiency goals over time, and development of flexibility in contracting arrangements to encourage integrated energy-efficient design and construction.
- Recommendations that the infrastructure for implementation (meters, accounting systems, staff, etc.) be established as soon as possible.
- Establishing "retained savings" policies whereby government agencies are able to retain funds saved by reducing energy bills for further energy efficiency/renewable energy investments or other uses.
- Require carbon neutral bonding for new construction and renovations and additions. A carbon neutral performance standard will require architects and engineers to design buildings to meet a climate-neutral requirement and built to meet or exceed the state's existing sustainable building guidelines and will save the taxpayers money as life-cycle costs will yield lower operational costs.
- Focus incentives on specific technologies, including white roofs, rooftop gardens, and landscaping to lower electricity demand, and solar photovoltaics to provide electricity when demand in highest.

Potential supporting measures for this option include training and certification of building sector professionals, and performance contracting/shared savings, but could also include surveys of government energy and water use, energy benchmarking, measurement, and tracking programs for municipal and state buildings.

Policy Design

Goals:

- Reduce per-unit-floor-area consumption of carbon based electricity by 15% by 2010, 50% by 2020 and 100%, carbon neutral, by 2030, for government owned and leased buildings, as well as for construction utilizing state and local government funding. These goals can be made by a combination of demand reduction measures, on-site carbon neutral generation and grid based green power purchases. Green power purchases shall exceed the amount of green power purchases already provided by the utility.
- 15% reduction in State Agency energy consumption by 2015.
- Implement by 12/31/08 a requirement that state-owned or leased facilities use life-cycle costing, including full consideration of future energy costs, in the selection and implementation of building designs and components for both new and renovated space, or for the selection of replacement components, and require that the most cost-effective design/equipment/component options be chosen.
- **Timing:** See above.
- **Parties Involved:** State and local governments; Maryland Municipal League and Maryland Association of Counties; Public Service Commission; Maryland State

Contractors association and related private contractor and materials and supply providers; Environmental Advocacy Organizations; and Maryland Energy Administration

- **Other:**

Implementation Mechanisms

- **Collect Data on State and Local Government Building and Facilities Energy Use.** A key implementation mechanism for this option will be to first provide a thorough assessment of the status and energy consumption of all existing State and local government buildings, including establishing a database of buildings and building attributes including floor area, insulation level, energy-using equipment, and history of energy consumption. This baseline, or "carbon footprint," will be used to assess program success.
- **Benchmark State Buildings:** Benchmarking is a process of using the data on building size, use, and energy use to quickly compare a building against others of similar size and use to get an idea of how efficiently the building is operating. It is an important step in identifying opportunities for savings and prioritizing work to be done.
- **Mandate that all new construction and major renovations of government-owned buildings**, including schools and publicly-owned hospitals, meet standards such as LEED™ Gold, for designs that begin after 6/30/08.
- **Commission State Buildings:** Building commissioning is a process of reviewing and tuning up the operation of building systems and controls much like the tune-up of a vehicle. Potential targets for commissioning might include commissioning of state buildings upon completion of construction or renovation and whenever the energy use in a building shows an unexpected and unexplained increase in energy use.
- **Purchase Green Power:** Enter into agreements to purchase green power for a portion of the states electricity needs. Increase purchases over time until 100% of power needs are met through direct use of renewable energy or green power purchased by 2030.
- **Energy Use Targets:** Set targets for energy use in the operation of state buildings, potentially including capping state and local building and facilities energy use per square foot. Motion sensors are a specific technology for reducing lighting energy use in government buildings that may have broad application in Maryland.
- **Renovate State and Local Buildings and Facilities through a Buildings and Facilities Energy Program:** Renovate all state and local buildings and facilities with more than 5,000 square feet and smaller buildings identified through energy benchmark process as having a high potential for energy savings within 5 years. The State and locals buildings and facilities energy program will provide funds for energy audits, engineering analyses, and renovation costs.
- **Evaluate and Minimize GHG Emissions along the Entire Supply Chain, and increase the Efficiency of Operations Through Purchasing and End-of-Life Disposal or Recycling:** Establish state and local policies for purchasing only energy efficient

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products and services by specifying Energy Star–certified and other efficient equipment and appliances, stocking only energy efficient and environmentally preferable products in Central Stores, and planning for end of- life disposal of equipment and other goods when initial purchase is made. Purchase items that can be composted, recycled or reused rather than thrown away. Purchasing and contracting practices should consider comprehensive environmental impacts (including actions by suppliers to mitigate GHG emissions; products' embodied carbon; recycled content; products that are produced and available locally; thermal comfort; indoor air quality) as well as energy efficiency.

- **Develop and Use Renewable Energy Resources:** Evaluate the potential for direct use of solar, wind, biomass, geothermal, and hydro power to meet the needs of state government operations. Take advantage of these renewable resources whenever it is cost-effective to do so, and as a means to lead by example in investing in these systems when it is practical to do so.
- **Carbon-Neutral Bonding:** Climate-neutral bonding will require that any building projects financed with the issuance of state, county, or local/municipal bonds result in no net increase in GHG emissions. If a new construction project is projected to result in an emissions increase, there must be GHG emissions offsets within the state or particular jurisdiction. Offsets could include onsite renewable energy development, renewable energy purchases, energy efficiency (in existing state buildings), carbon sequestration (tree planting), and switching to cleaner or renewable fuels. Any GHGs emitted after the bond-financed project becomes operational will have to be offset. The new buildings could also offset their emissions by purchasing renewable electricity from their local utility. Paying a premium for what's known as "green pricing" electricity will usually be a more expensive offset option than energy efficiency. A community or state could install their own renewable energy project as a way to offset heir GHG emissions.
- **Monitoring and Verification:** conduct periodic reviews of building energy use over time.

Related Policies/Programs in Place

- Maryland State Buildings Council Program to set energy efficiency programs for State buildings.
- State buildings required to reduce energy use by 15% by 2015.
- Montgomery County Government and Board of Education, Bill 17-06 and Green School Focus.

Type(s) of GHG Reductions

Reduction in GHG emissions (largely CO_2) from avoided electricity production or on-site fuel combustion

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Estimated GHG Reductions and Net Costs or Cost Savings

	GHG Reductions ($MMtCO_2e$)			Gross Costs (Million $)	Gross Benefits (Million $)	Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)
	2012	2020	Total 2008-2020				
RCI–4 Total	0.3	1.2	7.3	162	-559	-397	-55
Government Buildings	0.3	1.1	6.4	143	-491	-347	-55
Schools	0.0	0.2	0.9	19	-69	-50	-56

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Data Sources:

For Government Buildings and Schools

M. A. Halverson, K. Gowri, and E. E. Richman of Pacific Northwest National Laboratory. "Analysis of Energy Saving Impacts of New Commercial Energy Codes for the Gulf Coast", December 2006, http://www.energycodes.gov/pdf/pnnl16282.pdf (accessed January 6, 2008)

Incremental Costs from WBCSD, "Energy Efficiency in Buildings: Summary Report," October 2007.

RSMeans Construction Bookstore, QuickCost Estimator, http://www.rsmeans.com/calculator/index.asp (accessed January 6, 2008).

Additional Resources For Schools

Statistics found at http://maryland.schooltree.org/counties-page1.html and http://www.heritage.org/research/Education/SchoolChoice/Maryland.cfm

Forefront Economics, Inc., H. Gil Peach & Associates LLC, and PA Consulting Group. "Duke Energy Carolinas DSM Action Plan: South Carolina Draft Report." July 24, 2007.

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<#>Maryland Municipal League, http://www.mdmunicipal.org/mmlhome/index.cfm¶
<#>Maryland Association of Counties, http://www.mdcounties.org/¶
<#>Community development block grants¶
<#>Department of Budget and Management, http://www.dbm.maryland.gov/portal/server.pt?¶
<#>Maryland Stadium Authority, mdstad.com ¶

Quantification Methods:

Benefits: First, separate ramp ins for energy savings by existing and new buildings were developed to together meet the overall energy savings goal and defined an overall energy savings ramp in. Then, the number of existing and new building participants was calculated. Energy savings were developed using the energy savings ramp ins and the number of building participants. After the energy savings were broken out by fuel type, the greenhouse gas emission reductions were calculated using emissions factors for each fuel type. The avoided costs by fuel type were also calculated.

Costs: Incremental cost trajectories were developed independently for existing and new buildings based on the energy savings trajectories. For existing buildings this was calculated using a bottom up approach by estimating the cost of specific measures to achieve the first level of energy savings and scaling these costs according to the energy savings trajectory. For new buildings this was calculated using a top down approach by determining the cost to build the building and using a percentage to back out the incremental costs of outfitting it with beyond-code measures. Then, the incremental cost for the first level of energy savings was scaled according to the energy savings trajectory. The incremental cost per building was multiplied by the number of participants to determine the overall costs.

Key Assumptions:

The analysis of costs and GHG benefits was limited to energy efficiency measures. Alternative means of reaching the goals (switching to low and no carbon based fuels for previously carbon based end-uses, off-site purchases on grid supplied "green power" and/or installing on-site off-grid power generating equipment) were not modeled.

Schools were included in this analysis as requested by TWG members.

It was assumed that the number of commercial government buildings from CBECS did not include schools although this could not be confirmed.

For Government Buildings and Schools

The following is the assumed energy savings ramp in to achieve the total energy savings goal:

Year	Existing	Notes on Existing	New	Notes on New
2009	15%	Code (15%)	40%	LEED Gold
2010	15%	Code (15%)	40%	LEED Gold
2011	15%	Code (15%)	40%	LEED Gold
2012	15%	Code (15%)	40%	LEED Gold
2013	15%	Code (15%)	40%	LEED Gold
2014	30%	Energy Star Standard (15% + 15%)	40%	LEED Gold
2015	30%	Energy Star Standard (15% + 15%)	40%	LEED Gold
2016	30%	Energy Star Standard (15% + 15%)	40%	LEED Gold
2017	35%	LEED Certification (15% + 20%)	40%	LEED Gold
2018	35%	LEED Certification (15% + 20%)	40%	LEED Gold
2019	35%	LEED Certification (15% + 20%)	40%	LEED Gold
2020	45%	LEED Silver (15% + 30%)	40%	LEED Gold

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For Government Buildings

The following is the assumed incremental cost trajectory based on the energy savings:

Year	Existing	Notes on Existing	New	Notes on New
2009	15%	$16,182	40%	4.5% increase
2010	15%	$16,182	40%	4.5% increase
2011	15%	$16,182	40%	4.5% increase
2012	15%	$16,182	40%	4.5% increase
2013	15%	$16,182	40%	4.5% increase
2014	30%	$16,182 * 2.0	40%	4.5% increase
2015	30%	$16,182 * 2.0	40%	4.5% increase
2016	30%	$16,182 * 2.0	40%	4.5% increase
2017	35%	$16,182 * 2.3	40%	4.5% increase
2018	35%	$16,182 * 2.3	40%	4.5% increase
2019	35%	$16,182 * 2.3	40%	4.5% increase
2020	45%	$16,182 * 3.0	40%	4.5% increase

Benefits:

Assumption	Existing Bldgs	New Bldgs	Notes
Avg Square Footage per Building	26,453		From CBECS
Number of Buildings	21,348	2,102	Existing: As of the end of 2008 New: 2009-2020
Reach	50%	100%	Placeholder assumption
Avg. Energy Use	0.00008 bbtu/sq. ft./yr		Calculation of energy use divided by projected number of homes/buildings

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Ratio of Commercial to Government Energy Use per Sq. Ft.	1.00	Placeholder assumption
Current Stock vs. New Stock Energy Savings	16%	Calculated using Gulf Coast studies on building codes
Proportion of Energy Savings by Fuel Type, Emissions Factors, T&D Electricity Loss, Avoided Energy Costs	Same assumptions as used for RCI-1.	

Costs:

Assumption	Existing Bldgs	New Bldgs	Notes
Real Discount Rate	Same assumptions as used for RCI-1.		
Capital Recovery Factor for Levelization	6.20% Interest Rate: 5% Period: 30 yrs		Calculated assumption
Avg Construction Cost of a Building	$3,081,309		Using a cost estimator and a range of Maryland-specific zip codes

For Schools

The following is the assumed incremental cost trajectory based on the energy savings:

Year	Existing	Notes on Existing	New	Notes on New
2009	15%	$14,783	40%	4.5% increase
2010	15%	$14,783	40%	4.5% increase
2011	15%	$14,783	40%	4.5% increase
2012	15%	$14,783	40%	4.5% increase
2013	15%	$14,783	40%	4.5% increase
2014	30%	$14,783 * 2.0	40%	4.5% increase
2015	30%	$14,783 * 2.0	40%	4.5% increase
2016	30%	$14,783 * 2.0	40%	4.5% increase
2017	35%	$14,783 * 2.3	40%	4.5% increase
2018	35%	$14,783 * 2.3	40%	4.5% increase
2019	35%	$14,783 * 2.3	40%	4.5% increase
2020	45%	$14,783 * 3.0	40%	4.5% increase

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Benefits:

Assumption	Existing Bldgs	New Bldgs	Notes
Avg Square Footage per Building	34,995		From SC
Number of Buildings	2,267	238	Existing: As of the end of 2008 New: 2009-2020
Reach	50%	100%	Placeholder assumption
Avg. Energy Use	0.00008 bbtu/sq. ft./yr		Calculation of energy use divided by projected number of homes/buildings
Ratio of Commercial to Government Energy Use per Sq. Ft.	1.00		Placeholder assumption
Current Stock vs. New Stock Energy Savings	23%		Calculated using school-specific data from Gulf Coast studies on building codes
Proportion of Energy Savings by Fuel Type, Emissions Factors, T&D Electricity Loss, Avoided Energy Costs	Same assumptions as used for RCI-1.		

Costs:

Assumption	Existing Bldgs	New Bldgs	Notes
Real Discount Rate	Same assumptions as used for RCI-1.		
Capital Recovery Factor for Levelization	Same assumptions as used for Government Buildings.		
Avg Construction Cost of a Building	$4,227,265		Using a cost estimator and a range of Maryland-specific zip codes

Key Uncertainties

TBD – [as needed and approved by the TWGs]

Additional Benefits and Costs

TBD – [as needed and approved by the TWGs]

Feasibility Issues

Will require state to provide resources.

Status of Group Approval

Pending – [until MWG moves to final agreement at Meeting #5 or #6]

Level of Group Support

TBD – [blank until MWG Meeting #5]

Barriers to Consensus

TBD – [blank until final vote by the MWG/MCCC]

RCI-5. Energy Efficiency and Environmental Impacts Awareness and Instruction

Policy Description

Public education and outreach stimulate citizen voluntary actions. The following draft policy for public education and outreach includes very aggressive schedules. Due to the positive-feedback nature of climate change, early actions are much more effective than later ones. A ton of carbon dioxide emission reduction this year is more effective in curbing warming than the same reduction the next year, and is much more effective than the same amount five years later. For this reason, this policy focuses on conservation and energy efficiency (which have immediate effects) and leaves out renewable energies and new climate-friendly technologies. These technologies should be considered when the policies are updated in the future. The TWG recommends that this measure build upon successful pilots, learn from and apply that experience, and replicate what has worked in larger-scale implementation.

This policy is intended to produce change by disseminating both general and technical information. In addition to increasing awareness of, and stimulating voluntary action on, climate change, conservation, and energy efficiency, it seeks to build human capital in technical “green collar” fields.

Specific elements of this policy include:

- Conduct a preliminary assessment of climate change, conservation, and energy efficiency education in the state.
- Educate and coordinate legislatures and government agencies on climate change, conservation, and energy efficiency. Energy conservation and efficiency apply to facilities, operations, and transportation.
- Public schools at all levels include climate change, conservation, and energy efficiency in curriculum at all levels. These school age instructions may influence behaviors for a life time and stimulate climate friendly behavior in peers and families.
- Educate faith communities, environmental non-profits, social/civic groups (Scouts, Lions Club, Rotary Club, 4-H) on climate change and coordinate them to educate the larger populations for widespread community actions in conservation, energy efficiencies, and growing trees.
- Higher education institutions
    - Include climate science and climate-friendly technologies such as renewable energy development in their curricula

    - Partner with industries to transfer green technologies from research to industries
    - Adopt measurable climate-friendly measures as much as possible in institution facilities
- Educate and stimulate Chamber of Commerce, building industry, building owners/tenants, building operators, trades people, inspectors, and home owners associations to adopt climate friendly measures in commercial buildings and homes and promote climate friendly products.

Policy Design

Goals:

- Legislatures and government agencies reinforce and further the state goals and serve as role models for citizens in conservation and energy efficiency
- High awareness in climate change and climate friendly behavior by
    - students of public schools and higher education institutions, and their families
    - Faith, environmental, social, and civic groups and citizens
    - Higher education institutions
    - Chamber of Commerce, building industry, building owners/tenants, building operators, trades people, inspectors, and home owners associations
- Widespread community actions on conservation and energy conservation
- Widespread institutional and student actions on conservation, energy efficiency, and planting trees
- Measurable GHG emission reduction and carbon dioxide sequestration

- **Timing:**
    - For state/county legislature and agencies; faith, environmental, social, and civic groups; higher education institutions; and Chamber of Commerce, building industry, building owners/tenants, building operators, trades people, inspectors, and home owners associations: Complete a plan in 1 month and start implementation in 3 months
    - For public schools: Complete the plan in 2 months, issue grants in 4 months, and start delivering teaching in the 2009 school year
- **Parties Involved:**
    - State and county departments of environment
    - Public schools, MDE, Maryland State Department of Education, County School Boards

    - Faith, environmental, social, and civic groups; state and county departments of environment
    - Higher education institutions (4-year and 2-year institutions)
    - Chamber of Commerce, building industry, building owners/tenants, building operators, trades people, inspectors, and home owners associations
    - State and county departments of environment
- **Other:** Grant opportunities are available for several of these policy elements.

Implementation Mechanisms

- State/county legislature and agencies: Deliver information (e.g., short lectures) on the climate crisis and call for actions in conservation and energy efficiency. Recommend climate friendly measures like
    - Lighting, indoor temperature, and hot water temperature with measurable GHG reduction goals
    - Reducing paper consumption (e.g., by printing multiple slides on a page and using both sides)
    - Reducing consumption of single use containers (e.g., drinks in plastic bottles and cans)
    - Growing trees in place of lawns
- Public schools: Develop a set of state-wide teaching modules (each to be used in a one-hour lecture, includes slides and teaching notes) on different climate change subjects (all modules should include a call for actions in conservation and energy efficiency) to be worked into curriculum (not added on top of existing requirements):
    - Science of climate change (elementary school level)
    - Science of climate change (middle school)
    - Social and political impacts of climate change (high school)
    - Public health impacts of climate change (high school)
    - Renewable energies and climate friendly technologies (high school)

    Set up a website to host voluntary experts on these subjects to answer questions from teachers (and students) in order to reduce training cost for teachers
- Faith, environmental, social, and civic groups: Form county chapters of a new Maryland Climate Leadership Corps to coordinate community actions (public education, growing trees, energy-conservation demonstration). Attract and train voluntary members from
    - Faith communities, social and civic groups (e.g., Scouts, Lions Club, Rotary, 4-H)
    - High school student in fulfilling community services

- College interns (unpaid)
- Adult volunteers

Use volunteers from environmental non-profits (e.g., Sierra Club, Audubon Society, Greater Washington Interfaith Power and Light) as trainers and coordinators. Require 2 traveling state coordinators for all the counties. Working Group members may serve as advisors.

- Higher education institutions
  - Educate administrators on climate change and recommend climate friendly measures on campuses
  - Form student chapters of the Maryland Climate Leadership Corps in institutions to coordinate actions (public education, growing trees, energy-conservation demonstration). Use student members to further public education and outreach in surrounding communities.
- Chamber of Commerce, building industry, building owners/tenants, building operators, trades people, inspectors, and home owners associations: Deliver information (e.g., short lectures) on the climate crisis and call for citizen actions in conservation and energy efficiency. Recommend climate friendly measures such as
  - Lighting, indoor temperature, and hot water temperature with measurable GHG reduction goals
  - Reducing paper consumption (e.g., by printing multiple slides a page and using both sides)
  - Reducing consumption of single use containers (e.g., drinks in plastic bottles and cans)
  - Growing trees in place of lawns

  May use the Maryland Climate Leadership Corps to deliver these educational lectures.

Related Policies/Programs in Place

Alliance to Save Energy program in Howard and Montgomery counties to build human infrastructure

Type(s) of GHG Reductions

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Reduction in GHG emissions (largely CO_2) from avoided electricity production or on-site fuel combustion and from landfills as a result of avoided waste. Increase in tree-planting and associated sequestration.

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Estimated GHG Reductions and Net Costs or Cost Savings

The potential for GHG reductions varies to such an extent that this option will not be quantified. While GHG reductions are difficult to directly attribute to this policy option, it acts as a supporting action for other quantified options, particularly RCI-4, RCI-6, and RCI-7.

Direct costs would include salaries for state coordinators (roughly 7, at about $125,000/year each), grant(s) for development of teaching modules, website development and hosting costs (estimated at $100,000), other startup costs, website support costs, and costs to update the teaching modules.

- **Data Sources:** Not applicable.
- **Quantification Methods:** Not applicable.
- **Key Assumptions:** Not applicable.

Key Uncertainties

TBD – [as needed and approved by the TWGs]

Additional Benefits and Costs

TBD – [as needed and approved by the TWGs]

Feasibility Issues

TBD – [as needed and approved by the TWGs]

Status of Group Approval

Pending – [until MWG moves to final agreement at Meeting #5 or #6]

Level of Group Support

TBD – [blank until MWG Meeting #5]

Barriers to Consensus

TBD – [blank until final vote by the MWG/MCCC]

RCI-6. Promotion and Incentives for Improved Design and Construction (e.g. LEED, green buildings, or minimum % improvement better than code) in the Private Sector

To be combined with RCI-1

Policy Description

Buildings are significant consumers of energy and other resources, and can contribute to local microclimates. Implementation of advanced/next generation building designs is an important avenue for reducing green-house gas emissions and other resource demands associated with construction, operation and maintenance of buildings. This policy provides for incentives and targets to induce the owners and developers of new and existing private sector buildings to improve the efficiency with which energy and other resources are used in those buildings, along with provisions for raising targets periodically and providing resources to building industry professionals to help achieve the desired building performance. This policy can include elements to encourage the improvement and review of energy use goals over time, and to encourage flexibility in contracting arrangements to encourage integrated energy- and resource efficient design and construction. This policy would build upon the existing Empower Maryland program (applicable to state buildings) by encouraging private sector facilities to meet the same building design and performance standards.

Additional potential elements of this option include:

- Provide incentives for new and existing residential and commercial buildings to incorporate design, construction, commissioning, operation, and maintenance features and practices that meet minimum and advanced LEED requirements.
- Provide incentives based upon performance superior by a substantial percentage over LEED. (While LEED is a well-known and familiar standard, merely requiring LEED may not lead to the most efficient buildings.)
- Target new, renovated, and/or existing buildings (retrofits).
- Set a cap on consumption of energy per unit area of floorspace for new buildings.
- Encourage building commissioning and recommissioning, including energy tracking and benchmarking.
- Set up a "feebate" program to encourage energy efficiency in building design.

- Provide incentives, in the form of tax credits, DSM program support, financing incentives (such as "green mortgages"), or other inducements for retrofit of existing residential and commercial buildings.
- Encourage the use of alternative and local building materials and practices.
- Focus incentives on specific technologies, including white roofs, rooftop gardens, and landscaping to lower electricity demand, and solar photovoltaics to provide electricity when demand in highest.

Potential supporting measures for this option include training and certification of building professionals, consumer and primary/secondary education, performance contracting/shared savings arrangements, and setting up of a clearinghouse for information on and access to software tools to calculate the impacts of energy efficiency and solar technologies for buildings.

Policy Design

The Policy will include financial incentives, outreach and public education, public recognition programs, and technical support resources for implementation of advanced building designs for both new and existing construction in the residential, commercial, and industrial sectors in the next two decades. These advances will enable buildings in Maryland to be "carbon neutral" in the aggregate by 2030, meaning that any energy needs in a building, net of efficiency gains through building design to reduce energy use and net of on-site renewable energy use, should be supplied by renewable energy sources.

- **Goals**: Reduce per-unit-floor-area consumption of grid electricity and natural gas by 20% by 2020 in existing buildings, and by 50% in new buildings by 2020, excluding industrial process facilities. Up to 10% of the targeted reduction for new homes can come from use of off-site electricity generation from renewable energy
- **Timing:** See above.
- **Parties Involved:** Maryland Department of General Services, Maryland Energy Administration; Maryland Department of the Environment; Maryland Department of Labor, Licensing, and Regulation; Maryland Department of Business and Economic Development, Maryland Public Service Commission; Maryland Green Building Council

Implementation Mechanisms

For the residential sector, encourage voluntary attainment of the EnergyStar "high performing" standard (see HPH100.org for definition), using property tax credits. Tax credits are effective for 2 years, and are based on the assessed property value of new, private residential units that achieve the Energy Star "high performing" standard.

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For the commercial sector, encourage voluntary attainment of the Architecture 2030 standards, which increase in stringency over time, using property tax credits based on the incremental construction cost for new, private commercial buildings that achieve Architecture 2030 standards; tax credits are capped at 10 years.

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For the industrial sector, Maryland should look at additional tools and opportunities for technology transfer if existing tools are found to be inadequate.

Related Policies/Programs in Place

- US Green Buildings Council's LEED™ New Construction (NC), LEED™ Existing Buildings (EB), LEED™ Core and Shell (C&S), and LEED™ Homes (H) (expected launch of LEED for Homes in Fall 2007)
- EPA Energy Star and HPH100
- Architecture 2030
- State of Maryland:
    - Legislature has shown interest in "standard 189" code.
    - Empower Maryland Program
    - Maryland Energy Administration grant incentives for installation of certain renewable energy technologies.
    - Maryland Public Service Commission rules allowing net-metering from qualifying self-generators of renewable energy, including: PV, wind, and biomass, up to 200 kilowatts.
    - Maryland Public Service Commission's Renewable Portfolio Standard which requires that a minimum percentage of retail energy sales be derived from renewable sources. EXECUTIVE ORDER 01.01.2001.02 Sustaining Maryland's Future with Clean Power, Green Buildings and Energy Efficiency
    - Montgomery County Bill 1706: 10,000 ft^2 threshold

Type(s) of GHG Reductions

Reduction in GHG emissions (largely CO_2) from avoided electricity production or on-site fuel combustion

Estimated GHG Reductions and Net Costs or Cost Savings

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	GHG Reductions ($MMtCO_2e$)			Gross Costs (Million $)	Gross Benefits (Million $)	Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)
	2012	2020	Total 2008-2020				
RCI–6 Total	1.7	4.9	32.5	TBD	-2,521	TBD	TBD
Existing Homes	1.2	3.2	22.0	TBD	-1,709	TBD	TBD
New Homes	0.1	0.6	3.1	TBD	-236	TBD	TBD
Existing Buildings	0.4	1.0	6.7	TBD	-521	TBD	TBD
New Buildings	0.0	0.1	0.7	TBD	-56	TBD	TBD

Data Sources:

NESEA. "Zero Energy: This Year's Crop," presented by Betsy Pettit of Building Science Consulting, 2007, http://www.buildingscienceconsulting.com/resources/presentations/NESEA/2007/2007_NESEA_Pettit_sec.pdf (accessed on January 2, 2008)

R. G. Lucas of Pacific Northwest National Laboratory. "Analysis of Energy Saving Impacts of New Residential Energy Codes for the Gulf Coast", January 2007, http://www.energycodes.gov/pdf/pnnl16265.pdf (accessed January 2, 2008).

M. A. Halverson, K. Gowri, and E. E. Richman of Pacific Northwest National Laboratory. "Analysis of Energy Saving Impacts of New Commercial Energy Codes for the Gulf Coast", December 2006, http://www.energycodes.gov/pdf/pnnl16282.pdf (accessed January 6, 2008).

WBCSD, "Energy Efficiency in Buildings: Summary Report," Figure 22. Costing Green: A Comprehensive Cost Database and Budgeting Methodology. October 2007. Page 31.

Building Codes Assistance Project (BCAP), personal communications with Nils Petermann

RSMeans Construction Bookstore, QuickCost Estimator, http://www.rsmeans.com/calculator/index.asp (accessed January 6, 2008).

Quantification Methods:

Existing Homes and Buildings

Benefits: An annual reach was calculated by dividing the overall reach to be achieved by the number of years over which it will be achieved. Then, the number of homes and buildings as of the end of the year 2008 was multiplied by the annual reach to determine the number of homes and buildings participating per year. The energy savings was calculated from the number of homes and buildings participating per year and the average energy savings of 20% per square foot per building. After the energy savings was broken out by fuel type, the greenhouse gas emission reductions were calculated using emissions factors for each fuel type. The avoided costs by fuel type were also calculated.

Costs: Incremental costs were developed by summing the incremental costs of specific measures that can be taken to achieve 20% reductions in energy use and are indicative of the approaches taken to bring an existing home or building up to current code. The incremental cost per building was multiplied by the number of participants to determine the overall costs.

New Homes and Buildings

Benefits: A reach ramp-in was developed by increasing the reach goal consistently year over year until the goal was reached. Then, the number of new homes and buildings was multiplied by the annual reach to determine the number of new homes and buildings participating per year. The energy savings was calculated from the number of new homes and buildings participating per year and the average energy savings of 50% per square foot per home or building. After the energy savings was broken out by fuel type, the greenhouse gas emission reductions were calculated using emissions factors for each fuel type. The avoided costs by fuel type were also calculated.

Costs: Incremental costs were developed by multiplying the average construction cost of a new home or building by the percentage of cost increase to build a LEED Platinum home or building which achieves approximately 50% energy savings as compared to new homes and buildings built to current codes. The incremental cost per new home or building was multiplied by the number of participating new homes and buildings to determine the overall costs.

Key Assumptions:

For existing homes and buildings, we are assuming that 20% energy savings is equivalent to bringing the existing stock to current new home and building standards. No beyond code programs need be adopted in order to achieve these energy savings.

For simplicity, we are assuming that every home or building, without regard for the year when it is retrofitted or built achieves the energy savings goals as written. Please note that there are alternate ways to analyze this policy, including assuming that a proportion of the homes and buildings that participate in a given year attain energy savings that are less than the goal and the remaining proportion exceed the goal.

Upon further consideration, the goal of reaching 70% of existing homes and buildings by 2020 was revised to 50% due to potential feasibility issues with this goal. However, we continued to assume that 70% of new homes and buildings could be reached with this policy by 2020 as this seemed more reasonable.

We have assumed that renewable energy purchases (off-site electricity generation from renewables) are not needed in order to achieve the energy savings goals for new homes and buildings. However, it is likely that on-site renewable generation accounts for a portion of the energy savings in some LEED Platinum homes and buildings.

Existing Homes and Buildings

Benefits:

Assumption	Residential Sector	Commercial Sector	Notes
Reach per Year	4.2%		50% target/12 yrs
Avg Square Footage per Existing Building	1,400	11,829	Residential: Estimate of differences between existing and new homes from a California Study Commercial: Calculation of projected square footage of buildings divided by the projected number of buildings
Number of Existing Homes/Buildings	2,187,489	68,893	As of the end of 2008
Number of Existing Home/Building Participants	1,093,745	34,446	Assuming 50% of the total
Avg. Energy Use, Proportion of Energy Savings by Fuel Type, Emissions Factors, T&D Electricity Loss, Avoided Energy Costs	Same assumptions as used for RCI-1.		

Costs:

Assumption	Residential Sector	Commercial Sector	Notes
Real Discount Rate, Capital Recovery Factor for Levelization	Same assumptions as used for RCI-1.		
Incremental Cost of Measures	$3,841 per home	$7,236 per bldg	Calculated using Gulf Coast studies on building codes

New Homes and Buildings

The following assumed ramp in applies to both the Residential and Commercial sectors:

Year	Target
2009	5.8%
2010	11.7%
2011	17.5%
2012	23.3%
2013	29.2%
2014	35.0%
2015	40.8%
2016	46.7%
2017	52.5%
2018	58.3%
2019	64.2%
2020	70.0%

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Benefits:

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Assumption	Residential Sector	Commercial Sector	Notes
Percentage of Energy Use Supplied by Green Power Purchases	0%	0%	No green power purchases were assumed to achieve the goals
Avg Square Footage per New Building	2,000	11,829	Residential: Estimate of differences between existing and new homes from a California Study Commercial: Calculation of projected square footage of buildings divided by the projected number of buildings
Number of New Home/Building Participants	109,936	2,572	Assuming a ramp in to 70% of the total
Percent Reach	38%	38%	Calculated assumption
% Energy Reductions	50%	50%	Goal
Current Stock vs. New Stock Energy Savings	20%	16%	Calculated using Gulf Coast studies on building codes

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Avg. Energy Use	0.0770 bbtu/home/yr	0.00007 bbtu/sq. ft./yr	Adjusted energy use to reflect efficiencies for new buildings
Number of New Homes/Buildings, Proportion of Energy Savings by Fuel Type, Emissions Factors, T&D Electricity Loss, Avoided Energy Costs	Same assumptions as used for RCI-1.		

Costs:

Assumption	Residential Sector	Commercial Sector	Notes
Real Discount Rate, Capital Recovery Factor for Levelization, Avg Cost of a Home/Building	Same assumptions as used for RCI-1.		
Incremental Costs Associated with Energy Savings from LEED Platinum	9%	9%	Estimated from a WBCSD paper

Key Uncertainties

It will likely be desirable to maximize the efficiency gains from measures installed in existing homes. However, it is unknown what the maximum achievable reductions to an existing home without entering into a major renovation could be.

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Additional Benefits and Costs

TBD – [as needed and approved by the TWGs]

Feasibility Issues

TBD – [as needed and approved by the TWGs]

Status of Group Approval

Pending – [until MWG moves to final agreement at Meeting #5 or #6]

Level of Group Support

TBD – [blank until MWG Meeting #5]

Barriers to Consensus

TBD – [blank until final vote by the MWG/MCCC]

RCI-7. More Stringent Appliance/Equipment Efficiency Standards (state-level, or advocate for regional or federal-level standards)

Policy Description

Appliance efficiency standards reduce the market cost of energy efficiency improvements by incorporating technological advances into base appliance models, thereby creating economies of scale. Appliance efficiency standards can be implemented at the state level for appliances not covered by federal standards, or where higher-than-federal standard efficiency requirements are appropriate. Regional coordination for state appliance standards can be used to avoid concerns that retailers or manufacturers may (1) resist supplying equipment to one state that has advanced standards or (2) focus sales of lower efficiency models on a state with less stringent efficiency standards.

There are existing federal standards for 17 residential products and 11 pieces of commercial equipment. Laws require the U.S. Department of Energy (DOE) to set minimum appliance efficiency standards that are technologically feasible and economically justified. However, there are many appliances not covered by federal standards for which state standards can play a role.

This policy option includes:

- Lobbying for more stringent appliance standards at the federal level.
- Establishment and enforcement of higher-than-federal state-level appliance and equipment standards (or standards for devices not covered by federal standards).
- Joining with other states in adopting higher standards.

Consumer education is an important supporting measure for this option.

Policy Design

- **Goals:** State minimum efficiency standards for appliances not covered by federal standards as recommended by Appliance Standards Awareness Program[1] by 2009.

[1] See http://www.standardsasap.org/documents/a062_sc.pdf. The analysis recommends standards for the following products: bottle-type water dispensers, commercial boilers, commercial hot food holding containers, compact audio products, DVD players and recorders, liquid immersion distribution transformers, medium voltage dry-type distribution transformers, metal halide lamp fixtures, pool heaters, portable electric spas, residential furnaces and boilers, residential pool pumps, single voltage external AC to DC power supplies, state regulated incandescent reflector lamps, walk-in refrigerators and freezers.

- **Timing:** As noted above.
- **Parties Involved:** As noted above.

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Implementation Mechanisms

Appliance Standards can be promulgated by legislation or developed administratively.

Appliances covered by the Appliance Standards Awareness Program (ASAP) are updated annually to incorporate the effects of new state and federal appliance standards. Review and adoption of updated ASAP-recommended state-level appliance standards should be undertaken periodically (e.g., every 3 years or as new federal standards are enacted).

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It is recommended that the state work with manufacturers and consider impacts on manufacturers when setting new standards.

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Related Policies/Programs in Place

- Maryland Energy Efficiency Standards Act (became law per Maryland Constitution, Chapter 2 of 2004 on January 20, 2004):

  Maryland standards apply to 9 appliances: Torchiere lighting fixtures; unit heaters; low-voltage, dry-type distribution transformers; ceiling fans and ceiling fan light kits; red and green traffic signal modules; illuminated exit signs; commercial refrigeration cabinets; large packaged air conditioning equipment; and commercial clothes washers. Standards become effective in March 2005. The exceptions to this general rule relate to commercial clothes washers, and ceiling fan light kits. Commercial clothes washers and ceiling fan light kits do not have to meet the new efficiency standards until March 1, 2007. Commercial clothes washers and ceiling fan light kits not meeting the standards may be installed until January 1, 2008. There is no overlap between the appliances covered by this Act and the appliances recommended by the Appliance Standards Awareness Program.

- Maryland Energy Efficiency Standards Act of 2007:

  Before January 1, 2008 the Maryland Energy Administration shall adopt regulations establishing minimum efficiency standards for the following types of new products: Bottle-type water dispensers; commercial hot food holding cabinets; metal halide lamp fixtures; residential furnaces; single-voltage external AC to DC power supplies; state-regulated incandescent reflector lamps; walk-in refrigerators and freezers. Seven appliances from this act overlap the appliances recommended by the Appliance Standards Awareness Program. Compact audio products and DVD players and recorders were also included in the original bill, but removed before the bill became law.

- Energy Independence and Security Act of 2007:

  This federal law establishes new minimum efficiency standards for several appliance types, including five that are also recommended by the Appliance Standards Awareness Program: residential boilers; state-regulated incandescent reflector lamps; single-voltage external AC to DC power supplies; metal halide lamp fixtures; and walk-in refrigerators and freezers. This legislation will supersede the standards established in the Maryland Energy Efficiency Standards Act of 2007, where applicable.

Type(s) of GHG Reductions

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Reduction in GHG emissions (largely CO_2) from avoided electricity production or on-site fuel combustion

Estimated GHG Reductions and Net Costs or Cost Savings

Deleted: TBD – [CCS to list GHG reductions with input / approval from TWG]¶

	GHG Reductions ($MMtCO_2e$)			Gross Costs (Million $)	Gross Benefits (Million $)	Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)
	2012	2020	Total 2008-2020				
RCI–7	0.1	0.2	1.2	42	-174	-132	-111

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Data Sources:

- U.S. Congress. House. *Energy Independence and Security Act of 2007*. H.R.6. 110th Cong., 1st sess.
- *Maryland Energy Efficiency Standards Act*, Annotated Code of Maryland, sec. 9-2006 2004.
- *Maryland Energy Efficiency Standards Act of 2007*, Annotated Code of Maryland, sec. 9-2006, 2007.
- Center for Integrative Environmental Research, University of Maryland, College Park 2007. Economic and Energy Impacts from Maryland's Potential Participation in the Regional Greenhouse Gas Initiative: A Study Commissioned by the Maryland Department of the Environment, available at http://www.cier.umd.edu/RGGI/.
- Nadel, Steven, Andrew deLaski, Maggie Eldridge, and Jim Kleisch. Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards, ASAP and ACEEE, Report Number ASAP-6/ACEEE-A062, March 2006.
- Nadel, Steven, Andrew deLaski, Maggie Eldridge, and Jim Kleisch. Energy Efficiency Standards Benefits – 2006 Model Bill: Maryland, ASAP and ACEEE, http://www.standardsasap.org/documents/a062_md.pdf (accessed December 7, 2007).
- Prindle, Bill. Energy Efficiency in Maryland's Electricity Future. American Council for an Energy-Efficient Economy, ACEEE Report Number E077, September 2007.

Quantification Methods:

- Projected electricity and natural gas savings are taken from the 2006 Appliance Standards Awareness Program data for Maryland for the appropriate appliances not already covered by the Maryland Energy Efficiency Standards Act.

- These annual energy savings are adjusted to fit the analysis period, per ramp rate of appliances and target implementation year.
- The appropriate GHG emissions factors, energy prices, and discount rate are applied.

Key Assumptions:

- Costs and savings from efficiency improvement via standards are similar in Maryland to those indicated in the ASAP/ACEEE report.
- It is assumed that development and manufacturing lead time for bringing appliances that meet ASAP standards to market is minimal, because most of the appliances identified by ASAP are subject efficiency standards in other states (http://www.standardsasap.org/state.htm). Consistent with ASAP assumptions, appliances are assumed to be available starting in 2009, except for commercial boilers, pool heaters, and residential furnaces and residential boilers, which will be introduced in 2012.

Key Uncertainties

It is unknown the degree to which other states in the region will join with Maryland in setting higher-than-federal standards so as to increase effectiveness and practical application of standards.

Additional Benefits and Costs

TBD – [as needed and approved by the TWGs]

- Reduction in water use for some appliance upgrades.

Feasibility Issues

The feasibility of this policy option is enhanced by ongoing efforts in nearby states.

Status of Group Approval

Pending – [until MWG moves to final agreement at Meeting #5 or #6]

Level of Group Support

TBD – [blank until MWG Meeting #5]

Barriers to Consensus

TBD – [blank until final vote by the MWG/MCCC]

RCI-8. Rate structures and Technologies to Promote Reduced GHG Emissions (Including Peak Pricing and Inverted Block Rates)

Policy Description

This option could include various elements of utility rate design that are geared toward reducing greenhouse gas emissions, often with other benefits as well, such as reducing peak power demand. The overall goal is to revise rate structures so as to better reflect the actual economic and environmental costs of producing and delivering electricity as those costs vary by time of day, day of the week, season, or from year to year. In this way, rates provide consumers with information reflecting the impacts of their consumption choices.

Potential elements of this option include:

- Time-of-use rates, which typically price electricity higher at times of higher power demand, and thus better reflect the actual cost of generation. Time-of-use rates may or may not have a significant impact on total GHG emissions, but do affect on-peak power demand and thus both the need for peaking capacity and fuel for peaking plants.
- Tiered (increasing/inverted block/peak) rates for electricity and natural gas use, which provide affordable base usage rates for consumers, but which increase with increasing consumption.
- "Smart metering"—implementation of consumer meters showing real-time pricing, and the level of GHG emissions related to consumption at any given time.

Policy Design

Goals:

- Implement a 3-tiered pricing system for Standard Offer Service (SOS) electricity customers. The cheapest tier should apply to a percentage of average consumption and be priced below average rates. The most expensive tier should apply to electricity use above average consumption and be priced high enough to encourage conservation. California may offer a good example of percentages and rates. The need for a low income exclusion from the program should be investigated.
- Replace traditional electricity meters with "smart meters" as meters otherwise need to be replaced. Time of use rates should be implemented in conjunction with the replacement of existing meters with smart meters.

- **Timing:** The three-tiered pricing system should be implemented for all utilities within 12 months. Conversion to smart meters should begin immediately but proceed slowly for many years. Once more cost-effective energy efficiency measures have been taken, proactive replacement of meters with smart meters should begin and expand.
- **Parties Involved:** SOS electricity customers, utilities, OPC, PSC, MEA
- **Other:**

Implementation Mechanisms

The three-tiered inverted block rates will be proposed by the utilities and approved by the PSC within 12 months. This pricing system will be designed to recover the cost of electricity generation as determined under Standard Offer Service (SOS) procurements. The three-tiered pricing system will be rolled in consistent with successive SOS procurements, to allow generation providers to adjust bid offers.

The need for a low income exclusion from the program should be investigated by the PSC.

Under a replacement schedule and cost recovery plan approved by the PSC and consistent with the schedule for SOS procurement, utilities will replace traditional electricity meters with "smart meters". When their existing meters are replaced with smart meters, customers will be transferred to a time of use rate schedule.

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Focus initially on residential and small commercial sectors

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Related Policies/Programs in Place

TBD – [as needed and approved by the TWGs]

The Southern California Edison program, which included a low-income component, should be investigated.

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Type(s) of GHG Reductions

Reduction in GHG emissions (largely CO_2) from avoided electricity production or on-site fuel combustion

Estimated GHG Reductions and Net Costs or Cost Savings

	GHG Reductions ($MMtCO_2e$)			Gross Costs (Million $)	Gross Benefits (Million $)	Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/t$CO_2$e)
	2012	2020	Total 2008-2020				
RCI–8 Total	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Data Sources:

- *Price elasticity of electricity:* EIA, Price Responsiveness in the AEO2003 NEMS Residential and Commercial Buildings Sector Models, available at

www.eia.doe.gov/oiaf/analysispaper/elasticity/index.html and
www.eia.doe.gov/oiaf/analysispaper/elasticity/table1.html

- *Electricity prices:*
  - Center for Integrative Environmental Research, University of Maryland, College Park 2007. Economic and Energy Impacts from Maryland's Potential Participation in the Regional Greenhouse Gas Initiative: A Study Commissioned by the Maryland Department of the Environment, available at http://www.cier.umd.edu/RGGI/
- *Inverted block rates in California:*
  - Inverted block rates by the Sacrament Municipal Utility District (SMUD) in California have three tiers in its inverted block rates.

SMUD			
Regular Rate [c/kWh]	Block [kWh]	IBR [c/kWh]	Retular Rate/IBR
9.73	0-700	8.32	0.86
9.73	701-1000	14.62	1.50
9.73	1001+	16.1	1.65

Tier structure is different for winter and summer. Numbers shown are an average of the two.

  - The California Public Utilities Commission requires IOUs to establish inverted block rates for residential energy service. In this rate structure, the baseline consumption or threshold that covers basic needs of residential customers, which largely differ by geographic location, season, and power source. The baseline consumption allocation typically covers 60-70% of the average residential energy use in each region.[2]

SCE Baseline Allocation Chart

[2] SCE. Residential Baseline Allocation, available at http://www.sce.com/NR/rdonlyres/DF137120-E263-459E-96F4-0B4F4BA60520/0/597R0906ResidentialBaseline.pdf

Tier	Baseline Allocation	Cost per kWh
5	More than 300% of baseline (or more than 201% **over** baseline)	Most Expensive
4	kWh usage from 201% to 300% of baseline (or 101% to 200% **over** your baseline allocation)	
3	kWh usage from 131% to 200% of baseline (or 31% to 100% **over** your baseline allocation)	
2	kWh usage from 101% to 130% of baseline (or 1% to 30% **over** your baseline allocation)	
1	Baseline (kWh usage **up to** your baseline allocation)	Least Expensive

Source: Southern California Edison. "Residential Baseline Allocation," available at http://www.sce.com/NR/rdonlyres/DF137120-E263-459E-96F4-0B4F4BA60520/0/597R0906ResidentialBaseline.pdf

Generation Charge for Residential Customers ($/kWh)

Consumption level	Rate
Baseline Service	0.02634
101%-130% of Baseline	0.05357
131%-200% of Baseline	0.17351
201% - 300% of Baseline	0.22162
Over 300% of Baseline	0.26973

Source: SCE Schedule D: Domestic Service, available at http://www.sce.com/AboutSCE/Regulatory/tariffbooks/ratespricing/residentialrates.htm

- *Impacts of Different Types of Smart Metering:*
    - "Smart Metering Study Summary" (smart-metering-append.pdf) compiled by CU Denver for the City and County of Denver
    - Primen, Inc. 2004. California Information Display Pilot Technology Assessment, www.ucop.edu/ciee/dretd/documents/idp_tech_assess_final1221.pdf
    - Summit Blue Consulting, Inc. 2006. Evaluation of the 2005 Energy-Smart Pricing PlanSM, prepared for Community Energy Cooperative, August 2006, available at www.energycooperative.org/pdf/ESPP-Evaluation-Executive-Summary-2005.pdf and www.energycooperative.org/energy-smart-pricing-plan.php

- *Cost of Metering*
    - Primen, Inc. 2004. California Information Display Pilot Technology Assessment, www.ucop.edu/ciee/dretd/documents/idp_tech_assess_final1221.pdf
    - Idaho Power 2005. Phase One AMR Implementation Status Report under IPC-E-02-12, December 30, 2005
    - CA PUC 2006. Advanced Metering Infrastructure (AMI) Update, available at www.cpuc.ca.gov/Static/hottopics/1energy/ami_update+june+2006.pdf
    - Demand Response and Advanced Metering Coalition (DRAM) 2004. White Paper: Overview of Advanced Metering Technologies and Costs, available at http://www.dramcoalition.org/id66.htm
    - Booz Allen Hamilton 2007. "Smart Grid – Opportunity Meets necessity," presented at the EEI Strategic Issues Forum in Miami, FL on February 7, 2007.

Quantification Methods: This analysis consists of two major components: impact of inverted block rates and smart meters. The steps that would be required to estimate the impact of inverted block rates are as follows:

- Determine the focus of customer groups within SOS service (i.e., residential only or all customers).
- Estimate the average electricity consumption of customer group(s) to be analyzed
- Estimate the total or average consumption of low-income customers. This information will be used to exclude low-income customers from this analysis.
- Determine three levels of electricity rates based on consumption levels
- Allocate projected total electricity consumption by customer group among the three tier rates
- Project change in electricity consumption based on price elasticity
- Estimate energy savings and the associated economic benefit based on price elasticity
- Estimate GHG emissions reduction from energy savings

The second piece of this analysis for smart metering involves the following:

- Identify the status of the # and type of existing meters
- Develop a time schedule for replacing existing meters with smart meters
- Estimate the cost and energy savings from deployment of smart meters through 2020
- Estimate GHG emissions reduction from energy savings

Key Assumptions:

- *Rate Design*: customers who install smart meters will opt out from inverted block rates.
- *Average electric consumption of standard offer service customers*: Only residential SOS customers will be covered. (California IOUs have inverted block rates only for residential customers. Establishing inverted block rates for commercial and industrial customers under SOS may make a lot of those customers leave SOS service)
- *Three levels of electric rates based on consumption level for residential customers*: based on our review of several existing inverted block rates in the U.S., we identified two utilities have three tiered rates as proposed in this policy. We examined one of the two utilities' rates (by the Sacrament Municipal Utility District of SMUD) and developed an inverted block rate for Maryland.

Proposed Blocks [kWh]	Proposed IBR [c/kWh]	Regular Rate [c/kWh]
0-990	8.3	9.72
991 - 1400	14.6	9.72
1401 +	16.1	9.72

  The ratio of the blocks to the average electric consumption and the ratio of the IBR to the average rates in Maryland are set equal to those of SMUD's blocks to its average consumption and of SMUD's IBR to its residential rate.

- *Total electric consumption by low income customers*: low income customers are excluded from this analysis and policy.
- *Status of the # and type of existing meters*: it would be very helpful if MD utilities could provide us with this information.
- *Schedule for replacing existing meters*: it would be very helpful if MD utilities could provide us with this information.
- *Cost of smart meters (that are capable of having at least critical peak pricing) and in-home display*: The cost of smart metering infrastructure for full deployment appears to range from $200 to $300 per meter. This range is based on the following studies:
    - The Primen, Inc. 2004. California Information Display Pilot Technology Assessment, www.ucop.edu/ciee/dretd/documents/idp_tech_assess_final1221.pdf
    - Idaho Power 2005. Phase One AMR Implementation Status Report under IPC-E-02-12, December 30, 2005
    - CA PUC 2006. Advanced Metering Infrastructure (AMI) Update, available at www.cpuc.ca.gov/Static/hottopics/1energy/ami_update+june+2006.pdf
- *Demand reduction from deployment of smart meters:*
- *Assumed cost of implementation of inverted-block tariffs:* $0 (placeholder assumption)

- *Avoided electricity cost:* Same assumptions as used for RCI-1.
- *Retail electric rates:*
- *Emission factors:* Same assumptions as used for RCI-1.

Key Uncertainties

TBD – [as needed and approved by the TWGs]

Additional Benefits and Costs

TBD – [as needed and approved by the TWGs]

Feasibility Issues

Procurement of wholesale electricity supply will be complicated by the three-tiered inverted block rates and Time of Use rates. Bidders in the annual SOS procurement will want extensive information about which meters will be replaced, when, and how consumption is likely to change as a result of the new rate schedules. It is unclear whether rate schedules can be changed for customers supplied under the terms of the existing SOS power procurements.

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Administrative costs of providing these data to bidders will be burdensome.

Status of Group Approval

Pending – [until MWG moves to final agreement at Meeting #5 or #6]

Level of Group Support

TBD – [blank until MWG Meeting #5]

Barriers to Consensus

TBD – [blank until final vote by the MWG/MCCC]

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RCI-9. GHG or Carbon Tax

Transferred to ES TWG

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A carbon or GHG tax is typically a tax on each ton of CO_2 purchased directly or emitted from an emissions source. A GHG tax could be imposed upstream based on the carbon content of fuels (e.g., imposed at the level of fossil fuel or electricity suppliers) or at the point of combustion and emission (this would typically be applied for large point source emitters such as large industrial plants). This program would supplement that of RGGI and expand into other sectors. A tax should be evaluated for application into sectors not covered by RGGI to stimulate efficiencies in these other sectors.¶
Taxed entities may pass some or all of the cost on to consumers, change production processes to lower emissions, or a combination of the two. As the suppliers respond to the tax, consumers would see the implicit cost of GHG emissions in products and services, and could adjust their behavior to purchase substitute goods and services that result in lower GHG emissions. This price signal is an essential element of a market-based policy, leaving the choice of specific emissions reduction strategies to households and firms.¶
A GHG tax may be imposed in conjunction with other market-based climate change policies. Theoretically, a GHG tax and a cap-and-trade system can have the same outcomes with respect to emissions and the cost of carbon: either the tax rate is set to achieve a desired emission level or a cap is defined, and permit auction prices assign value to carbon emissions. In the optimum, both are equivalent with respect to emissions outcomes, assuming the permits are periodically re-issued and traded. But since a cap-and-trade system defines an emissions goal and mechanisms to reach it, it is unlikely that the goal will be surpassed. Combining a GHG tax with cap-and-trade may provide added benefits to compel emitters to continue to reduce emissions and even move beyond compliance.¶
GHG tax revenue could be used in a number of ways, from income tax reduction to policies and programs to support GHG reductions or technology innovation. GHG tax revenue could also be directed to helping the competitiveness of industries or assisting communities or groups most affected by the tax. There are additional opportunities to promote policy flexibility and equality through time-of-use tax rates (i.e., when is electricity consumed and generate ... [1]

RCI-10. Energy Efficiency Resource Standard (EERS)

Policy Description

An Energy Efficiency Resource Standard (EERS) is a market-based mechanism to require more efficient use of electricity and natural gas. State public utility commissions or other regulatory bodies set electric and/or gas energy savings targets for utilities. All EERS include end-use energy savings improvements; in some cases, distribution system efficiency improvements and combined heat and power (CHP) systems and other high-efficiency distributed generation systems are included as well.

The EERS is intended to achieve the incremental difference between the energy efficiency gains from RCI-2 (RGGI-funded) and the EmPOWER Maryland goals.

Policy Design

Goals: Together with RCI-2 and RCI-3, require the utilities to achieve energy savings equal to 15 percent of per capita demand by 2015.

For RCI-10, develop mandatory utility electricity reduction targets of 0.5% of demand in 2009, 1.0% in 2010, 1.5% in 2011-2013, and 2% in 2014-2015.

For RCI-10, develop mandatory utility natural gas reduction targets of 0.5% of demand in 2009, 1.0% in 2010, 1.5% in 2011-2013, and 2% in 2014-2015. The targets apply to natural gas to be used for energy purposes only; natural gas for use as feedstock is excluded.

- **Timing:** As above.
- **Parties Involved:** All load-serving electricity and natural gas entities.
- **Other:**

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Implementation Mechanisms

Utilities submit plans for efficiency programs to the Public Service Commission for approval. The plan must include a diverse portfolio of programs, including home energy assessments, energy efficiency rebates, commercial and industrial programs, training for contractors and facility managers, and demand response programs. The plan should evaluate programs in terms of cost-effectiveness, ability to capture opportunities for energy efficiency that would otherwise be lost, and fair distribution of programs geographically, relative to the source of the funds, and within sectors.

After the plan is approved, utilities issue RFPs for each type of energy service. Energy service companies of all shapes and sizes would be encouraged to submit bids and do the work.

Related Policies/Programs in Place

TBD – [as needed and approved by the TWGs]

Type(s) of GHG Reductions

Reduction in GHG emissions (largely CO_2) from avoided electricity production or on-site fuel combustion

Estimated GHG Reductions and Net Costs or Cost Savings

	GHG Reductions ($MMtCO_2e$)			Gross Costs (Million $)	Gross Benefits (Million $)	Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/t$CO_2$e)
	2012	2020	Total 2008-2020				
RCI – 10 Total	3.4	13.6	81.6	1872	-6,191	-4,319	-53
Electric DSM	2.9	11.7	70.4	1629	-5,042	-3,414	-48
NG DSM	0.4	2.0	11.1	244	-1,149	-905	-81

Data Sources:

- *General:* MEA modeling completed by Exeter (electric only, not natural gas)
- *Energy efficiency potential study*: See RCI-2
- *Cost of energy efficiency measures in Maryland:* See RCI-2
- *Experience in other states on cost of energy efficiency:* See RCI-2
- *Cost of saved natural gas*: See RCI-2
- *Avoided cost of fuels*

Quantification Methods:

- Estimate energy reduction based on the recommended energy reduction targets electricity and natural gas consumption.
- Estimate the total cost of electricity and natural gas savings
- Estimate the GHG emissions reduction through the electric energy efficiency measures.

Key Assumptions:

- *Discount Rate:*

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- *Avoided cost*: avoided cost data for major utilities in Maryland
- *Target electricity and natural gas efficiency savings until 2015*: The following table provides a placeholder assumption on energy savings target each year until 2020.

Year	Target
2008	0%
2009	0.50%
2010	1.00%
2011	1.17%
2012	1.33%
2013	1.50%
2014	1.75%
2015	2.00%
2016	2.00%
2017	2.00%
2018	2.00%
2019	2.00%
2020	2.00%

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- *Target electricity and natural gas efficiency savings after 2015:* 1.6% per year for electricity efficiency and 1.2% per year for natural gas efficiency based on a number of DSM potential studies and experiences by leading electric and natural gas utilities.
- *Cost of Electric Efficiency Measures:* Same assumptions as used for RCI-2.
- *Cost of saved natural gas:* Natural gas savings per $ of program investment is 72,700 MCF/yr per $ million based on the average cost of a number of gas DSM programs reported in SWEEP 2006. We will estimate the levelized cost of saved natural gas per MMBtu based on (1) natural gas savings per program investment above, (2) a 13 year average program lifetime, (3) a real discount rate
- *Efficiency Measure Lifetime:* Same assumptions as used for RCI-2.
- *Displaced Emissions*: Same assumptions as used for RCI-1.

Key Uncertainties

TBD – [as needed and approved by the TWGs]

Additional Benefits and Costs

TBD – [as needed and approved by the TWGs]

Feasibility Issues

TBD – [as needed and approved by the TWGs]

Status of Group Approval

Pending – [until MWG moves to final agreement at Meeting #5 or #6]

Level of Group Support

TBD – [blank until MWG Meeting #5]

Barriers to Consensus

TBD – [blank until final vote by the MWG/MCCC]

RCI-11. Phase out incandescent light bulbs in state

Policy Description

This policy option involves phasing out the sale or use of energy-inefficient incandescent light bulbs in the state. California has announced its plan to phase out the use of incandescent light bulbs by 2018, Nevada adopted a lighting efficiency standard for light bulbs sold beginning in 2012, and a number of other states are considering similar policies, including Connecticut, Rhode Island, and New Jersey. Australia and Ontario, Canada, have announced similar bans.

Incandescent bulbs waste roughly 95 percent of the electricity they consume—emitting heat rather than light. In contrast, efficient light bulbs emit more light (lumens) while consuming less electricity (watts). The typical incandescent bulb produces 14 lumens per watt, whereas a compact fluorescent bulb produces 63 lumens per watt. Compact fluorescent bulbs have the additional advantage of lasting up to ten times as long without burning out.

Policy Design

Goals: Improve the minimum efficiency of lighting to at least 25 lumens per watt by 2012 and have the Maryland Energy Administration propose higher efficiency standards beginning in 2016.

- **Timing:** As above.
- **Parties Involved:** All retailers.
- **Other:** If use of a type of incandescent bulb is required pursuant to federal, state or local statute or regulation, the phase out will exclude that type of incandescent bulb.

Implementation Mechanisms

Bulbs sold in state will be required to meet the minimum efficiency of lighting (25 lumens per watt). Enforcement to be conducted by…

The Maryland Energy Administration will conduct a review of the 25 lumens per watt standard in 2014 and propose higher efficiency standards beginning in 2016.

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The state should consider whether mercury from disposal of compact fluorescent bulbs may present a concern to human health or the environment. A recycling program for residential and commercial bulbs may be developed to address disposal.

Related Policies/Programs in Place

- Energy Independence and Security Act of 2007:

  This federal law establishes new minimum efficiency standards for common light bulbs, requiring them to use about 20-30% less energy than present incandescent bulbs by 2012-2014 (phasing in over several years) and requiring a DOE rulemaking to set standards that will reduce energy use to no more than about 65% of current lamp use by 2020.

Type(s) of GHG Reductions

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Reduction in GHG emissions (largely CO_2) from avoided electricity production or on-site fuel combustion

Estimated GHG Reductions and Net Costs or Cost Savings

	GHG Reductions ($MMtCO_2e$)			Gross Costs (Million $)	Gross Benefits (Million $)	Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/$tCO_2e$)
	2012	2020	Total 2008-2020				
RCI–11	0.1	0.0	0.4	8	-31	-24	-56

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Data Sources:

- U.S. Department of Energy. U.S. Lighting Market Characterization, Volume I: National Lighting Inventory and Energy Consumption Estimate. Prepared by Navigant Consulting, Washington, D.C.: U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, September 2002.
- One Billion Bulbs. Summary Statistics for Maryland. http://www.onebillionbulbs.com/Stats/State/MD (accessed December 11, 2007).
- 2004-2005 Database for Energy Efficiency Resources Update Study. California Public Utilities Commission and California Energy Commission, prepared by Itron, Inc., December 2005.
- U.S. Congress. House. *Energy Independence and Security Act of 2007*. H.R.6. 110th Cong., 1st sess.

Quantification Methods:

- Estimate the average number of incandescent bulbs in use per residential, commercial, and industrial buildings from DOE data on the average number of lamps per building.
- Estimate the per watt consumption of each bulb from DOE data on the average lamp wattage by sector.
- Use the average bulb wattage and assumption regarding the quantity and frequency of incandescent bulbs use to find average incandescent lighting load per building.

- Use the average incandescent lighting load per building and the assumed efficiency of using a CFL over an incandescent, to find total energy savings.
- Multiply the energy savings per bulb and the total number of bulbs in each building, times the number of buildings in Maryland. This should be building sector-specific.
- Multiply the incremental installed cost of each bulb times the number of bulbs to be replaced and subtract the avoided energy costs to find the net cost of bulb replacement.

Key Assumptions:

- Average number of bulbs in use by type per building by sector (DOE 2002):

Technologies	Residential	Commercial	Industrial
Incandescent	**37**	**91**	**33**
Standard - General Service	34	53	7
Standard – Reflector	2	17	6
Halogen - General Service	0.2	0.2	-
Quartz Halogen	0.1	4	1
Halogen - refl. - low volt	-	9	0.0
Low wattage (less than 25W)	-	9	20
Misc incandescent	-	-	-
Fluorescent	**6**	**324**	**1,340**
T5	-	1	0.1
T8 – less than 4'	-	7	28
T8 – 4'	-	83	631
T8 – More than 4'	-	0.4	0.1
T8 – U-bent	-	2	12
T12 – less than 4'	-	6	5
T12 – 4'	-	152	354
T12 – More than 4'	-	25	281
T12 – U-bent	-	7	7
Compact – Pin-base	-	21	6
Compact – Screw base	1	10	6
Compact – Pin-base – reflector	-	-	-
Compact – Screw base – reflector	0.0	1	1
Circline	-	5	8
Induction discharge	-	-	-
Miscellaneous fluorescent	5	1	2
HID	**0.0**	**7**	**67**
Mercury vapor	0.0	1	8
Metal halide	-	4	47
High pressure sodium	0.0	1	12
Low pressure sodium	-	0.1	0.3
Xenon	-	-	-
Electrodeless (e.g. mercury)	-	-	-
Solid State	**-**	**0.4**	**0.3**
LED	-	0.3	0.2
Electroluminescent	-	0.1	0.1
Total	**43**	**422**	**1,440**

Note: Individual values may not sum identically to the totals due to rounding

- Average bulb wattage by type and building sector (DOE 2002):

Lamp Type	Residential (watts)	Commercial (watts)	Industrial (watts)	Outdoor (watts)	Weighted Avg. (watts)
Incandescent	67	83	64	138	69
Fluorescent	38	41	48	150	41
HID	151	404	425	227	304
Solid State	-	5	5	15	6

- Average operating hours per day by sector and source (DOE 2002):

Lamp Type	Residential (hours/day)	Commercial (hours/day)	Industrial (hours/day)	Outdoor (hours/day)	National Avg. (hours/day)
Incandescent	1.9	10.2	16.7	7.9	2.8
Fluorescent	2.2	9.7	13.4	10.8	8.2
HID	2.8	10.1	13.9	11.3	11.0
Solid State	0.0	23.0	23.4	7.0	22.2
Sectoral Average	2.0	9.9	13.5	10.5	4.8

- A CFL reduces required lighting power by about 80% as compared to an incandescent.
- Number of buildings in each sector in Maryland
- Average energy price
- Incremental installed cost (including equipment and labor costs) of a 13 Watt CFL, with the equivalent of 62 lumens per watt or greater, is $8.03 (DEER 2005).
- Ramp rate for introducing CFLs into the market: ?

Table 8-7. Percentage of Electricity Consumption by Sector and Source, 2001

Lamp Type	Residential (% electricity)	Commercial (% electricity)	Industrial (% electricity)	Outdoor (% electricity)	National Avg. (% electricity)
Incandescent	90%	32%	2%	11%	42%
Fluorescent	10%	56%	67%	2%	41%
HID	0.3%	12%	31%	87%	17%
Solid State	0%	0.02%	0.00%	0.01%	0.01%
Totals	100%	100%	100%	100%	100%

Table 8-8. Percentage of Source Lumen Output by Sector and Source, 2001

Lamp Type	Residential (% lmhr/yr)	Commercial (% lmhr/yr)	Industrial (% lmhr/yr)	Outdoor (% lmhr/yr)	National Avg. (% lmhr/yr)
Incandescent	69%	8%	0%	2%	12%
Fluorescent	30%	78%	71%	1%	62%
HID	1%	14%	29%	96%	26%
Solid State	0%	0%	0%	0%	0%
Totals	100%	100%	100%	100%	100%

Key Uncertainties

Collection and disposal of compact fluorescent bulbs should be addressed to avoid mercury contamination.

Additional Benefits and Costs

There may be additional costs associated with the collection and disposal of compact fluorescent bulbs.

Feasibility Issues

TBD – [as needed and approved by the TWGs]

Status of Group Approval

Pending – [until MWG moves to final agreement at Meeting #5 or #6]

Level of Group Support

TBD – [blank until MWG Meeting #5]

Barriers to Consensus

TBD – [blank until final vote by the MWG/MCCC]

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Policy Description

A carbon or GHG tax is typically a tax on each ton of CO_2 purchased directly or emitted from an emissions source. A GHG tax could be imposed upstream based on the carbon content of fuels (e.g., imposed at the level of fossil fuel or electricity suppliers) or at the point of combustion and emission (this would typically be applied for large point source emitters such as large industrial plants). This program would supplement that of RGGI and expand into other sectors. A tax should be evaluated for application into sectors not covered by RGGI to stimulate efficiencies in these other sectors.

Taxed entities may pass some or all of the cost on to consumers, change production processes to lower emissions, or a combination of the two. As the suppliers respond to the tax, consumers would see the implicit cost of GHG emissions in products and services, and could adjust their behavior to purchase substitute goods and services that result in lower GHG emissions. This price signal is an essential element of a market-based policy, leaving the choice of specific emissions reduction strategies to households and firms.

A GHG tax may be imposed in conjunction with other market-based climate change policies. Theoretically, a GHG tax and a cap-and-trade system can have the same outcomes with respect to emissions and the cost of carbon: either the tax rate is set to achieve a desired emission level or a cap is defined, and permit auction prices assign value to carbon emissions. In the optimum, both are equivalent with respect to emissions outcomes, assuming the permits are periodically re-issued and traded. But since a cap-and-trade system defines an emissions goal and mechanisms to reach it, it is unlikely that the goal will be surpassed. Combining a GHG tax with cap-and-trade may provide added benefits to compel emitters to continue to reduce emissions and even move beyond compliance.

GHG tax revenue could be used in a number of ways, from income tax reduction to policies and programs to support GHG reductions or technology innovation. GHG tax revenue could also be directed to helping the competitiveness of industries or assisting communities or groups most affected by the tax. There are additional opportunities to promote policy flexibility and equality through time-of-use tax rates (i.e., when is electricity consumed and generated), energy variable rates (tax based on carbon amount in energy source), or through industry variable tax rates, which help less able industries cope with the GHG tax. Carbon taxes have been in place in a number of European countries since the early 1990s and have recently caught on in U.S. cities, Australia and Quebec.

Policy Design

Design Elements:

Tax either suppliers or consumers of fossil fuels (based on amount sold) and/or emitters of GHG (possibly based on electricity usage).

Consider all parties and exogenous factors when placing a tax to ensure significant mitigation, efficiency, and equality. This could include:

Availability of viable substitutes to different consumers and industries.

The impact of a tax on market compliments of fossil fuels.

Promote policy flexibility and equality through industry variable tax rates, time-of-use rates, variable energy source rates (contrast natural gas, oil, coal), and/or subsidies to parties most adversely affected by the tax.

Potential to implement in phases with an initial tax phase focusing on industry and a secondary phase focusing on the residential and commercial sectors; phases should be evaluated and updated prior to phase advancement.

Return revenue to those adversely affected by the tax (e.g., income tax cuts) and/or create a Green Fund that can further mitigate GHG.

Goals: Consider and evaluate design elements for a state tax on GHG emissions, with special attention to impacts on different industries. Any GHG tax would first need to mitigate GHG emissions and second, do so in an equitable and efficient manner. Additionally, compatibility with other GHG mitigation policies is critical; policy synergies should be sought after and policy redundancies avoided.

Timing: Initial tax rates must be adequate to achieve desired emissions reductions and the tax should occur in synchronization with other policies.

Parties Involved: Utility companies, non-renewable (fossil fuel) energy suppliers and retailers, energy-dependent sectors and industries, consumers and homeowners, and government agencies (federal, state, local).

Other: The focus has been on carbon, but other GHG could be considered.

Implementation Mechanisms

TBD – [CCS drafts based on TWG inputs; this can be developed as they go along, and can start early or late as they prefer; the level of detail can vary on TWG approval]

Related Policies/Programs in Place

Despite the widespread support of market-based mechanisms, GHG taxes have been rarely in the US to achieve a desired emissions level. Below are examples of GHG tax programs applied in four jurisdictions. The information shown may represent only part of that jurisdiction's total GHG tax program.

Jurisdiction	Where Tax Applied	Tax Rate – Applicability	Use of Revenue
Finland	Fuels	1993, \$3/ton of CO2 in fuel	Reimbursement via lower payroll taxes
Sweden	Residential and commercial electricity	2004, \$.002/kWh	Offset by income tax relief
UK	Electricity; renewable	2001, \$.0084/kWh	Fund established, and National

	energy exempt		Insurance rate cuts
City of Boulder, CO	Electricity	2006, (per kWh): Residential, $.0022 Commercial, $.0004 Industrial, $.0002	Funding for the City's Climate Action Plan

Types(s) of GHG Reductions

TBD – [CCS to list GHG reductions with input / approval from TWG]

Estimated GHG Reductions and Net Costs or Cost Savings

TBD – [CCS should provide a worksheet and other reference material as needed for transparency]

Data Sources: [TBD by CCS on TWG approval]

Quantification Methods: [e.g. Full life-cycle analysis with supply/demand equilibrium adjustments on TWG approval]

Key Assumptions: [TBD, as needed on TWG approval]

Key Uncertainties

TBD – [as needed and approved by the TWGs]

Additional Benefits and Costs

TBD – [as needed and approved by the TWGs]

Feasibility Issues

TBD – [as needed and approved by the TWGs]

Status of Group Approval

Pending – [until MWG moves to final agreement at Meeting #5 or #6]

Level of Group Support

TBD – [blank until MWG Meeting #5]

Barriers to Consensus

TBD – [blank until final vote by the MWG/MCCC]