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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 $)	Cost-Effectiveness ($/tCO_2e$)	Level of Support
		2012	2020	Total 2008–2020			
RCI -1	Improved Building and Trade Codes and Beyond-Code Building Design and Construction	0.6	2.4	14.2	-550	-39	Complete
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)	1.8	4.6	35.4	-1919	-54	Complete
RCI -3	Low-cost loans for energy efficiency	0.3	0.5	4.1	-187	-45	Pending
RCI -4	Improved design, construction, appliances, and lighting in new and existing state and local government buildings, "Government Lead-by-example"	0.3	1.4	7.6	-455	-60	Pending
RCI -5	Energy Efficiency and Environmental Impacts Awareness and Instruction in School Curricula	*Jointly considered with the CC TWG*					Complete
RCI -7	More Stringent Appliance/Equipment Efficiency Standards *(state-level, or advocate for regional or federal-level standards)*	0.1	0.2	1.5	-81	-54	Complete
RCI -8	Rate structures and Technologies to Promote Reduced GHG Emissions (including inverted block rates)	0.1	0.2	2.1	245	115	Pending
RCI -10	Energy Efficiency Resource Standard (EERS)	2.9	11.8	70.5	-3,648	-52	Pending
RCI-11	Promotion and Incentives for Energy Efficient Lighting	0.1	1.1	7.7	-362	-47	Complete
	Sector Total After Adjusting for Overlaps*	5.0	18.1	114.9	-5,528	-48	
	Reductions From Recent Actions	TBD	TBD	TBD	TBD	TBD	
	Sector Total Plus Recent Actions	TBD	TBD	TBD	TBD	TBD	

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* These totals account for the interaction between RCI policies. The benefits and costs of RCI policies overlap as follows: between residential and commercial new construction in RCI-1, RCI-2, and RCI-10; between RCI–4 and energy efficiency efforts in government and schools within RCI-2 and RCI-10; between RCI-7 and parts of RCI-2, RCI-4, and RCI-10; and between

RCI-11 and parts of RCI-2, RCI-4, and RCI-10. Overlaps also occur between RCI and Energy Supply, to the extent that demand is reduced by RCI measures, and generation emits less GHGs after ES policies; adjustments for overlaps between RCI and ES are TBD. An overlap with AFW-2 has been identified but also has not been quantified here.

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 and Beyond-Code Building Design and Construction in the Private Sector

Policy Description

Buildings are significant consumers of energy and other resources, and can contribute to local microclimates. 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.

This policy sets a goal for reducing building energy consumption, to be achieved by increasing standards for the minimum performance of new and substantially renovated commercial and residential buildings through the adoption and enforcement of building and trade codes. Building codes would be made more stringent via incorporation of aspects of advanced/next generation building designs and construction standards, such as LEED or a comparable standard. 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, builders, 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.
- Incorporating future code upgrades by reference language in the statute or regulation to avoid having to re-open the rule each time the referenced body changes its code.
- Targeting existing buildings for efficiency improvements during both major and minor renovation, through application and enforcement of building codes and/or with tax rebates or other incentives.
- Encouraging or requiring continued high performance of buildings that receive tax rebates or other incentives, through participation in LEED for Existing Buildings (LEED-EB) or comparable standard.
- 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.

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- Establishing specific goals for the size of building to be included, e.g. using Montgomery County Bill 17-06 as a model.
- Setting a cap on consumption of energy per unit area of floorspace for new buildings.
- Requiring high-efficiency appliances in new construction and retrofits.
- Providing incentives, such as permitting and fee advantages, tax credits, financing incentives (such as “green mortgages”), or other inducements to encourage retrofit of existing residential and commercial buildings or for the development of non-traditional off-grid low and carbon neutral energy sources. The state can work with financial institutions to develop loan tools for these programs.

Advanced/next-generation building design requirements might include use of specific materials (e.g., local building materials), implementation of specific technologies (e.g., energy-efficient roofing materials and landscaping to lower electricity demand), or attainment of points under an advanced standard (e.g., LEED or a comparable standard). Energy-reduction targets should be periodically reassessed.

Potential measures supporting this policy can include outreach and public education, public recognition programs, improved enforcement of building codes, encouraging or providing incentives for energy tracking and benchmarking, performance contracting/shared savings arrangements, technical support resources for implementation, development of a clearinghouse for information on and access to software tools to calculate the impact of energy efficiency and solar technologies on building energy performance.

Policy Design

Goals:

- 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.
- Reduce energy consumption per square foot of floor space by 15% by 2010 and 50% by 2020.
- 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, 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 Green Building Council

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 (or comparable standard) 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. Tax credits for the residential sector could be effective for 2 years and based on the assessed property value of new, private residential units that achieve the beyond code level desired in a given year. Tax credits for the commercial sector could be capped at 10 years and based on the incremental construction cost for new, private commercial buildings that achieve the beyond code level desired in a given year.
- **High Performance Building Codes for Energy and Efficiency**: These specify minimum energy efficiency requirements for new buildings or for existing buildings undergoing a major renovation and/or additions. The minimums specified could be updated.
- **Tax rebates or other incentives for ongoing building performance:** Encourage or require participation in LEED for Existing Buildings (LEED-EB) or a comparable standard to ensure continued high building performance through proper building operations and maintenance.
- **Increased Tax Incentives:** Develop incentives for building energy efficiency improvements.
- **Empower Maryland Program**: This policy could build upon this existing program (applicable to state buildings) by encouraging private sector facilities to meet the same building design and performance standards.
- **Strengthen Regional Partnerships:** Such as NEEP (Northeast Energy Efficiency Partnership) in order to assure consistency and economies of scale.

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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.
- **Beyond Code:** US Green Buildings Council's LEED™ New Construction (NC), LEED™ Existing Buildings (EB), LEED™ Core and Shell (C&S), and LEED™ Homes (H), EPA ENERGY STAR and HPH100, Architecture 2030 , and the American National Standard Institute's National Green Building Standard (under development)
- **Legislative Action:** Local governments (see Montgomery County Bill 17-06 and Green Schools Focus, the City of Baltimore and the City of Annapolis adopted) have proposed and adopted standards for building energy and efficiency, interest in "standard 189" code, the Empower Maryland Program, the Maryland Energy Administration's incentives for installation of certain renewable energy technologies, the Maryland Public Service

Commission's rules allowing net-metering from qualifying self-generators of renewable energy, including: PV, wind, and biomass, up to 200 kilowatts, the 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

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–1 Total	0.6	2.4	14.2	537	-1,086	-550	-39
Residential New/Major Renovations	0.5	2.0	12.1	476	-931	-455	-38
Commercial New/Major Renovations	0.1	0.4	2.1	61	-156	-95	-46

Data Sources:

Building Codes Assistance Project (BCAP), personal communications with Aleisha Khan

R. Ewing, K. Bartholomew, S. Winkelman, J. Walters, and D. Chen. 2007, "Growing Cooler: The Evidence on Urban Development and Climate Change" Urban Land Institute. http://www.smartgrowthamerica.org/gcindex.html.

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

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)

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).

Costs:

- Greg Katz and Jon Braman. Greening Buildings and Communities: Costs and Benefits. Draft Findings on the Cost Premium, Energy and Water Savings by LEED Level. 2008. (unpublished, under review)
- ICC Code Website. Building Valuation Data. http://www.iccsafe.org/cs/techservices/ (accessed March 13, 2008).

Quantification Methods:

Benefits: The timing of the implementation of future building codes was determined. Then, the percentage of new and renovated homes and buildings that would comply with the new building codes instead of 2006 IECC was determined. Incremental energy savings goals were also determined based on the current energy savings trajectory for residential and commercial buildings for 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.

Key Assumptions:

While this policy applies to new structures, existing structures undergoing major renovations and existing structures undergoing more minor renovations, the impacts from existing structures undergoing more minor renovations were not modeled because the number of structures involved is not known. Also, there would be a wide variety of measures implemented with a range of possible energy savings.

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.

The building code 3-year cycle will start in 2009. Incorporation of beyond-code elements into building codes will occur starting with the second code cycle in 2012.

This analysis also assumes that improvements are incremental to a scenario where the status quo persists. 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 current code. The benefits and costs for renovated homes are derived in the same way; instead of being renovated to current code, 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 Updates	405,916	9,498	Calculated assumption
Avg. Energy Use for a New/Renovated Home/Building	0.00005 bbtu/sq. ft./yr	0.00007 bbtu/sq. ft./yr	Calculation of energy use divided by projected number of square feet
Avg Square Footage per New/Renovated Building	1,700	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: 30% 2012 IECC: 35% 2015 IECC: 40% 2018 IECC: 45%	2009 IECC: 5% 2012 IECC: 30% 2015 IECC: 33% 2018 IECC: 36%	Provided by Aleisha Khan at BCAP
Energy Savings Goals	2009: 30% 2012: 40% 2015: 45% 2018: 50%	2009: 15% 2012: 30% 2015: 40% 2018: 50%	Assumes more aggressive building codes incorporating elements of LEED or other beyond code measures

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Assumption	Residential Sector	Commercial Sector	Notes
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 (2008-2020): 0.77 MtCO2e/MWh, or 224.3 (MtCO2/BBtu) , Natural Gas: 54 tCO2e/Bbtu		Electricity: generation-weighted average of projected annual CO2e emissions by utilities and non-utilities (excluding commercial & industrial CHP) for the marginal fuels. Generation and emissions projections are taken from the MD GHG emissions forecast. Coal, natural gas, and petroleum are assumed to be on the margin, Natural Gas: EPA 2003 US GHG inventory, Appendix A
T&D Electricity Loss	10%		Placeholder assumption
Avoided Energy Costs	Electricity: $24,434/Bbtu (2006$) Natural Gas: $8,061/Bbtu (2006$)		Maryland-specific; calculated based on 15-year BG&E and 5-year 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.

Costs:

Assumption	Residential Sector	Commercial Sector	Notes
Real Discount Rate	5%		Placeholder assumption
Capital Recovery Factor for Levelization	6.20% Interest Rate: 5.0% Period: 30 yrs	6.52% Interest Rate: 5.5% Period: 30 yrs	Calculated assumption
Average Construction Cost of a Home/Building	$187,425	$1,546,610	Based on national estimates from the International Code Council (ICC)
Incremental Costs from Building Code Improvements	2009: 2% 2012: 2% 2015: 3% 2018: 4%	2009: 0.5% 2012: 2% 2015: 2% 2018: 4%	Based on the incremental costs of LEED levels with like energy savings

For simplicity, every home or building, without regard for the year when it is retrofitted or built, is assumed to achieve 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.

It is assumed that renewable energy purchases (off-site electricity generation from renewables) are one of the ways with which the home or building can accomplish the given goal.

Key Uncertainties

Assumptions for which there was little to no supporting data include:

- The number of renovated homes and buildings;
- The building code compliance rate; and
- The cost of building code implementation.

Additionally, the cost of new construction is based on national estimates. Region-specific estimates are not available but may be either higher or lower than these costs.

In its "Growing Cooler" report, the Urban Land Institute predicts a reversal of 20th-century sprawling development patterns towards increasing demand for compact development, due in part to a relative decline in the share of households with children versus those made up of older Americans (http://www.smartgrowthamerica.org/gcindex.html). Energy consumption in large-lot homes is generally higher than in compact development, which tends to be more tightly built, and for which much of the heat loss occurs into adjacent unit(s). If Maryland experiences higher demand for compact development, as projected by ULI on a nation-wide basis, baseline energy consumption could be lower, and hence costs of attaining a given level of energy savings under RCI-1 would be lower. No adjustment has been made to the policy analysis or baseline, because estimates of the energy savings associated with compact development vary widely, and data to apply these efficiencies to the baseline in Maryland are lacking.

Estimates for the incremental cost of beyond-code improvements vary widely, and these assumptions represent the lowest costs we have seen to date.

Also, there is a need to better define and distinguish major from minor renovations.

There is a need to define the threshold which would trigger the need for a building code permit.

Additional Benefits and Costs

- Resource conservation, including water – lower water demand leads to lower costs and reduced energy use for water production. In the City of Annapolis, water utility and sewer pumps account for around 23% of energy use and 30% of CO_2e emissions.
- 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

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. 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 for smaller counties in particular.

The energy savings trajectory is more aggressive for the Commercial sector as compared to the Residential sector. Because Commercial building codes are not slated to achieve the same reductions as the Residential building codes, a greater effort must be made with regard to increasing the stringency of these building codes such that the Commercial sector meets the same goal as the Residential sector. However, the feasibility of the energy savings trajectory as defined for the Commercial sector is unknown.

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:

- Establishment of ongoing, high-level statewide resource planning in coordination with the Public Service Commission.
- 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.

RCI-2 is intended to achieve the incremental difference between the energy efficiency gains from RCI-10 (the Energy Efficiency Resource Standard) and statewide application of the EmPOWER Maryland goals (15% per capita electricity and natural gas use by 2015).

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.
- 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

- Establish of ongoing, high-level statewide resource planning in coordination with the Public Service Commission.
- Facilitate 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. Invest in consumer education and program marketing.
- 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.
- 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.
- Provide incentives to address potential "lost opportunities" in new construction, equipment and appliance replacement, and retrofits.
- Promote the purchase of appliances, thermostats, and compact fluorescent lamps (CFLs) that qualify for current ENERGY STAR® or better (See also RCI-7 and RCI-11.)

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  Deleted: by sales tax exemptions

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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.
- Promote specific technologies, including incentives for solar hot water installation. Solar hot water systems reduce use of other fuels for water heating (largely electricity and natural gas), thereby avoiding GHG emissions, reducing Maryland's dependence on natural gas, and potentially reducing the price of this fuel.
- Possible funding sources: proceeds of RGGI allowance auctions, Environmental Trust Fund, or a new public benefits charge

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

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 – 2 Total	1.8	4.6	35.4	913	-2832	-1919	-54
Electric DSM	1.5	3.8	29.1	707	-2182	-1476	-51
NG DSM	0.3	0.8	6.3	206	-650	-443	-70

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*
    - Optimal Energy Inc. et al. 2006. Natural gas Energy Efficiency Development Potential in New York, October 31, 2006
    - Southwest Energy Efficiency Project 2006. Natural Gas Demand-Side Management Programs: A National Survey, available at www.swenergy.org

Quantification Methods:

(1) Develop energy savings targets for RCI-2 and RCI-10

(2) Develop a maximum achievable DSM savings scenario, which aims to attain the 15% energy savings goal by 2015. After 2016, the maximum achievable annual savings scenario for gas and electric DSM draws on experience in other states.

(3) Estimate energy savings from RCI-2 as the difference between RCI-10 and the maximum achievable DSM savings scenario.

(4) Estimate energy reduction based on the percentage reduction goal in per capita electricity and natural gas each year until 2015 for RCI-2 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.)

(5) Estimate the total cost of electricity and natural gas savings, capped at $100 million per year.

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

Key Assumptions:

- *Discount Rate:* Same assumptions as used for RCI-1.
- *Cost of financing:* 0% interest rate (DSM costs are incurred as the Systems Benefits Charge (SBC) is collected)
- *Avoided cost of electricity and fuels:* Same assumptions as used for RCI-1.
- *Maximum achievable electricity and natural gas efficiency savings until 2015, for RCI-2 and RCI-10*:

Year	Target
2008	1%
2009	2%
2010	3.5%
2011	5%
2012	7%
2013	9%
2014	12%
2015	15%

- *Maximum achievable 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 07/12/06
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

- *Cost of saved natural gas:* $2.47/MMbtu based on Optimal Energy Inc. et al. (2006), which investigated the natural gas energy efficiency potential in downstate (urban and suburban) and upstate (predominantly rural) New York State. The downstate cost of saved natural gas is used here, as it is assumed to be more applicable to State of Maryland.
- *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.
- *Electric Efficiency Measure Lifetime:* 13 years on average for electricity DSM
- *Displaced Emissions*: Same assumptions as used for RCI-1.

Key Uncertainties

The source of funding to implement the aggressive DSM program envisioned here is uncertain.

Additional Benefits and Costs

- 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 the risk of power shortages

- 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

Feasibility Issues

None noted.

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

Revolving loan funds are effective tools for promoting energy efficiency investment. This policy involves the creation of revolving low-interest loan fund(s) targeting distribution service areas that are not covered by existing utility programs, as well as expanding the scope of existing programs in areas that are currently covered. RCI-3 is intended to complement the programs being considered as part of RCI-2 and RCI-10.

The policy could help a variety of customer classes improve the energy efficiency of their building or residence through one or more specific measures. While this policy does not support comprehensive improvements for each participant, the measures that are installed would likely be some of the most needed improvements and thus deliver significant energy savings. Measures that are good candidates for this program would likely include appliance replacements and/or furnace, boiler, and/or hot water heater upgrades. This policy is not intended to fund major structural changes to residences and buildings or large-scale renovations such as replacing roofs or windows. The action would 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. Terms of the loan can be designed to allow loan repayment as cost savings on utility bills are realized. 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:

- Establish revolving loan funds for small-scale residential and commercial energy efficiency projects. Government funding will provide $15 million ($10 million for the Residential sector and $5 million for the Commercial sector), to be leveraged with private capital ($40 million for the Residential sector and $20 million for the Commercial sector) to create a larger fund and allow for greater participation.

Timing: Applications for loan funds will be reviewed in 2008 and allocation and use will occur starting in 2009.

Parties involved:

- Residential and commercial property owners and tenants
- Government housing and other state and federal government agencies
- Weatherization and energy service providers
- 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

- Implement loan programs to target difficult-to-reach populations. Pay-as-you-save programs, or other loan programs that link energy efficiency savings to the meter to pay for them over time, should be included in the suite of loan programs. Utilities would be encouraged to submit proposals to the PSC, which would review and have authority to approve proposals.
- 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.
- Complementary measures to target rental properties may be needed. The state should consider the feasibility of the following measures:
    - Completing 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
    - Establishing and enforcing requirements that rental properties meet energy and appliance codes
    - Requiring landlords to meet efficiency standards (such as current ENERGY STAR or better) at the time the rental occupancy changes
    - Providing 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
    - Benchmarking rental properties using the ENERGY STAR benchmarking program or equivalent. Target low performing buildings, using a combination

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of incentive payments from RCI-2 and financing to produce the highest possible improvements

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 ENERGY STAR mortgage plan offered by the Southern Maryland Energy Cooperative if they purchase an ENERGY STAR 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 bill financing mechanisms
- 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

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 $)	Cost-Effectiveness ($/tCO₂e)
	2012	2020	Total 2008-2020				
RCI–3 Total	0.3	0.5	4.1	163	-351	-187	-45
Residential	0.2	0.4	3.2	137	-272	-135	-42
Commercial	0.1	0.1	0.9	26	-79	-53	-59

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Data Sources:

- *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*
    - Optimal Energy Inc. et al. 2006. Natural gas Energy Efficiency Development Potential in New York, October 31, 2006

Deleted: <#>Residential Square Footage from Comparison of Newer and Older California Homes Energy Use and Efficiency Measures Saturation, page 15, at: http://aceee.org/conf/06et/st2_friedmann.pdf¶
<#>Commercial Square Footage from CBECS¶

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Quantification Methods:

Benefits: Assumptions about the funding pool, the percent of the funding pool that will be used to fund measures that save electricity vs. natural gas, the cost of saved electricity and natural gas, the average loan amount per building and the average loan payback period were made. The number of homes and buildings that could be reached by the policy in the first year was calculated by dividing the funding pool by the average loan amount per home or building. The number of homes and buildings that could be reached in subsequent years was calculated by dividing the amount of funds that were repaid in that year by the average loan amount per home or building. The energy savings were calculated by breakout out the funding pool into funds for electricity vs. natural gas measures and multiplying these pools by the energy savings per dollar spent in the first year on electricity and natural gas measures, respectively. Greenhouse gas emission reductions were calculated using emissions factors for each fuel type. The avoided costs by fuel type were also calculated.

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Deleted: multiplying the average percent energy reduction per square foot per home or business, by the average energy use per square foot of a home or business, and by the number of participating homes and businesses. After the energy savings were broken out by fuel type, the g

Costs: Assumptions about the difference between the interest rates for the government and participants were developed. The government interest was calculated by multiplying the full loan amount by the interest rate for the government for each year. The participant interest was calculated by multiplying the loan that had not been paid off by the participant interest rate for each year. The cost was calculated as a sum of the difference between the interest the government is paying on the loan and interest that is being paid to the government by participants who are holding portions of that loan each year, plus the total loaned amount. The loan amount was calculated as the total amount lent out over the entire period (because the loan was 're-lent' as it was repaid, subsequent 'lendings' of the same money were counted).

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Key Assumptions:

100% of the fund are lent out to participants in the first year. As soon as the loan is repaid by a participant, those funds are immediately lent out to another participant.

The interest is calculated at the end of each year based on the simple assumption that all of the funds are lent out and paid back at the beginning of each year. No corrections for mid-year transactions have been made. The interest was compounded over time.

Default risk, though more likely when working specifically with low-income populations, was not assessed in this analysis.

Assumption	Residential Sector	Commercial Sector	Notes
Loan Fund	$50,000,000	$25,000,000	Placeholder assumption
Loan Payback Period	5 years	10 years	Placeholder assumption
% Fund Allocated to Electricity vs. Natural Gas Measures	68%		Based on Maryland electricity and natural gas revenues across all sectors
Btus Saved per $ spent on Electricity Measures	0.01 MMBtu/$		Based on experience from Maryland and other states
Btus Saved per $ spent on Natural Gas Measures	0.04 MMBtu/$		Based on experience from other states
Proportion of Energy Savings by Fuel Type, Emissions Factors, T&D Electricity Loss, and Avoided Energy Costs	Same assumptions as used for RCI-1.		

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Costs:

Assumption	Residential Sector	Commercial Sector	Notes
Real Discount Rate	Same assumptions as used for RCI-1.		
Government Interest Rates	4.00%	4.00%	Used for all government policies
Participant Interest Rates	2.00%	2.00%	Placeholder assumption

Key Uncertainties

Many of the assumptions in this analysis are targets rather than based on actual data from an existing program, and are therefore uncertain. These include:

- The amount of the loan fund

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- The average loan payback period; and
- The amount of electricity and natural gas savings that can be achieved per dollar spent.

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Appropriation(s) must be made for establishing the fund. The source of these funds is uncertain.

Additional Benefits and Costs

- 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 the risk of power shortages
- 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

Feasibility Issues

Default risk may be an issue if low-income populations are targeted.

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 (including 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. Energy savings measures can pay for themselves through reductions in energy costs and improvements in workforce efficiency over the lifetime of the structure. All new State buildings and facilities, and renovations and additions shall be Leadership in Energy and Environmental Design (LEED) certified at the Gold or Platinum level (the stringency of this policy increases over time), or certified to a comparable standard, and meet or exceed the energy efficiency and renewable energy goals below stated.
- Participation in LEED for Existing Buildings (LEED-EB) or a comparable standard would be encouraged or required for government buildings and facilities to ensure continued high performance through proper building operations and maintenance.
- 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.
- 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.

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- 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 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. 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.
- **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

Implementation Mechanisms

- **Mandate that all new construction and major renovations of government-owned buildings**, including schools and publicly-owned hospitals, meet the following standards:
    - LEED™ Gold or a comparable standard, for buildings that are constructed between 2009 and 2012;
    - LEED™ Platinum or a comparable standard, for buildings that are constructed between 2013 and 2020.

- **Consider Innovative Financing:** Matthew Brown (former Energy Policy Director with National Council for State Legislature, currently working for Governor Ritter of Colorado on energy efficiency and renewable energy financing) offered some thoughts about how public money could be used to keep financing costs and risks to a minimum. More benefits could be achieved, at potentially similar financing costs, using these principles:
    - Incoming cash flow or dedicated funds (e.g. RGGI allowance revenues) can be used as leverage to buy down interest rates by providing a loss reserve (i.e., collateral for a loan, which can bring down interest rates by 2% or more), while at the same time earning interest for the state.
    - Incoming cash flow or dedicated funds can also provide support for low-cost bonds. With this strategy, it is important not to have to "call" on funds.
    - Leveraging private capital can expand the options open to public entities. Public-private financing is a fairly new and developing area, and existing business models are diverse. However, there is a large amount of interest and capital being considered for such investments (for example, Bank of America is financing $20 billion, mostly for renewable energy, but it includes generic "green" investments that could definitely be energy efficiency). Private investment will generally require a higher rate of return than secured public financing, but the private rate will not necessarily be higher than the rate of return on public, unsecured debt. If backed by public dollars to buy down the rate and establish a loss reserve, private funding could have a low rate.
- **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.
- **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.
- **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

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–4 Total	0.3	1.4	7.6	124	-578	-455	-60
Government Buildings	0.3	1.2	6.6	110	-507	-398	-60
Schools	0.0	0.2	0.9	14	-71	-57	-61

Data Sources:

U.S. Energy Information Administration, Commercial Buildings Energy Consumption Survey (CBECS), http://www.eia.doe.gov/emeu/cbecs/

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.

Greg Katz and Jon Braman. Greening Buildings and Communities: Costs and Benefits. Draft Findings on the Cost Premium, Energy and Water Savings by LEED Level. 2008. (unpublished, under review)

ICC Code Website. Building Valuation Data. http://www.iccsafe.org/cs/techservices/ (accessed March 13 , 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.

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	Energy Savings from Existing Bldgs	Notes on Existing	Energy Savings from New Bldgs	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%)	50%	LEED Platinum
2014	30%	ENERGY STAR Standard (15% + 15%)	50%	LEED Platinum
2015	30%	ENERGY STAR Standard (15% + 15%)	50%	LEED Platinum
2016	30%	ENERGY STAR Standard (15% + 15%)	50%	LEED Platinum
2017	40%	LEED Certification/Silver (15% + 25%)	50%	LEED Platinum
2018	40%	LEED Certification/Silver (15% + 25%)	50%	LEED Platinum
2019	40%	LEED Certification/Silver (15% + 25%)	50%	LEED Platinum
2020	50%	LEED Silver/Gold (15% + 35%)	50%	LEED Platinum

For Government Buildings

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

Year	Energy Savings from Existing Bldgs	Assumed Incremental Cost for Existing Bldgs	Energy Savings from New Bldgs	Assumed Incremental Cost for New Bldgs
2009	15%	$16,182	40%	2.0% increase
2010	15%	$16,182	40%	2.0% increase
2011	15%	$16,182	40%	2.0% increase

Year	Energy Savings from Existing Bldgs	Assumed Incremental Cost for Existing Bldgs	Energy Savings from New Bldgs	Assumed Incremental Cost for New Bldgs
2012	15%	$16,182	40%	2.0% increase
2013	15%	$16,182	50%	4.0% increase
2014	30%	$16,182 * 2.0	50%	4.0% increase
2015	30%	$16,182 * 2.0	50%	4.0% increase
2016	30%	$16,182 * 2.0	50%	4.0% increase
2017	40%	$16,182 * 2.7	50%	4.0% increase
2018	40%	$16,182 * 2.7	50%	4.0% increase
2019	40%	$16,182 * 2.7	50%	4.0% increase
2020	50%	$16,182 * 3.3	50%	4.0% 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
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	5.6% Interest Rate: 4% Period: 30 yrs		Calculated assumption
Avg Construction Cost of a Building	$3,458,708		Based on national estimates from the International Code Council (ICC)

For Schools

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

Year	Energy Savings from Existing Bldgs	Assumed Incremental Cost for Existing Bldgs	Energy Savings from New Bldgs	Assumed Incremental Cost for New Bldgs
2009	15%	$14,783	40%	2.0% increase
2010	15%	$14,783	40%	2.0% increase
2011	15%	$14,783	40%	2.0% increase
2012	15%	$14,783	40%	2.0% increase
2013	15%	$14,783	50%	4.0% increase
2014	30%	$14,783 * 2.0	50%	4.0% increase
2015	30%	$14,783 * 2.0	50%	4.0% increase
2016	30%	$14,783 * 2.0	50%	4.0% increase
2017	40%	$14,783 * 2.7	50%	4.0% increase
2018	40%	$14,783 * 2.7	50%	4.0% increase
2019	40%	$14,783 * 2.7	50%	4.0% increase
2020	50%	$14,783 * 3.3	50%	4.0% increase

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 School 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.		

Assumption	Existing Bldgs	New Bldgs	Notes
Capital Recovery Factor for Levelization	Same assumptions as used for Government Buildings.		
Average Construction Cost of a Building	$5,027,732		Based on national estimates from the International Code Council (ICC)

Key Uncertainties

Assumptions for which there was little to no supporting data include:

- The percentage of existing and new buildings that can be effectively reached with this policy;
- The ratio between average commercial building energy use and government/school building energy use; and
- The incremental cost to renovate existing government buildings to achieve beyond code energy savings.

Additionally, the cost of new construction is based on national estimates. Region-specific estimates may be either higher or lower than these costs.

Additional Benefits and Costs

- With any lead-by-example policy, the intent is that state employees will become interested in implementing the types of energy savings measures they are exposed to at work in their own commercial buildings and/or residential homes. Another way that this initiative can spread is through word of mouth to the employees friends and family. (This policy analysis did not include a quantification of this additional benefit.) See CC-4.
- Indoor comfort and air quality improvements, with related improvements in health and productivity
- Savings on energy bills
- Electricity system benefits: reduced peak demand, reduced capital and operating costs, improved utilization and performance of electricity system
- Reducing the risk of power shortages
- 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

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

Jointly considered with the CC TWG. See CC-5.

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

Combined with RCI-1

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 19 residential products and 19 pieces of commercial equipment, as well as 14 lighting standards. 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.
- **Timing:** As noted above.

[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.

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

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).

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

Manufacturers shall be required to keep spare parts for existing appliances for a specified number of years, if mandated by and consistent with federal regulation.

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 2006 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. All of the appliances from this act are included in the appliances recommended by the 2006 Appliance Standards Awareness Program. However, the standards for all of these appliances, except for bottle-type water dispensers, commercial hot food holding cabinets, and residential furnaces, will be superseded by the federal Energy Independence and Security Act of 2007. 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 2006 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

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–7	0.1	0.2	1.5	23	-104	-81	-54

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 and the federal Energy Independence and Security Act of 2007.

- 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 to efficiency standards in other states (http://www.standardsasap.org/state.htm). Consistent with ASAP assumptions, appliances are assumed to be available starting in 2008, except for commercial boilers, distribution transformers, pool heaters, and residential furnace fans, which are assumed to be available as of 2010, 2010, 2013, and 2014 respectively.
- *Capital Recovery Factor:* 10.27%, consistent with a 5.25% interest rate (average of commercial and residential rates) and 13 year asset life

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

- Reduction in water use for some appliance upgrades – lower water demand leads to lower costs and reduced energy use for water production. In the City of Annapolis, water utility and sewer pumps account for around 23% of energy use and 30% of CO2e emissions.
- 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
- Reducing dependence on imported fuel sources
- Reducing energy price increases and volatility

Feasibility Issues

The feasibility of this policy option is enhanced by ongoing efforts in nearby states and at the federal level.

Status of Group Approval

Complete.

Level of Group Support

Unanimous consent.

Barriers to Consensus

Not applicable.

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

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:

- Tiered (increasing/inverted block) surcharges on electricity transmission and distribution charges, which keep base usage rates affordable but increase with increasing consumption. Similarly, inverted block rates for natural gas use may be considered.
- 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.
- "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 2 -tiered, inverted-block surcharge structure for all commercial and residential electricity customers, to be placed on electricity transmission and distribution charges. The cheapest tier should apply to a percentage of average consumption. 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 two-tiered surcharge 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:** residential and commercial electricity customers, utilities, OPC, PSC, MEA
- **Other:**

Implementation Mechanisms

A two-tiered surcharge, applicable to all residential and commercial customers, will be proposed by the utilities and approved by the PSC within 12 months. The revenues from this surcharge will be invested in DSM programs.

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, 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.

Related Policies/Programs in Place

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

AMI filings with the Maryland Public Service Commission (Case Number: 9111):

- Application of Potomac Electric Power Company for Authority to Establish a Demand-Side Management Surcharge, an Advance Metering Infrastructure Surcharge and to Establish a DSM Collaborative and an AMI Advisory Group. (ML# 105286),
- Application of Delmarva Power & Light Company for Authority to Establish a Demand-Side Management Surcharge, an Advance Metering Infrastructure Surcharge and to Establish a DSM Collaborative and an AMI Advisory Group. (ML# 105287)

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 (assuming 0.5% savings from smart metering)	0.1	0.2	2.1	408	-163	245	115
DSM Surcharge – Residential	0.04	0.0	0.3	0	-30	-30	-96
DSM Surcharge – Commercial	0.01	0.0	0.1	0	-6	-6	-96
Smart Metering:							
0.5% savings	0.1	0.2	1.8	408	-127	281	160
1.5% savings	0.2	0.7	5.3	408	-381	28	5
3.0% savings	0.4	1.4	10.5	408	-761	-353	-34

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:*
  - ACEEE et al. 2008. Maryland's Clean Energy Future Potential For Energy Efficiency And Demand Response To Meet Electricity Needs In Maryland
- Distribution curve for electricity consumption
  - EIA Residential Energy Consumption Survey (RECS) 2001
  - EIA Commercial Buildings Energy Consumption Survey (CBECS) 2003
- *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
  - 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
  - Primen, Inc. 2004. California Information Display Pilot Technology Assessment, www.ucop.edu/ciee/dretd/documents/idp_tech_assess_final1221.pdf.

- *Cost of Metering*
    - 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, available at http://www.eei.org/meetings/nonav_2007-02-07-ja/index.htm
- Metering Deployment Schedule
    - The Brattle Group 2007. Quantifying Customer Benefit from Reductions in Critical Peak Loads from PHI's Proposed Demand-Side Management Program, September 21, 2007.
- Energy Savings from Smart Metering
    - IBM Global Business Services et al. 2007. Ontario Energy Board Smart Price Pilot Final Report, July 2007, available at http://www.oeb.gov.on.ca/html/en/industryrelations/ongoingprojects_regulatedpriceplan_smartpricepilot.htm
    - Summit Blue Consulting, LLC. 2007. Final Report for the MyPower Pricing Segments Evaluation, submitted to Public Service Electric and Gas Company, December 21, 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 (i.e., residential and commercial).
- Determine two levels of surcharges that are applied to different levels of consumption thresholds (e.g., 3 mills per kWh above 830 kWh per month per household (or 10 MW per year) and 5 mills per kWh above 1420 kWh per month per household; 3 mills per kWh above 0.8 kWh per month per square foot of commercial floor space and 5 mills per kWh above 1.3 kWh per month per square foot)
- Develop distribution curves for electricity consumption by residential and commercial customers using the data available in EIA's RECS 2001 and CBECS 2003.
- Identify the total amount of consumption for three consumption groups (A, B, and C) where households in Group A consume less than the first threshold per year, households in Group B consume above the first threshold up to the second threshold per year, and households in Group C consumes above the second threshold.

- Identify the level of consumption for consumers in each group that is subject to each consumption threshold as a percentage of the total residential or commercial consumption. (e.g., the sum of the consumption levels for households in Group B that is not subject to surcharges is about 26% of the total residential consumption and the sum of the consumption levels that is subject to the first surcharge is about 22%).
- Apply the percentage of the total consumption subject to each surcharge to the total consumption in each year
- Apply surcharges to appropriate consumption segments.
- 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:

- 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 be placed on Time-of-Use rates.
- *DSM Surcharge*: 3 mills per kWh above the first threshold (Group B) and 5 mills per kWh above the second threshold (Group C).
- *Fraction of Total Regional Consumption by Residential Grouping (for Surcharge)*:

Group A	13%
Group B	48%
Group C	39%
Total	100%

- *Level of Household Consumption Subject to Each Surcharge as Percentage of Total Residential Consumption in Each Consumption Group*

	No Surcharge	1st Surcharge	2nd Surcharge	Total
Group A	13%	0%	0%	13%
Group B	26%	22%	0%	48%
Group C	13%	11%	15%	39%
Total	53%	32%	15%	100%

- *Fraction of Total Consumption by Commercial Grouping in Maryland (for Surcharge)*

Group A	13%
Group B	51%
Group C	36%
Total	100%

- *Level of Consumption Subject to Each Surcharge as Percentage of Total Commercial Consumption in Each Group*

	No Surcharge	1st Surcharge	2nd Surcharge	Total
Group A	13%	0%	0%	13%
Group B	38%	13%	0%	51%
Group C	16%	15%	5%	36%
Total	67%	28%	5%	100%

- *Distribution curve for electricity consumption*: we are developing the curve based on the data available in EIA Residential Energy Consumption Survey 2001
- *Consumption Thresholds for Residential Customers*

1st threshold: TBD for Maryland. The thresholds we used to identify the consumption levels subject to surcharges are based on regional data. We will adjust those threshold levels and present Maryland specific thresholds.

2nd threshold: TBD for Maryland. The thresholds we used to identify the consumption levels subject to surcharges are based on regional data. We will adjust those threshold levels and present Maryland specific thresholds.

- *Consumption Thresholds for Commercial Customers*

1st threshold: about 11 kWh per year or 0.92 kWh per month per square foot

2nd threshold: about 17 kWh per year or 1.4 kWh per month per square foot

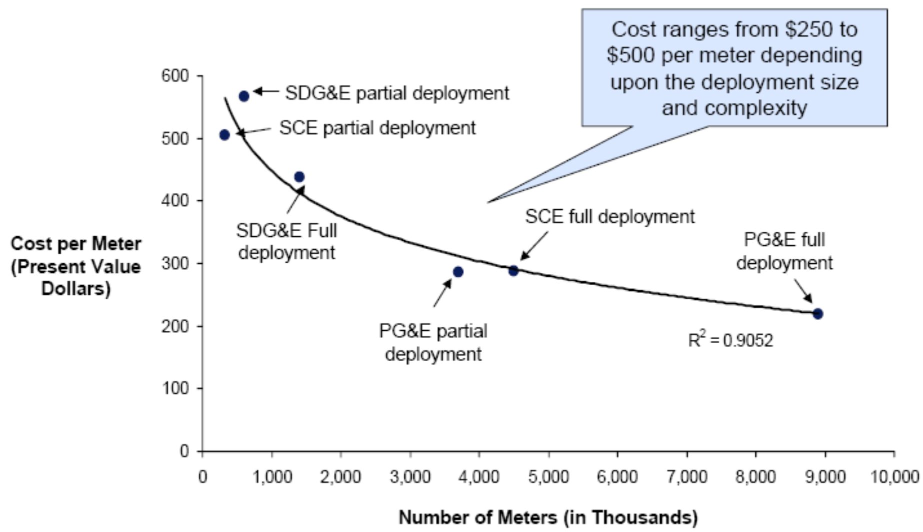
- *Schedule for replacing existing meters*: we assume a two year lead time for planning, program designs, and selecting vendors and technologies before deploying smart metering. Deployment schedule is 6 years. We assume utilities start to deploy smart metering/advanced metering infrastructure (AMI) starting in 2011 and will fully deploy by 2016. After 2016, small numbers of meters are deployed to cover the new customers. This deployment schedule is longer than what has been proposed by utilities. For example, according to the Brattle Group (2007), Pepco and DPL in Maryland are planning to deploy AMI in three years. Also Pepco in Washington D.C. and DPL in Delaware are planning to fully deploy AMI in two years.

Year	Share
2009	0%
2010	0%

2011	17%
2012	33%
2013	50%
2014	67%
2015	83%
2016	100%

- *Cost of smart meters (that are capable of having at least critical peak pricing) and in-home display*: $350 per smart meter system installed. Cost of smart metering/advanced metering systems (including interval meters, in-home displays, and meter data management system) ranges from $200 to $500 per meter depending upon the deployment size and complexity. This range is based on Idaho Power 2005, CA PUC 2006, Demand Response and Advanced Metering Coalition (DRAM) 2004, and Booz Allen Hamilton 2007.

  The following figure from Booz Allen Hamilton (2007) presents cost of AMI deployments based on number of meters. We are assuming utilities will deploy approximately 2.8 million meters by 2020.



Source: Booz Allen Hamilton 2007

- *Demand reduction from deployment of smart meters*: No existing studies estimate annual energy reduction as well as emission reductions from the time of use pricing that has been proposed recently including critical peak pricing. The studies on smart metering and critical peak pricing pilot projects in New Jersey and Ontario, Canada provide some useful, but limited experience on annual energy savings. Given the uncertainty regarding how much annual energy consumption and emissions this program (smart metering and time of use pricing) will reduce and how many years the savings can be expected to last when a program runs for many years and is applied to all customers, we assume multiple scenarios on the percentage of energy reduction (e.g., 0.5%, 1.5% and 3.0% savings). Note that there is the possibility that GHG emissions could increase if this program increases energy consumption at off peak hours, because coal-fired power plants are the dominant source of energy during off-peak hours.

Summit Blue Consulting (2007) found that customers participating in NJ PSEG's MyPower Pricing pilot project reduced consumption from 3.3% to 4.3% during the summer time. IBM Global Business Services et al. (2007) found that customers participating in Ontario's Smart Price Pilot reduced energy consumption by 6% during the pilot period, from August 1, 2006 to February 28, 2007 (6 months). Primen (2004) cited past studies that documented energy use reductions of 4 to 15% associated with energy price feedback using an in-home display. However, Primen (2004) is less relevant to RCI-8, because the savings in this study are not associated with time of use pricing that is tied to billing. Furthermore, many cited studies were conducted in other countries, and they do not provide how long the savings lasted.

- *Cost of financing:* 8.52% capital recovery factor, consistent with a 6.5% interest rate for utility financing and 20 year asset life
- *Lifetime of smart metering infrastructure:* 20 years
- *Number of residential and commercial customers:* projected to increase in proportion to the growth rate of electricity consumption
- *Number of smart meters required per site:* assumed to be equal to the number of total customers.
- *Assumed cost of implementation of inverted-block surcharges:* $0 (placeholder assumption)
- *Avoided electricity cost:* Same assumptions as used for RCI-1.
- *Retail electric rates:* Same assumptions as used for RCI-3.
- *Emission factors:* Same assumptions as used for RCI-1.

Key Uncertainties

The level of energy savings from deployment of smart meters is uncertain. Three percent savings is a conservative estimate of savings based on two critical peak pricing pilot projects in New Jersey and Ontario, Canada. Both pilot projects ran only for six months, including summer peak. Annual average savings are likely to be lower because the savings during the other 6 months are likely to be lower. Also, if all customers are required to take time of use service (as is contemplated in this policy, but unlike the conditions in the referenced study), the savings are likely to be significantly lower. The public’s reaction to being required to accept smart metering and TOU rates could be negative. Finally, these estimates are based on customer response for less than a year. No study has estimated how customers would respond to price signals from time of use or critical peak pricing for long periods of time (e.g., 10 to 20 years).

Technological progress in this field is very fast and cost-effectiveness (benefit-cost ratio) of different metering technologies is uncertain. Thus stakeholders, utilities, and the public utility commission need to be careful about the choice of technology.

Time-of-Use rates tend to encourage consumers to shift electricity usage to off-peak times. A policy that moves consumption from peak to off-peak times may or may not decrease GHG emissions, depending on whether the generation avoided during times of reduced consumption has lower emissions than the generation that is dispatched when consumption is increased.

Other uncertainties include actions the Public Service Commission and the utilities may take in the future.

Additional Benefits and Costs

- Aligning price signals with demand to increase awareness of costs of consumption
- Savings to consumers and business on energy bills.
- Reduced peak demand and reduced capacity requirements
- Other electricity system benefits: reduced capital and operating costs, improved utilization and performance of electricity system
- Reducing energy price increases and volatility

Feasibility Issues

Legislation may be required for implementation of this policy.

Procurement of wholesale electricity supply may be complicated by the shifts in consumption accompanying the implementation of three-tiered surcharges and Time of Use rates, especially in the beginning of the program when data are limited. Bidders in the annual SOS procurement may want information about which meters will be replaced, when, and how consumption is likely to change as a result of the new rate schedules. Administrative costs of providing these data to bidders could be burdensome.

The policy should apply to all customers in the rate class, to avoid switching.

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-9. GHG or Carbon Tax

Transferred to ES TWG

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.

Policy Design

Goals: Together with RCI-2, 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:**

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

None noted.

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	2.9	11.8	70.5	1716	-5,364	-3,648	-52
Electric DSM	2.4	10.2	60.6	1416	-4,373	-2,957	-49
NG DSM	0.4	1.6	9.9	300	-991	-691	-70

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:* See RCI-2

Quantification Methods:

- Estimate energy reduction based on the recommended energy reduction targets for 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:* See RCI-1.
- *Cost of financing:* 0% interest rate (DSM costs are incurred as the Systems Benefits Charge (SBC) is collected)
- *Avoided cost of electricity and fuels*: See RCI-1

- *Target electricity and natural gas efficiency savings*: Through 2015, the target draws on the stated policy goal. After 2015, 1.6% per year for electricity efficiency and 1.2% per year for natural gas efficiency is assumed, based on a number of DSM potential studies and experience by leading electric and natural gas utilities.

Year	Electricity Target	Natural Gas Target
2008	0%	0%
2009	0.5%	0.5%
2010	1.0%	1.0%
2011	1.2%	1.2%
2012	1.3%	1.3%
2013	1.5%	1.5%
2014	1.8%	1.6%
2015	2.0%	1.6%
2016	1.6%	1.2%
2017	1.6%	1.2%
2018	1.6%	1.2%
2019	1.6%	1.2%
2020	1.6%	1.2%

- *Cost of Electric Efficiency Measures:* Same assumptions as used for RCI-2.
- *Cost of saved natural gas:* Same assumptions as used for RCI-2.
- *Efficiency Measure Lifetime:* Same assumptions as used for RCI-2.
- *Displaced Emissions*: Same assumptions as used for RCI-1.

Key Uncertainties

The source of funding to implement the aggressive DSM program envisioned here is uncertain.

Consumer response to this program is also uncertain.

Additional Benefits and Costs

- 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 the risk of power shortages
- 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

Feasibility Issues

It may be difficult to achieve the aggressive energy savings goals set by this policy.

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. Promotion and Incentives for Energy Efficient Lighting

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 light (CFL) bulbs have the additional advantage of lasting up to ten times as long without burning out. With current prototypes boasting even higher efficiencies than CFLs, light-emitting diodes (LEDs) show promise for widespread use in a variety of different applications, including general service lighting, if production costs can be lowered.

Policy Design

Goals: Implement aggressive campaigning and incentives encouraging residential customers to purchase screw-in compact fluorescent light bulbs or other high-efficiency lighting as needed to replace their screw-in incandescent light bulbs. Screw-in compact fluorescent bulbs will make up 95% of residential light bulb sales by 2014.

- **Timing:** As above.
- **Parties Involved:** Residential customers.

Implementation Mechanisms

Voluntary measures would be encouraged through public awareness campaigns.

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

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 $)	Cost-Effectiveness ($/tCO₂e)
	2012	2020	Total 2008-2020				
RCI–11	0.1	1.1	7.7	153	-516	-362	-47

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.
- California Lamp Report 2003. Prepared for: Southern California Edison, Prepared by: Itron, Inc., July 15, 2004.
- Report to Baltimore Gas and Electric: Demand-Side Management Program Measure Impact and Cost. Submitted to: Honeywell Utility Solutions, Prepared by: Summit Blue Consulting, LLC, November 12, 2007.
- Residential Energy Efficiency Program Design Recommendations. Submitted to Baltimore Gas and Electric, Prepared by: American Council for an Energy Efficient Economy (ACEEE), October 2006.
- 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.
- U.S. Congress. House. *Energy Independence and Security Act of 2007*. H.R.6. 110th Cong., 1st sess.

Quantification Methods:

- Estimate the lumen/watt output of all light bulbs currently sold in the US.

- Estimate the ramp in rate necessary for achieving the Maryland-specific goal and the minimum targets under the federal 2007 Energy Bill.
- Estimate the current and projected number of screw-in light bulbs (all types) sold in Maryland.
- Estimate the current and projected number of screw-in compact fluorescent lightbulbs sold in Maryland.
- Estimate the amount of energy saved by meeting the Maryland-specific goals (excluding the amount of energy saved by meeting the 2007 federal energy bill targets).
- Estimate the total cost by multiplying the number of bulbs sold under the Maryland-specific goal by the incremental cost of each compact fluorescent light bulb.

Key Assumptions:

- The energy savings, GHG emissions reductions, benefits, and costs only apply to new light bulbs sold in Maryland after 2008.
- An average compact fluorescent light bulb outputs 63 lumens/watt, while an average incandescent light bulb outputs 14 lumens/watt. (LEDs were not modeled in this analysis.)
- Analysis only applies to the residential sector and medium screw-based light bulbs
- Annual energy savings of installing a compact fluorescent instead of an incandescent light bulb: 51 kWh/year
- Average lifetime of a compact fluorescent light bulb: 10,000 hours
- Average number of hours used per day: 4 hours
- Average incremental cost of a compact fluorescent over an incandescent light bulb: $6.33/bulb
- Number of residential screw-in light bulbs (all types) sold nationally
- Market penetration of ENERGY STAR residential light bulbs in screw-in light bulbs sold nationally
- The purchases of compact fluorescent light bulbs by residential customers ramp up linearly from the current market penetration to 95% of light bulbs sold by 2014 and then holds steady at 95% through 2020.
- Market share of medium screw-based halogen bulbs stays constant
- Maryland residential customers as a percent of total US customers: 1.8%

Key Uncertainties

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

It is unclear how manufacturers will respond to the 2007 federal energy bill, which requires common light bulbs to use 25-30% less energy by 2012-2014 and a minimum efficiency of 45 lumens/watt for all bulbs sold by 2020. Retailers are assumed to linearly ramp up the efficiency of their light bulbs sold to meet the 2007 Energy Bill targets, beginning in 2009. This assumption gives the most conservative estimation of Maryland-specific energy savings.

This analysis assumes that customers would bear all incremental costs of replacing an incandescent light bulb with a compact fluorescent light bulb. However, direct incentives will probably be required to achieve the voluntary target stated in this policy. For example, in a November 2007 report to Baltimore Gas and Electric from Summit Blue Consulting, the recommended incentive was $1.50 per screw-in compact fluorescent bulb:

DEMAND/ENERGY SAVINGS						INCENTIVE CALCULATIONS				CUSTOMER COST/SAVINGS			
Fixture Type	Incand. Fixture Watts	CFL Fixture Watts	Non-Coincid. Demand Savings (KW)	On-pk Energy Savings (KWh)	Off-pk Energy Savings (KWh)	PV Benefit ($)	Recommended Incentive ($)	PV Program Cost ($)	NPV ($)	Incr. Cost ($)	Cost Savings ($)	Payback wo/Inc. (yrs)	Payback w/Inc. (yrs)
SCREW-IN	35	9	0.026	18	8	18	1.50	6	12	5.03	3	1.4	1
	75	20	0.055	39	16	39	1.50	6	33	5	7	0.7	0.5
	150	41	0.109	77	32	76	1.50	8	68	7.21	15	0.5	0.4
Weighted Average			0.072	51	21	50	1.50	7	43	5.89	10	0.74	0.54

Existing penetration of CFLs into the residential sector may be higher. A recent national study estimates penetration at 20%. However, a change to this assumption does not materially change the results of the policy analysis.

Additional Benefits and Costs

- Exposure to fluorescent bulbs producing light in the blue part of the spectrum suppresses the body's production of melatonin more than conventional incandescent bulbs. Melatonin helps to prevent tumor formation, which suggests that there may be a link between blue-light emitting CFLs and cancer. (Weiss, Rick. "Lights at Night Are Linked to Breast Cancer" Washington Post, Feb 20 2008. http://www.washingtonpost.com/wp-dyn/content/article/2008/02/19/AR2008021902398_pf.html)
- 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
- Reducing dependence on imported fuel sources
- Reducing energy price increases and volatility
- Additional costs associated with the collection and disposal of compact fluorescent bulbs

Feasibility Issues

95% target is aggressive.

Status of Group Approval

Complete.

Level of Group Support

Unanimous consent.

Barriers to Consensus

Not applicable.

Page 24: [1] Deleted	Jennifer Kallay	4/3/2008 4:15:00 PM	
Avg Loan Per Participant	$5,000	$30,000	Placeholder assumption
Number Homes/Buildings Participating	8,888	459	Placeholder assumption

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Energy Savings per Building	15%	15%	Placeholder assumption