Energy Supply
Technical Work Group

Summary List of Pending Priority Policy Options for Analysis

	Policy Option	GHG Reductions (MMtCO$_2$e)			Net Present Value 2008–2020 (Million $)	Cost-Effective-ness ($/tCO$_2$e)	Level of Support
		2012	2020	Total (2008–2020)			
ES-1	Promotion of renewable energy (zoning and siting incentives for centralized facilities)	0.2	0.5	3.3	$89	$27.0	Pending
ES-2	Technology-focused initiatives for electricity supply (biomass co-firing, energy storage, fuel cells, landfill gas, clean energy incentives)	U	U	U	U	U	Pending
ES-3	GHG cap-and-trade	Pending	Pending	Pending	Pending	Pending	Pending
ES-4	CCSR incentives, requirements and/or enabling policies (administration, regulation, liability, incentives)	0.0	3.4	27.2	$2,001	$73.5	Pending
	Low efficiency	0.0	3.2	25.8	$1,230	$47.8	
	Medium efficiency	0.0	3.4	27.2	$2,001	$73.5	
	High efficiency	0.0	3.6	28.8	$3,002	$104.2	
ES-5	Clean Distributed Generation: standards, incentives and barrier removal for distributed generation, including combined heat and power (CHP), district heating and cooling, landfill gas, solar, and other forms of renewable energy.						Pending
	ES-5a Distributed Generation	0.3	1.1	6.7	$250	$37.5	
	ES-5b Combined Heat & Power	0.3	1.0	6.3	$90	$14.4	
ES-6	Integrated resource planning (IRP) with or without re-regulation and/or state energy plan	U	U	U	U	U	Pending
ES-7	Renewable Portfolio Standard	5.2	13.8	100.7	$2,589	$25.7	Pending
ES-8	Efficiency improvements and repowering existing plants						Pending
	ES-8a Biomass component	1.2	2.0	17.9	$389	$21.8	
	ES-8b Repowering component	0.5	2.9	15.5	$980	$63.2	
ES-9	Carbon (GHG) tax	Pending	Pending	Pending	Pending	Pending	Pending
ES-10	Generation Performance Standards						Pending
	GPS - 1125 lb CO$_2$e per MWh	6.2	6.6	74.3	$5,155	$69.4	
	GPS - 1100 lb CO$_2$e per MWh	7.1	7.6	85.4	$5,926	$69.4	
	GPS - 1050 lb CO$_2$e per MWh	8.9	9.6	107.7	$7,469	$69.4	

ES-1: Promotion of Renewable Energy Resources

Policy Description

This policy option focuses on encouraging renewable energy development by removing regulatory and financial barriers to large-scale centralized facilities as well as on-site generation. It is directed primarily on revising existing statutes and regulations to:

- Remove unduly burdensome zoning and siting requirements;
- Ensure that any State resource planning process includes consideration of renewable energy projects;
- Develop a clean energy fund to provide for revolving loans (through bonds or any other effective financing mechanisms).
- Make use of long-term contracts for offshore wind and renewables

In addition, this option would include efforts to facilitate greater use of existing State authority for performance-based contracting of renewable energy projects. The goal of these proposals is to encourage investment in renewable energy by helping to overcome impediments to increased use in Maryland.

For purposed of this policy option, renewable sources include the following tier 1 sources defined in the Maryland Renewable Portfolio Standard: solar energy, wind energy, qualifying biomass, methane from the anaerobic decomposition of organic materials in a landfill or wastewater treatment plant, geothermal energy, ocean energy (including energy from waves, tides, current, and thermal differences), fuel cells that produce energy from designated tier 1 renewable energy sources, and small hydroelectric power meeting specified criteria. (See MD CODE sec. 7-701)

Policy Design

- **Timing:** This policy would be intended to come into effect in 2009 and would continue indefinitely as an enabling mechanism for other climate-related policies.
- **Parties Involved:** Maryland Public Service Commission, Maryland Dept. of Natural Resources, and Maryland Dept. of Environment**.**
- **Other:** Energy service companies, financial community, renewable energy developers, environmental community; local government

Implementation Mechanisms

The proposed implementation mechanism for this option is the revision of local zoning laws, the Certificate of Public Convenience and Necessity (CPCN) process before the Public Service

Commission (PSC), and resource planning procedures by the PSC (as developed by appropriate state and local agencies).

In addition, it is recommended that the state develop model zoning ordinances and permitting code amendment to allow local government to begin the conversation of establishing clean energy zones to enable streamlined planning and permitting approval.

Coordination with Federal, state and local economic development authorities is needed to prioritize clean energy in certain economic development zones.

Related Policies/Programs in Place

There are several state efforts in place that are related to this option, as follows…

Existing CPCN exemption for wind projects $\leq$ 25 MW.

Renewable Portfolio Standard that requires a certain percentage of renewable electricity to be purchased by Load Serving Entities.

Large municipal purchases of clean energy with preferential regional purchasing clauses (e.g. Montgomery County Wind Power Purchasing Group).

Types(s) of GHG Reductions

Renewable generation can reduce fossil fuel use in power generation and correspondingly reduce CO2 emissions.

Estimated GHG Reductions and Net Costs or Cost Savings

The policy evaluated includes the increase of Tier 1 renewable energy alternatives at the rate of 0.1% of total MD utility production each year from 2009 through 2020. These increases are assumed to result solely from the easing of zoning and site requirements and the use of long-term contracts for Tier 1 electricity sources. The current analysis does not quantify the effects or costs associated with establishing a clean energy fund. The increase in Tier 1 production is assumed to result in a comparable reduction in electricity production from coal. The renewable energy alternatives were assumed to be apportioned as follows: Wind, 65%; Landfill Gas,10%; Biomass, 10%; Solar, 10%; and Geothermal, 5%. GHG reductions range from 0.17 $MMtCO_2e$ in 2012 to 0.50 $MMtCO_2e$ in 2020, with a cumulative reduction of 3.30 $MMtCO_2e$. The cost of these reductions is estimated to be 27.0 2005$/tCO2e.

Key Uncertainties

Development of financial mechanism by 2009.

Additional Benefits and Costs

Reduction in electric transmission and distribution system; reduced air pollution; increased space in landfills.

Feasibility Issues

System integration of intermittent power generation; adequacy of electric transmission capacity; restructuring of zoning and siting requirements, development of financial mechanism; restructuring of State planning procedures.

It is likely that there are technical feasibility issues regarding the degree to which biomass co-firing would lead to the risk of wear, corrosion, slagging and fouling in the combustion system

Status of Group Approval

(to be completed at a future stage)

Level of Group Support

(to be completed at a future stage)

Barriers to Consensus

(to be completed at a future stage)

ES-2: Technology-focused initiatives for electricity supply

Policy Description

Technology and innovation play a critical role in the development of economic processes, including energy production and use. Major progress in climate change policy requires improvements to technologies as well as increased rates of technology adoption and use. Trends toward smaller scale in energy production technology, combined with the impact of automation and remote system controls, present challenges to current business models and operational procedures. This policy is an umbrella covering several technology-related policy options that together can contribute to GHG emission reductions in Maryland.

Policy Design

- **Goals:** This set of policies would provide state government and other private and public parties with resources and incentives for analysis, targeted R&D, market development, and adoption of GHG-reducing technologies that are not covered by other policies. The overall goals would be: a) to position Maryland as a world leader in climate-related technology development and deployment; b) to achieve actual emission reductions from technology investments, and c) to develop state industries with high in-state and export capability. The policy should especially target landfill gas combustion for power generation, use of biomass co-firing in existing coal fired units, energy storage and use of fuel cells.

- **Timing:** This policy would be intended to come into effect in 2008 and 2009 and would continue indefinitely as an enabling mechanism for other climate-related policies.

- **Parties Involved:** Maryland government. Private and public partners on a voluntary basis.

- **Other:** NA

Implementation Mechanisms

An R&D budget line item would be created to fund a small staff in the appropriate state agency, most likely the MEA, or an agency to be determined. This group would follow technology trends and identify critical technology pathways as well as opportunities for collaboration and funding from other sources.

If the effort does not overlap with current MEA policy, the state should investigate the formation of a Clean Technologies Innovation Program funded at the state level to provide grants and incentives as they are identified by the state along with other sources of public input into the prioritization process. Two models would be the California Public Interest Energy Research

(PIER) program and the New York Energy Research and Development Agency (NYSERDA). Utilities would be able to apply as partners for these funds.

Finally, the state's regulated utilities and independent power producers would be allowed to devote a percentage of their sales revenue to substantial R&D projects on a voluntary basis as part of their overall energy supply portfolios. The invested capital portion of these projects would be given advantageous cost recovery as an incentive to carry out such projects. This policy could be relaxed when effective climate change policy comes into effect, although there may still be merit in continuing some level of incentive for utility R&D effort even when climate policy is in place.

Related Policies/Programs in Place

There are several state efforts in place that are related to this option, as follows: a) innovation including biotechnology, agriculture, transportation etc, b) renewable development, c) tax credits and federal incentives, and d) technology-specific policies such as hybrid vehicle or solar pilot programs and incentives.

Types(s) of GHG Reductions

Various, from no direct reductions to direct offset of emitting fuels, processes, etc. to actual uptake and use of GHGs thus removing them from the atmosphere.

Estimated GHG Reductions and Net Costs or Cost Savings

By consensus, this option was not quantified.

Data Sources: Not applicable.

Quantification Methods: Not applicable.

Key Assumptions: Not applicable.

Key Uncertainties

Funding level stability

Ability to identify productive technology pathways

Measures of success and program oversight

Additional Benefits and Costs

None.

Feasibility Issues

Requires broad range of skills for effective administration.

Status of Group Approval

(to be completed at a future stage)

Level of Group Support

(to be completed at a future stage)

Barriers to Consensus

(to be completed at a future stage)

ES-3 Cap-and-Trade

Policy Description

Use of competitive forces within a cap and trade regime will provide the incentives for economic investment and efficient technological innovations necessary to achieve the desired environmental improvements. Under a GHG emissions trading program, the regulatory agency sets a maximum limit or *cap* on the total amount of emissions (in tons) of greenhouse gases (e.g., CO_2 or CO_2 equivalent for other covered gasses). The *cap* limits emissions from all covered facilities in a specific sector (e.g., electric generation). The program generally requires that the *cap* will be reduced over a period of years to achieve emission reduction targets.

The regulatory agency implements an emissions trading program by creating and distributing a specific number of *allowances* to regulated entities. An *allowance* represents an authorization to emit a specific amount of a pollutant (generally measured in tons) during a particular year or *compliance period*. The total amount of *allowances* cannot exceed the *cap*, thereby limiting total emissions.

At the end of each compliance period, each regulated entity must demonstrate that it possessed sufficient allowances to cover all emissions of the capped pollutant. If an entity releases emissions (for a particular compliance period) in excess of the allowances it holds, it can meet the program requirements by buying additional allowances from entities that have excess allowances due to reduced emissions. This exchange of allowances is called a *trade*. In effect, the seller of the allowances is rewarded for reducing its pollution below its number of allowances and the buyer of the allowances must pay a premium for releasing emissions in excess of its allocated level.

Through trading, participants with lower costs of compliance can choose to over-comply and sell their additional reductions to participants for whom compliance costs are higher. In this fashion, overall costs of compliance are lower than they would otherwise be. The compliance obligation for the cap-and-trade program can be imposed “upstream” (at the fuel extraction or import level) or “downstream” at points of fuel consumption or points of emissions.

One key policy issue in designing a cap-and-trade program relates to the treatment of energy efficiency and renewable energy (EERE). Unless a cap-and-trade program is well-designed, it will not assure the maximum achievable GHG reductions from renewable energy and energy efficiency projects.

There are several policy options available to assure that EERE development results in overall CO2 emission reductions if a GHG emissions trading program is established. For example, Maryland could adopt a key optional section of the model rule issued by the Regional Greenhouse Gas Initiative (RGGI). This optional section authorizes States to retire allowances on behalf of voluntary purchases of renewable energy. However, if EERE programs and projects are not accounted for under the cap (through the retirement of allowances or in setting the level of the cap) in any future GHG emissions trading program that might be established in Maryland, then they will not affect the overall level of CO_2 emissions.

Among the other important considerations in designing a cap and trade program are: The geographic scope, the sources and sectors to which it would apply; the baselines for these sources and sectors; the level and timing of the cap; and what, if any offsets, would be allowed. Other issues to consider include which greenhouse gases are covered; whether there is linkage to other trading programs; banking and borrowing of allowances, and early reduction credit.

There are three steps to creating a cap-and-trade system:

1. Set the caps.

2. Create a timeline for state agencies to design programs to meet the cap.

3. Establish a trading system so that parties covered by those programs can buy and sell emission allowances.

Maryland is already a partner in the Regional Greenhouse Gas Initiative, a cap-and-trade program for large electric power plants. Any statewide cap-and-trade program should be consistent with RGGI.

Policy Design

- **Goals:** Caps for electric power plants should match the RGGI goals, which are 2005 emissions starting in 2009 through 2014, followed by a 10 percent reduction through 2019. Other sectors could be included if RGGI were to expand by sector. If this were to happen the resulting reductions should contribute to the State goal, which is anticipated to be 25% below 2006 emissions by 2020 and 90% below 2006 emissions by 2050. These caps should be revisited periodically to reflect current scientific understanding of climate change.
- **Timing:** The state should meet the timing requirements set by RGGI for electric power plants, specifically the adoption of Maryland’s RGGI Rule in sufficient time to allow a January 1, 2009 program start. Non-RGGI sectors should be studied for potential inclusion in RGGI and pursue complementary policies and measures in order to meet the state goal.

- **Parties Involved:** As a member of RGGI, Maryland must coordinate with the other members on matters involving the electric power sector. In the event the RGGI members seek expansion of the program to include other sectors, Maryland should design its program to blend into the expanded regional effort. Maryland could advocate for expansion of RGGI to as many sources as practical, including major industrial emitters, the transportation sector, and the buildings sector (particularly state and university new buildings). Inclusion of those sectors that are easier to regulate can begin prior to more complicated sectors.
- **Other:** For offsets that are a part of the cap-and-trade system, care should be taken that local jurisdictions can apply for offsets for qualifying programs which they create.

  Linkages to external comparable programs should be explored. The state should strongly advocate links to regional or national programs of equal strength and effectiveness.

Implementation Mechanisms

There are three key implementation mechanisms. The first concerns the designation of the entity responsible for acquiring and surrendering allowances for emissions. In some sectors, such as major industrial emissions, this is simply the in-state entity operating the facility from which the emissions are released.

However, for other sectors, it is either impractical or undesirable to use this approach. RGGI has adopted a production-based (smokestack) system for the electrical power sector but is considering modifying this approach to incorporate greater consideration of load-based (consumer) emissions. The Western Climate Initiative states are considering a more load-based approach.

There are many pros and cons to each approach which should be comprehensively fleshed out in the program development phase.

The transportation sector offers a similar challenge because a program requiring the surrender of allowances from the end users of motor fuels would be complex and is generally thought to be unworkable. Therefore, transportation sector emissions should be regulated upstream, focusing on the entity that imports or distributes the petroleum in the state.

Natural gas also should be regulated upstream, again focusing on the entity that imports the natural gas into the state. Major industrial emissions should be regulated at the point of emissions, except to the extent emissions are associated with natural gas and petroleum that has already been regulated upstream. Emissions of certain high global-warming potential gases may also be regulated upstream of their usage (e.g. at the distribution level) if more practical.

Allowances may be distributed by auction or given free-of-charge to covered entities. The State of Maryland has decided to auction 100% of its RGGI allowances. Maryland may want to consider a different allowance distribution approach for new sectors if and when they are added.

The second key implementation mechanism concerns offsets. Offsets are out-of-sector emissions reductions or carbon sequestration projects that are recognized by the program as qualifying for allowance credit. By definition, offsets must be measures that are not required by the program, and they cannot be required by any emissions reduction program in most cases. They provide an incentive for low-cost investments in emissions reductions as an alternative to higher-cost in-sector reductions or allowance purchases. Offsets should be subject to stringent standards to ensure their environmental integrity, and should be limited to ensure that the overwhelming majority of emission reductions come from covered sectors. Any offsets allowed under the program should be real, verifiable, surplus, permanent, and enforceable.

Related Policies/Programs in Place

A Carbon Tax (ES-9) is seen as a complementary policy, applying to sectors not covered by the cap and trade.

Types(s) of GHG Reductions

All 6 statutory GHGs (CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride)

Estimated GHG Reductions and Net Costs or Cost Savings

(to be completed at a future stage)

Key Uncertainties

(to be completed at a future stage)

Additional Benefits and Costs

(to be completed at a future stage)

Feasibility Issues

(to be completed at a future stage)

Status of Group Approval

(to be completed at a future stage)

Level of Group Support

(to be completed at a future stage)

Barriers to Consensus

(to be completed at a future stage)

ES-4: Combined Capture, Storage, and Reuse (CCSR) incentives, requirements and/or enabling policies

Policy Description

Carbon Capture and Storage for integrated gasification combined cycle (IGCC) is being tested and shows promise as a technology for coal-fired power plants to move toward coal use with zero or very low emissions of CO2. More recently, a new technology is being tested which can capture CO2 from conventional coal-fired plants. IGCC involves partially combusting coal under high pressure to produce a synthetic gas, which is then turned into electricity via combined cycle combustion. Use of technology for existing plants could save considerable cost by retrofitting conventional plants as well as building new IGCC power plants.

Policy Design

- **Goals:** Require CCSR for all new plants and retrofit existing plants with best available technology by 2020.
- **Timing:** As noted above.
- **Parties Involved:** All power producers operating qualifying facilities in Maryland, independent power producers, and state regulators. Also, recognizing that these are emerging technologies there will be a need to harmonize the legal and regulatory framework through coordination with other states and federal agencies.
- **Other:** Not applicable.

Implementation Mechanisms

There are four key aspects to the implementation of this option in Maryland, as follows:

- Require development of the legal and regulatory frameworks needed for geologic storage of CO2 – new regulations should address issues of CO2 ownership in storage and liability for same. State environmental agencies should develop permitting processes for underground storage, including guidance on pipelines, drilling, storage, measurement, monitoring and verification.
- Support comprehensive assessments of geologic reservoirs at state and federal levels to determine storage potential and feasibility.
- Evaluate the feasibility of CO2 transport via pipeline and “advanced sequestration” (i.e., mineralization, carbon nano-fibers) if Maryland determines it does not have sufficient in-state storage opportunities.

- Provide tax incentives for CCS and seek grants and participation from the Federal government. Joint projects should be sought with Pennsylvania and West Virginia as these states have similar facilities and coal shafts that can be used for sequestration.

Related Policies/Programs in Place.

None.

Types(s) of GHG Reductions

Carbon dioxide from coal-fired power plants.

Estimated GHG Reductions and Net Costs or Cost Savings

The policy includes the installation of a single IGCC/CCSR unit rated at 600 MW. This represents approximately 12% of Maryland's current coal capacity. The plant is estimated to come on line in 2013. Reductions in existing sources will come exclusively from traditional coal plants. Three carbon capture efficiencies based on analyses presented by the IPCC in their 2007 energy supply report were evaluated: low (81%), medium (86%) and high (91%). Transportation and geologic storage costs are from the range of values included in the IPCC technical report and assume a total of 250 kilometers of transportation prior to storage. GHG reductions ranged from 3.2 to 3.6 $MMtCO_2e$ in 2020. Cumulative GHG reductions through 2020 range from 25.8 to 28.8 $MMtCO_2e$. Depending on the carbon capture efficiency assumption used, cost effectiveness varies between $47.8 and $104.2 2005$/tCO_2e.

Key Uncertainties

CCSR technologies are under development and it is not known whether the efficiencies will ultimately fall within the IPCC projections. Likewise, the cost of these technologies may increase if currently unforeseen obstacles to commercialization are found, or costs may decrease if technological breakthroughs occur. Finally, while 2013 is generally believed to be a reasonable start of operations date for the first CCSR plant in Maryland, it is possible, for the reasons just stated and others that use of CCSR might be delayed.

It is unclear if and how the new source review provisions of the Clean Air Act would affect the promotion of plant upgrades.

Additional Benefits and Costs

Reduced air pollution; installation of more efficient technology.

Feasibility Issues

Technology currently in demonstration stage.

Status of Group Approval

(to be completed at a future stage)

Level of Group Support

(to be completed at a future stage)

Barriers to Consensus

(to be completed at a future stage)

ES-5: Clean Distributed Generation (renewables and combined heat and power)

Policy Description

This policy option reflects a suite of financial incentives to encourage investment in distributed renewables and combined heat and power. Financial incentives for distributed renewables could include: (1) direct subsidies for purchasing/selling distributed renewable technologies given to the buyer/seller; (2) tax credits or exemptions for purchasing/selling distributed renewable technologies given to the buyer/seller; (3) tax credits or exemptions for operating distributed renewable energy facilities; (4) feed-in tariffs, which provide direct payments to distributed renewable generators for each kWh of electricity generated from a qualifying renewable facility; (5) tax credits for each kWh generated from a qualifying renewable facility; (6) R&D funding to support development of distributed renewable technologies; (7) net metering; (8) financial incentives or assurance of cost recovery for regulated utilities that make reasonable and prudent investments in utility-owned or customer-owned distributed renewable energy resources and (9) a clean energy grants program. Maryland should strive toward capital buy downs and production incentives such that there is full payback over 25-30 years to those who install distributed renewable options.

Combined heat and power (CHP) can reduce GHG emissions by increasing the overall efficiency of fuel use and reducing transmission line loss with the co-location of heat and power facilities. CHP also lends itself to the use of biofuels, an important Maryland emphasis. However, there are numerous barriers to CHP, including inadequate information, institutional barriers, high transaction costs because of small projects, high financing costs because of lender unfamiliarity and perceived risk, "split incentives" between building owners and tenants, and utility-related policies like interconnection requirement, high standby rates, exit fees, etc. The lack of standard offer or long-term contracts, payment at avoided cost levels, and lack of recognition for emissions reduction value provided also creates obstacles. Policies to remove these barriers can include: improved interconnection policies, improved rates and fees policies, streamlined permitting, recognition of the emission reduction value provided by CHP and clean distributed generation, financing packages and bonding programs, power procurement policies, education and outreach, etc.

Financial incentives for CHP could include: direct subsidies for purchasing/selling CHP systems given to the buyer/seller; tax credits or exemptions for purchasing/selling CHP systems given to the buyer/seller; tax credits or exemptions for operating CHP systems; feed-in tariff, which is a direct payment to CHP owners for each kWh of electricity or BTU of heat generated from a qualifying CHP system; and tax credits for each kWh or BTU generated from a qualifying CHP system.

Policy Design

- **Goals:** Undertake a concerted effort to revise its regulatory policies and remove institutional barriers in order to allow distributed renewable and CHP to compete on a level playing field with other sources of electric and thermal energy. Set a goal for distributed renewable generation equal to 1% of all electricity sales in the state by 2020, with a start-up year of 2010. Set a goal for combined heat and power equal to 15% of in-state CHP technical potential at commercial and industrial facilities by 2020, with a start-up year of 2010.
- **Timing:** As noted above.
- **Parties Involved:** Financial incentives would be administered by a state agency and provided to individuals, commercial enterprises, and industrial enterprises.
- **Other:** A source of funds to cover these financial incentives would need to be determined. It may be possible to link incentives to (or condition them upon) the manufacture within Maryland of associated equipment.

Implementation Mechanisms

There are five key aspects to the implementation of this option in Maryland, as follows:

- Information and education.
- Technical assistance.
- Financial incentives.
- Regulatory policies.
- Codes and standards.

Related Policies/Programs in Place

None.

Types(s) of GHG Reductions

Reductions in emissions of carbon dioxide from combustion sources.

Estimated GHG Reductions and Net Costs or Cost Savings

The incentives and other mechanisms proposed in this option generally benefit two classes of technologies: distributed generation and combined heat and power. These have been analyzed separately and may be aggregated to reflect the total impact of the measures themselves. The coal replacements in CHP are assumed to be 90% natural gas and 10% biomass. The DG replacements are 50% wind and 25% each of landfill gas and solar/PV technology. The results on the Summary table are broken out by technology because the results from each are quite different. For example, the expected cost per tonne of CO_2e mitigated for distributed generation technologies is $37.5. This compares to a cost of $14.4 per tonne mitigated for the CHP technologies. Over the study period of 2008 through 2020, CHP incentives and measures are projected to mitigate 6.3 $MMtCO_2e$, while DG measures are expected to mitigate 6.7 $MMtCO_2e$.

Key Uncertainties

It is unclear what level incentives need to be to encourage the installation of DG. Additionally, information about CHP in Maryland is limited, leading to uncertainty among policy makers and the regulated community.

Additional Benefits and Costs

Reduced dependence on fossil fuels with use of biofuels; reduced air pollution.

Feasibility Issues

Design and implementation of tax credits; decreasing real or perceived risk associated with financing.

Status of Group Approval

(to be completed at a future stage)

Level of Group Support

(to be completed at a future stage)

Barriers to Consensus

(to be completed at a future stage)

ES-6: Integrated Resource Planning

Policy Description

Integrated Resource Planning (IRP) is a regulatory process by which alternative solutions for reliably meeting electric demand are identified and evaluated to determine a least-cost or least-risk approach to achieving specific goals. The goal of IRP is to evaluate the costs, benefits, and risks of feasible options for meeting or modifying electric demand on a consistent basis. Accomplishing this goal requires an objective review of energy supply options (from both conventional and renewable energy sources) and energy-efficiency options (demand-side management) prior to approving utility expansions of generation or transmission. Although the Maryland Public Service Commission (PSC) utilized IRP from the late 1980s through the mid-1990s, this regulatory approach was discontinued when the State restructured its electric markets pursuant to the Electric Customer Choice and Competition Act of 1999.

IRP can be implemented in States with either traditional approaches for regulating electric utilities or in those with market-based regulation. However, policymakers must carefully design the IRP framework to assure its effectiveness under the existing regulatory regime.

IRP provides a state resource adequacy method that evaluates many different options for meeting future electricity demands and selects the optimal mix of resources that minimizes the cost of electricity supply while meeting reliability needs and other objectives, such a increasing the state's production of renewable energy sources. An IRP framework would strive to achieve the following: (a) evaluate all options, from both the supply and demand sides, in a fair and consistent manner; (b) minimize risks of cost increases to all stakeholders; and (c) consider environmental impacts (including greenhouse gas emissions from both in-state and out-of-state generation sources serving Maryland customers); and (d) create a flexible plan that allows for uncertainty and permits adjustment in response to changed circumstances.

The use of IRP would help to better align environmental and energy supply policies because it would require consideration of more options than current law and would require the consideration of a longer time horizon in making resource decisions. IRP could be accomplished by action on the part of the PSC to establish a process by which the state determines energy resources needed to meet demand and issues a competitive Request for Proposal (RFP) to meet that demand. The PSC can determine the parameters of the RFP that meet the overall goals of the state: electricity supply and reliability, demand reductions, and environmental protection in the most cost-effective manner to the consumer. Also the PSC could direct or encourage utilities to invest in advanced metering, information exchange infrastructure and usage control technologies to enable customers to reduce their electricity consumption and demand.

Moreover, in the IRP process, the PSC should consider the risk of cost increases associated with future regulation of emissions of greenhouse gases (*e.g.*, CO2), conventional pollutants (*e.g.*, NOx and SO2) and hazardous pollutants (*e.g.*, mercury) when evaluating both supply-side (*e.g.*, new power plants) and demand-side (*e.g.*, energy efficiency) resource options. In addition, the

IRP plans should evaluate a broad range of possible fuel costs and consider the risks of fuel price increases and volatility. The plans also should consider the risk mitigation benefits of energy efficiency and renewable energy.

Policy Design

- **Goals:** To develop a comprehensive state resource adequacy plan for Maryland that meets the reliability, environmental, and economic policies of the state. The plan should support and attempt to balance all three goals.
- **Timing:** The IRP process could be implemented by 2009. The PSC can conduct a hearing and get draft resource needs to meet Load Serving Entity demand in 2008 with the first IRP plan and RFP issued by early 2009.
- **Parties Involved:** PSC, Maryland Energy Administration, Maryland Department of Environment, regulated electric utilities, environmental and consumer advocates, renewable energy industry, energy efficiency industry, financial community.

Implementation Mechanisms

This is an option that requires changes to PSC rules and/or new legislation.

Related Policies/Programs in Place

- The PSC is currently pursuing a number of proceedings and reports that are examining IRP-related issues at a policy level and detailed program level. These proceedings and reports include Docket 9111 (demand-side management and energy efficiency programs), Docket 9117 (utility provision of standard offer service), and the December 2007 interim report to the legislature on electricity regulation and regulatory structure.
- Numerous other states have implemented IRP and can provide examples for Maryland. Delaware is currently working on implementation of its IRP, and its plan should be considered in developing regulatory options. In addition, the National Action Plan for Energy Efficiency, coordinated by the U.S. Department of Energy and the Environmental Protection Agency, has compiled information on IRP best practices. (See http://www.epa.gov/cleanenergy/pdf/napee/napee_chap3.pdf), and the Lawrence Berkeley National Laboratory has conducted extensive research analyzing the treatment of renewable energy and energy efficiency in the IRPs of more than a dozen Western States. (See http://eetd.lbl.gov/ea/ems/rplan-pubs.html)

Types(s) of GHG Reductions

Greater reliance on renewable energy and energy efficiency would reduce dependence on electricity produced by burning coal and other fossil fuels, thereby reducing emissions of carbon dioxide and other greenhouse gases.

Estimated GHG Reductions and Net Costs or Cost Savings

By consensus, this option was not quantified.

Data Sources: Not applicable.

Quantification Methods: Not applicable.

Key Assumptions: Not applicable.

Key Uncertainties

(to be completed at a future stage)

Additional Benefits and Costs

(to be completed at a future stage)

Feasibility Issues

(to be completed at a future stage)

Status of Group Approval

(to be completed at a future stage)

Level of Group Support

(to be completed at a future stage)

Barriers to Consensus

(to be completed at a future stage)

ES-7: Renewable Portfolio Standard

Policy Description

A renewable portfolio standard (RPS) is a policy requiring investor-owned electric utilities and power importers to supply a certain percentage of retail electricity from renewable energy sources by a stipulated date. Utilities can satisfy the RPS requirement by generating renewable energy themselves or by purchasing renewable energy credits (REC) from a renewable energy generator. A REC is equal to 1 kWh of eligible and verified renewable electricity produced. Eligible renewable sources and energy efficiency applications are defined in the current RPS.

Currently, Maryland's RPS includes the following components.

Tier 1 resources (truly clean renewables) must constitute 1% of load in 2006, increasing to 9.5% in 2022.

Tier 2 resources (which are less environmentally friendly) may currently constitute 2.5% of load, but will decrease to 0% by 2019.

Solar PV must constitute 0.005% of load in 2008, increasing to 2% by 2022.

The alternative compliance fee (ACF) is $20/MWh for Tier 1 and $15/MWh for Tier 2. Load associated with industrial sources has a lower ACF. The solar ACF starts at $450/MWh in 2008 and decreases to $50/MWh by 2023.

Renewable projects in the PJM region or a distribution region adjacent to the PJM region are eligible for Maryland RECs. This stretches the geographic scope from Illinois to New York to Virginia.

Maryland is the only state that allows existing hydropower in its RPS. Therefore, Maryland ratepayer dollars are going to operators of existing hydropower dams in other states.

This proposed policy would increase the Tier 1 requirements from 9.5% to 20% by 2020.

Policy Design

- **Structure:** Strengthen the existing RPS to achieve 20% renewable energy by 2020. Do not make any changes to the Tier 2 timeline or percentages. In addition,
    - Reduce the size of the geographic region to the core PJM states – Maryland, Pennsylvania, Delaware and New Jersey.
    - Raise the alternative compliance fee to $50.
    - Remove existing hydropower from the list of eligible resources.
    - Give ten percent extra credit for projects that create substantial numbers of jobs in Maryland.

- **Timing:** As noted above.
- **Parties Involved:** All load-serving entities providing electricity over utility distribution lines in Maryland. The RPS requirement applies to electricity supplied to Maryland customers.
- **Other:** Not applicable.

Implementation Mechanisms

This is a policy requiring a legislative act by the MD legislature.

Related Policies/Programs in Place

The option is a strengthened version of the existing RPS.

Types(s) of GHG Reductions

Carbon dioxide from displaced coal, NG combined cycle and combustion turbine facilities; Methane through the use of animal waste-to-energy and landfill gas-to-energy (LFGE) resources; and aerosols from displaced coal.

Estimated GHG Reductions and Net Costs or Cost Savings

This policy evaluates the net changes in GHG emissions as a result of the implementation of a renewable portfolio standard. The requirements of the standard are outlined in the Policy Description section and represents an increase over current legislation of 9.5% Tier 1 by 2022 (see Policy Description). The Tier 1 renewable energy alternatives were assumed to be apportioned as follows: Wind, 80%; Landfill Gas, 2%; Biomass, 10%; and Geothermal, 8%. Solar and Tier 2 sources were not implemented, as the requirements of the policy are already met by existing hydropower. Hydropower is assumed to go to zero in 2019 IAW the current RPS (replaced by coal). Tier 1 RPS was initiated in 2006 and Tier 2 in 2008. Cumulative GHG reductions through the study period are estimated to be 100.7 $MMtCO_2e$ at a cost per tonne mitigated of $25.7.

Key Uncertainties

Requirements for 10 per cent extra credit; timing for legislation. The current estimates do not include provisions of subsection (a)(2) from section 7-703 of the RPS standard. Those exclusions will alter the total GHG reductions and associated costs.

Additional Benefits and Costs

Reduced air pollution; reduced dependence on fossil fuels.

Feasibility Issues

System integration of intermittent power generation; adequacy of electric transmission capacity.

It is likely that there are technical feasibility issues regarding the degree to which biomass co-firing would lead to the risk of wear, corrosion, slagging and fouling in the combustion system

Status of Group Approval

(to be completed at a future stage)

Level of Group Support

(to be completed at a future stage)

Barriers to Consensus

(to be completed at a future stage)

ES-8 Efficiency Improvements and Repowering Existing Plants

Policy Description

This policy would promote the identification and pursuit of cost-effective emissions reductions from existing generating units through improving their operating efficiency, adding biomass, or other fuel changes. This policy would complement a Generation Performance Standard (which applies to new plants and new units) by applying to existing units. Given that CO2 emissions have not previously been the focus of state regulation, and given that existing units have not been the focus of resource planning, it is expected that there are as-yet unidentified opportunities to reduce emissions from existing facilities that will be cost-effective, particularly once CO2 limits are in place. This policy would, in time, result in the identification of a portfolio of technological options for reducing greenhouse gas emissions and allow state utilities to share the opportunities they have identified.

Key aspect of the options include a) requiring utilities to evaluate their existing generating units for opportunities to improve their emissions profile through efficiency improvements, the addition of biomass or other fuel changes. This evaluation would be part of an overall plan identifying cost-effective options for reducing system CO2 emissions on a short-term and long-term basis; b) requiring utilities to pursue cost-effective options for reducing their emissions profile through measures identified above; and c) creating financial incentives that reward such emissions reductions. The terms "cost effective" would be defined by some objective measure, such as cost per tonne of carbon equivalent.

Policy Design

- **Goals:** The repowering option should seek to achieve biomass co-firing at its upper practical limit (i.e., not requiring major capital investments) by 2015. This option would set a goal of repowering 30% of eligible coal stations with natural gas by 2020.
- **Timing:** As noted above.
- **Parties Involved:** The option applies to Maryland electric load serving entities.
- **Other:** Not applicable.

Implementation Mechanisms

The planning and emission reduction requirements would be implemented through planning processes already implemented by the Public Utilities Commission.

Related Policies/Programs in Place

The option is an important counterpart to the Generation Performance Standard (GPS), which only covers new financial commitments. It complements a cap and trade policy by ensuring that utilities pursue cost-effective potential emission reductions rather than the more obvious option of purchasing emission allowances (with the projected price of allowances being a key part of the definition of "cost effective" reductions).

Types(s) of GHG Reductions

All 3 major GHG emissions (i.e., CO_2, methane, nitrous oxide).

Estimated GHG Reductions and Net Costs or Cost Savings

This policy option evaluates the effect of co-firing biomass in existing coal plants and re-powering existing coal plants with natural gas. The biomass portion of the policy assumes that biomass provides 8% of power at existing coal-fired plants. The transition to biomass starts in 2010 and is fully implemented in 2014. The cost associated with biomass is assumed to be $3.40 per million btu, based on values in a 2006 biomass feasibility report prepared for the State of Maryland.

The re-powering portion of this policy assumes that NGCC replaces existing coal at a rate of 3% per year, starting in 2010. The conversion of coal plants to NG may reduce the effect of the biomass option. This reduction has not been quantified.

Total GHG reductions through the study period are roughly equal between the two measures, with biomass co-firing yielding 17.8 $MMtCO_2e$, and repowering yielding 15.5 $MMtCO_2e$. Biomass is expected to be a lower-cost option at 21.8 $/$tCO_2e$, versus 63.2 $/$tCO_2e$ for repowering.

Key Uncertainties

This analysis used a conservative set of assumptions regarding the availability of biomass feedstock within short distances of candidate power plants. The use of this resource for this purpose may compete with other recommendations under considerations by the MWG. These assumptions must be reevaluated if competing uses for this resource are also recommended.

It is unclear how the new source review provisions of the Clean Air Act would affect the promotion of plant upgrades.

Additional Benefits and Costs

Reduced air pollution; reduced dependence on fossil fuels.

Feasibility Issues

It is likely that there are technical feasibility issues regarding the degree to which biomass co-firing would lead to the risk of wear, corrosion, slagging and fouling in the combustion system

Status of Group Approval

(to be completed at a future stage)

Level of Group Support

(to be completed at a future stage)

Barriers to Consensus

(to be completed at a future stage)

ES-9: Carbon (GHG) tax

Policy Description

A carbon tax would be a tax on fossil fuels according to the amount of CO_2 emitted by their combustion. Carbon tax and cap and trade systems work toward similar ends in opposite ways. With the cap and trade, the government sets a limit on the tons of pollution that will be released and the market establishes the price. With a carbon tax, the government sets the price and the market drives the level of emissions. The Carbon Tax and Cap and Trade programs are seen as complementary measures. One of the benefits of the tax is that it can be more easily applied across all sectors, however the ES TWG recommends that the cap and trade program should be the primary market mechanism with the carbon tax used as a supplementary measure in those sectors where transaction costs or other concerns make the use of the cap and trade less desirable. Like most market-based approaches, it should be applied as broadly as possible, and would be best if applied nation-wide. On the negative side, it is politically difficult to apply a new tax, particularly since other taxes are expected to be rise to cover the Maryland budget deficit. Many economists argue that the carbon tax is the most efficient way to ensure that product prices reflect the cost of the greenhouse gas emissions generated in their manufacture and use. Administrative costs are low for the carbon tax and the impact on prices is predictable. The tax could be imposed upstream, based for example on the carbon content of fuels (electricity generators or distributors), at the point of combustion and emission or at the point of sale (gasoline, natural gas). Although taxed entities would pass some or all of the cost on to consumers, there would be competitive pressure to find cost-effective ways to lower (or offset) emissions. Consumers who see the implicit cost of GHG emissions in products and services could adjust their behavior to lower emissions and reduce cost. Revenues collected could offset other taxes, be applied to incentivize low emission alternatives, be directed for relief to parties that are disproportionately impacted by the tax, or rebates could be created for CO_2 controls or offsets that prevent atmospheric emissions.

It is assumed that the cost of the tax would be passed down to the ultimate consumer, such as residential and commercial utility ratepayers for electricity. In order to achieve the stated goal, the amount of the tax must be high enough to trigger financial and behavioral decisions toward conservation or a shift to lower emitting fuels.

Policy Design

- **Goals:** Make the cost of inefficient or higher CO_2 emitting activities more expensive than alternatives, thereby creating a financial incentive to change behavior away from activities that result in CO_2 emissions. The tax should include safety valves to reduce low-income impacts and minimize detrimental economic consequences. One option is to make the tax "revenue neutral," (an equal amount of other state taxes would be reduced so that the "net" to the state is zero); or the revenue from the tax could be used to develop or promote alternatives that reduce CO2 emissions. The amount of the tax should be high enough to contribute to the reduction targets specified in the cap-and-trade option (see ES-3).

- **Timing:** Pegged to the timing of the cap-and-trade option (see ES-3).
- **Parties Involved:** Major payers would be utilities that generate or distribute electricity in Maryland; refiners or distributors of transportation and heating fuels in Maryland; and commercial and industrial sources creating energy for production or other commercial use.
- **Other:** Technical Advisory Committee – The TWG recognizes that more in-depth analysis of the carbon tax and its interactions with the cap and trade and other policies will be required than is possible within the current process. It is therefore recommended that a Technical Advisory Committee be convened to study the proposal in greater depth, receive additional public comment and offer recommendations on the specifics of how a supplemental carbon tax should be enacted and applied.

Implementation Mechanisms

This option requires legislation and detailed tax collection system. Specifics of the implementation should be developed through an in-depth investigation as recommended under "Other" above.

Related Policies/Programs in Place

None.

Types(s) of GHG Reductions

Reductions in emissions of carbon dioxide from combustion sources.

Estimated GHG Reductions and Net Costs or Cost Savings

(to be completed at a future stage)

Key Uncertainties

(to be completed at a future stage)

Additional Benefits and Costs

(to be completed at a future stage)

Feasibility Issues

(to be completed at a future stage)

Status of Group Approval

(to be completed at a future stage)

Level of Group Support

(to be completed at a future stage)

Barriers to Consensus

(to be completed at a future stage)

ES-10 Generation Performance Standard

Policy Description

A generation performance standard (GPS) is a mandate that requires Load Serving Entities (LSEs) to acquire electricity on an average portfolio basis, with the portfolio meeting a per-unit emission rate below a specified standard. A GPS portfolio will incentivize investment in new low-carbon generation with overall lower greenhouse gas emissions in Maryland. A portfolio approach also is a mechanism to control cost to the consumer as well, balancing the energy supply and environmental goals of the state.

The GPS will be modeled after the existing Renewable Portfolio Standard program with the exception that the GPS standard must be met from Maryland generation. This will help encourage renewable energy sources and will also fit well with any state resource planning process for new generation.

Policy Design

- **Goals:** The general goal of the policy is to encourage the purchase of energy and capacity from low-carbon or renewable technologies. In particular, the generation performance standard portfolio would require that 100% of their energy portfolio emit an average of no more than a specified number of pounds of CO2 per megawatt-hour. In response to suggestions made by the MWG, the analysis has been run using three potential GPS standards; 1050, 1100 and 1125 pounds per MWh. The GPS would be designed to harmonize with policies that seek to reduce greenhouse gas emissions by promoting greater use of renewable energy sources.

- **Timing:** The program could be implemented by 2015 so as to provide time for new sources to be built.

- **Parties Involved:** The program would apply to any LSE selling energy to retail consumers in the state of Maryland, both competitive and those on Standard Offer Service. Public Service Commission would need to manage similar to the RPS portfolio obligation.

- **Other:** Not applicable.

Implementation Mechanisms

Implementation would be through the Public Utilities Commission, which would develop a GPS program similar in design to the current RPS program to ensure compliance with the generation performance standard.

Related Policies/Programs in Place

A Renewable Portfolio Standard is currently in place in Maryland and under ES-7 it would be strengthened. The GPS as proposed here would be applied separately from the RPS, in other words the separate requirements of the two standards would not be additive. In addition ES-8, Energy Efficiency Improvements and Repowering coal generation plants would complement this policy by reducing emissions from existing plants.

Types(s) of GHG Reductions

Reduces carbon dioxide emissions from fossil-fuel electric generators, and promotes low carbon alternatives to fossil fuel generators.

Estimated GHG Reductions and Net Costs or Cost Savings

This policy quantifies the effect on GHG of implementing a GPS that stipulates that the average emission rate for the entire energy portfolio (in-state and imports) be less than 1,050, 1,100 and 1,125 pounds of CO_2 per MWh. An analysis of the current electricity mix in Maryland indicates that the average energy intensity is about 1,200 pounds CO_2 per MWh. These values are based on averages from different energy sources. This analysis does not consider the emissions associated with the marginal MWh from any one source type or location (i.e., electricity via a dedicated power line from West Virginia). Replacement of existing coal was assumed to be 90% NGCC and 10% wind. The 1,050 standard yielded 8.9 and 9.6 $MMtCO_2e$ reductions in 2012 and 2020, respectively, and 107.7 $MMtCO_2e$ cumulatively between 2008 and 2020. The 1,100 standard yielded 7.1 and 7.6 $MMtCO_2e$ in 2012 and 2020, respectively, and 85.4 $MMtCO_2e$ cumulatively between 2008 and 2020. And the 1,125 standard yielded 6.2 and 6.6 $MMtCO_2e$ in 2012 and 2020, respectively, and 74.3 $MMtCO_2e$ cumulatively between 2008 and 2020. The cost effectiveness of each of these three standards was $69.4/$tCO_2e$.

Key Uncertainties

None.

Additional Benefits and Costs

Reduced air pollution; increased renewable power produced in Maryland.

Feasibility Issues

None.

Status of Group Approval

(to be completed at a future stage)

Level of Group Support

(to be completed at a future stage)

Barriers to Consensus

(to be completed at a future stage)