

## Energy Supply Technical Work Group

### Summary List of Pending Priority Policy Options for Analysis

	Policy Option	GHG Reductions (MMtCO <sub>2</sub> e)			Net Present Value 2008–2025 (Million \$)	Cost-Effectiveness (\$/tCO <sub>2</sub> e)	Level of Support
		2015	2025	Total (2008–2025)			
ES-5	Renewable and/or Environmental Portfolio Standard	7.7	15.7	133	\$7,502	\$56.4	Approved

Notes:

1. All option total are relative to the underlying assumption that electric expansion in MN proceeds with the recently legislated Conservation Improvement Program, Renewable Energy Standard and all planned additions including the Mesaba and Big Stone 2 stations.

## ES-5. Renewable and/or Environmental Portfolio Standard

### Policy Description

A portfolio standard policy can be designed to require that a sector (Electricity Supply, Transportation, Industrial/Manufacturing and Commercial/Residential buildings) provide for lower GHG emissions from energy use or operations by targeting an increased amount of lower emission activities in the aggregate by a target date. A renewable portfolio standard (RPS) is a requirement that utilities and other load-serving entities must supply a certain, generally fixed, percentage of electricity from eligible (e.g., low GHG emitting) renewable energy sources. An environmental portfolio standard (EPS) expands portfolio requirements to include energy production with technologies that are not now classified as renewable but are viewed as releasing less GHG emissions than conventional energy production. These can include energy efficiency improvements or other GHG emission-reducing technologies (such as combined heat-and-power [CHP]) as an eligible resource. About 20 states currently have an RPS in place, while a handful have implemented an EPS. In some cases, utilities can also meet their portfolio requirements by purchasing Renewable Energy Certificates from eligible renewable energy projects or carbon offsets from certified sources.

Minnesota has adopted a renewable energy objective of 25% by 2025.

### Policy Design

#### Goals:

- Evaluate what GHG reductions will be realized by the Renewable Energy Standard up through the 2025 time frame.
- Evaluate what GHG reductions may be realized should Minnesota increase portfolio requirements beyond the 2025 time frame requirement in existing law through 2050. The study should include an analysis of the adequacy of transmission capacity.
- Evaluate hydro, biomass and the use of offsets in the context of CO<sub>2</sub> benefits to meet RES/EPS requirements as defined in Minnesota State Statutes
- Increase R&D funding for renewable/environmental (low CO<sub>2</sub> emitting) energy that reduces CO<sub>2</sub>/GHG emissions (e.g., U of M IREE)
- Evaluate Performance Standards (Carbon Intensity Target) for renewable/environmental energy use by Residential, Commercial and Industrial entities.

**Timing:** Assume that current legislation will cover the time period from current to 2025. Legislation should be enacted by 2009 to give time for planning to meet any new standards. Funding for Renewable/Environmental R&D should begin as soon as practicable.

**Parties Involved:** M-RETS, Minnesota Public Utilities Commission, Minnesota State Legislature, Minnesota Department of Commerce

## Implementation Mechanisms

Requires future legislation covering period from 2025 to 2050 for the renewable requirement while:

- Performing an evaluation of expanding the RPS requirement once the dates in existing law have been reached.
- Providing utilities with adequate lead-time.
- Re-evaluating expansion of what qualifies as renewable and/or environmental sources.

Increase funding by 2009 for R&D relative to new and improved technology advancements.

Institute a renewable energy credit trading program. (Minnesota Statutes 2007, Chapter 216B.1691).

Explore creation of energy intensity targets like carbon intensity targets as a means for broadening the application of portfolio standards to all Minnesota sectors.

## Related Policies/Programs in Place

The state has adopted a 25% renewable energy goal by 2025.

Minnesota Statutes 2007, Chapter 216

## Type(s) of GHG Reductions

Reductions in all GHG emissions from energy production and GHG emissions associated with process operational emissions and energy consumption.

## Estimated GHG Reductions and Net Costs or Cost Savings

- Energy Information Administration, “Assumptions to the Annual Energy Outlook 2007,” DOE/EIA-0554, April 2007 (available at <http://www.eia.doe.gov/oiaf/aeo/assumption/pdf/electricity.pdf>);
- National Energy Technology Laboratory, “Cost and Performance Baseline for Fossil Energy Plants,” DOE/NETL-2007/1281, August 2007 (available at [http://www.netl.doe.gov/energy-analyses/pubs/Bituminous%20Baseline\\_Final%20Report.pdf](http://www.netl.doe.gov/energy-analyses/pubs/Bituminous%20Baseline_Final%20Report.pdf))
- Plant-specific Minnesota capacity addition data is based on Form EIA-906 (available at [http://www.eia.doe.gov/cneaf/electricity/epa/epa\\_sprdshts.html](http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html))
- Minnesota Next Generation Energy Bill; Article 5, Section 2, lines 41.2 and following

## Quantification Methods:

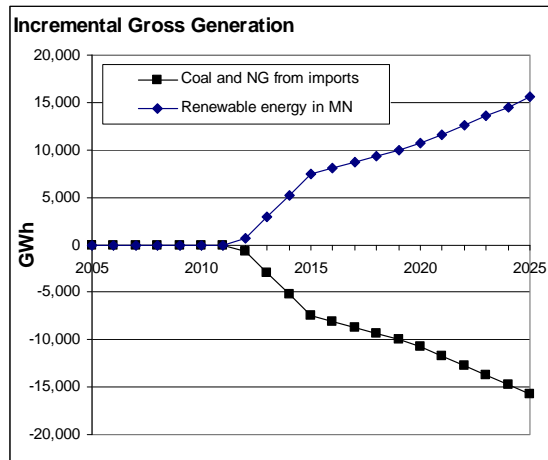
This option is a policy to require that utilities and other load-serving entities must supply a certain, generally fixed, percentage of electricity from eligible (e.g., low GHG emitting) renewable energy sources. The current MN statute through the year 2025 – 25% renewable energy as a percentage of sales – was modeled.

The TWG has made the following key assumptions for the analysis of this option, as follows:

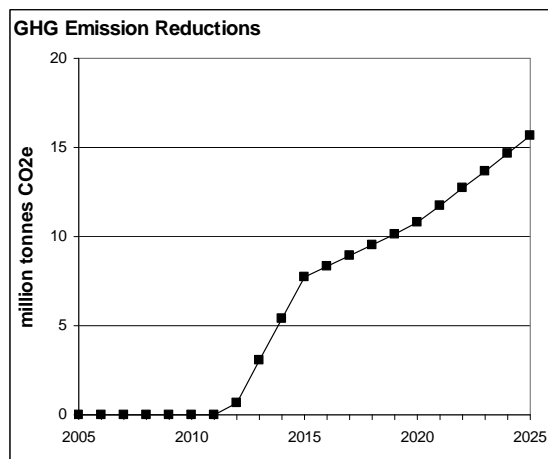
- The start year for the option is 2011.

- Incremental renewable energy generation associated with the implementation of the RES in MN would not displace generation from any generation resources in MN.
- Incremental renewable energy generation in MN would first displace NG-fired generation (combustion turbines) associated with imports and then coal-fired generation from imports.
- Roughly 25% of the power generation backed down from out-of-state coal facilities would be fully depreciated (i.e., fixed O&M, variable O&M, and fuel costs only; no capacity-related costs). Capital costs of non-depreciated units were assumed to be one-third of 2005 costs.

Regarding generation, the impact of the option is summarized in the chart below. The upper curve represents the total incremental generation associated with the RES in MN and the lower curve represents incremental displaced coal/NG-fired generation outside MN.



Regarding CO<sub>2</sub>-equivalent (CO<sub>2</sub>e) emission reductions, the impact of the option is summarized in the chart below. The annual emission reductions in 2015 and 2025 are 7.7 and 15.7 million tonnes CO<sub>2</sub>e, respectively. The cumulative emission reductions over the 2011-2025 forecast period are 133.1 million tonnes CO<sub>2</sub>e.



Regarding costs, there are cost savings associated with avoided fuel and O&M at coal- and natural gas-fired facilities located outside MN, and a portion of their capital costs. The levelized capital costs for imported coal-fired and NG-fired was assumed to be \$92/MWh and \$217/MWh, respectively (2005). There are incremental costs associated with capital costs, transmission costs,

variable O&M costs, fixed O&M costs and fuel costs associated with the RES. The annual product of real levelized costs and displaced generation is an estimate of the annual costs. The net present value of these annual costs are \$4.7 billion over the 2011-2025 period (2005\$).

Regarding the cost effectiveness of the option, it was calculated as the quotient of the NPV and cumulative GHG emission reductions, \$35.5/tCO<sub>2</sub>e (2005\$) (i.e., 4.7 billion divided by 133.1 million tonnes and multiplied by a conversion factor of 1,000).

**Key Assumptions:** See Annex 2

### **Key Uncertainties**

Costs of renewable energy technologies; price forecast for natural gas and coal delivered to regional power stations; portion of backed down generation which is full depreciated.

### **Additional Benefits and Costs**

Improved air quality associated with displaced coal and natural gas fired generation.

### **Feasibility Issues**

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

### **Status of Group Approval**

Approved

### **Level of Group Support**

Approved

### **Barriers to Consensus**

None

## Annex 2

### ES-5. Renewable and/or Environmental Portfolio Standard

Start year for RPS

2011

#### Share of backed-down imported coal generation that is fully depreciated

1

- 1 The share of imported generation that is fully depreciated is (default):
- 2 The share of imported generation that is fully depreciated is:

25%

0%

#### Share of backed down imported NG generation that is fully depreciated

1

- 1 The share of imported generation that is fully depreciated is (default):
- 2 The share of imported generation that is fully depreciated is:

25%

0%

#### Natural gas capacity composition - All Scenarios

Combustion turbine	100%
Combined cycle	0%
total	100%

#### Levelized cost assumptions for existing fossil capacity and all renewable capacity (2005\$/MWh)

	Capacity	Transmission	Fixed O&M	variable O&M	Fuel	Total
Coal	17.2	2.3	5.9	8.5	23.1	57.1
Natural Gas	8.0	4.0	1.4	20.5	158.8	192.6
Geothermal	140.4	4.0	63.5	0.0	0.0	207.9
MSW	81.1	2.7	29.4	0.0	0.0	113.1
Landfill gas	81.1	2.7	29.4	0.0	0.0	113.1
Biomass	93.2	2.7	13.7	5.3	40.0	154.9
Solar	195.7	0.0	0.0	5.6	0.0	201.2
Wind	131.3	5.7	16.7	0.0	0.0	153.7