What is Renewable?

A Summary of Eligibility Criteria Across 27 Renewable Portfolio Standards[1]

Currently 25 US states, as well as the United States federal government and, in Canada, the province of Quebec, which have either passed or proposed legislation requiring (or setting as a goal) a certain proportion of their electricity production to come from environmentally preferable fuel sources. These pieces of legislation are most commonly referred to as renewable portfolio standards, or RPSs. Each of these RPSs delimits the resources and technologies that will qualify as "renewable" in this context. This paper examines the range of definitions that have been proposed and/or passed across these 27 RPSs, and considers where the greatest degree of convergence in these criteria occurs in North America.

There are two energy sources that receive the most unanimous and unqualified support for development as renewable technologies: solar energy (thermal or photovoltaic) and wind. To these could be added energy derived from geothermal sources, ocean powered generation, and (non-fossil fuel) fuel cell applications, whose omission in some RPSs was more likely due to oversight than genuine opposition. Landfill gas and digester gas are also very frequently included in RPS legislation. Biomass and hydropower are both important sources that are widely considered as renewable but which are generally included with other restrictions that vary widely from jurisdiction to jurisdiction.

One of the main challenges facing broader-reaching RPSs is the difficulty in requiring the same level of performance from states with such differing capacities and endowments. Giving renewable credit for research and development in renewable technologies may be one way of allowing states with lower capacities to meet these requirements. Another strategy is setting requirements for only new renewable production.

The paper begins with a listing in Table 1 of the jurisdictions with existing or proposed RPSs. Table 2 presents a summary of the eligibility criteria of the various RPSs across the 27 jurisdictions, which is followed by an explanation of the criteria outlined there. The Appendix provides a more comprehensive list of the RPS criteria that are summarized in Table 2.

Table 1 – Jurisdictions with Renewable Portfolio Standard (RPS) legislation, proposed or passed

RPS Legislation	Proposed RPS Legislation
Arizona	Colorado
California	Maryland
Connecticut	Missouri
Hawaii	Montana
Illinois	Nebraska
Iowa	New York
Maine	Oklahoma
Massachusetts	Pennsylvania

[1] Background document produced for the Commission for Environmental Cooperation (CEC) based on the CEC Electricity and Environment Database, last updated 20 June 2003.

RPS Legislation	Proposed RPS Legislation
Minnesota	Utah
Nevada	Vermont
New Jersey	Washington
New Mexico	United States federal government
Québec	
Texas	
Wisconsin	

Table 2 - Summary of "Renewable" Energy Sources in RPS Legislation

Energy Type/Criteria	Tally
Fuel Source	
Biomass	27
Wind power	26
Solar generation	25
Gothermal	19
Landfill gas*	19
Hydropower (with or without other restrictions)	18
Digester gas	13
Fuel cell	12
Ocean powered generation	11
Municipal Solid Waste*	10
Fuel Sources Unique to One RPS	
Mine-based methane	1
Hydrogen fuels	1
Biodiesel or other biogases	1
Other Criteria	
"New" restrictions	10
In-state requirements	7
% Specifications	6
Extra credits	5
Other Technologies	
Cogeneration	1
Heat pump water heating	1
Criteria Unique to One RPS	
Generation offset	1
R&D option	1
Limit on size of any facility	1
Source: CEC Electricity and Environment Database - <www.cec.org/databases>	
This count assumes that RPSs which allow for unspecified "waste," "resource recovery" or "solid waste conversion" would permit municipal solid waste and landfill gas. Thus, if "waste," "resource recovery" or "solid waste conversion" is allowed under an RPS, this was considered to include municipal solid waste and landfill gas, unless these sources of fuels were referred to elsewhere in the RPS. Both of these may also be underestimated in this count, to whatever extent unspecified references to "biomass" were intended to include one or more of them.	

The Scope of RPSs

Definitions of what qualifies as an eligible source of energy in RPS vary quite dramatically in length, precision and breadth. To give a sense of the variation in elegibility requirements, two different examples are provided.

The first example is Vermont's broad definition of what are eligible renewable resources. Besides citing specific sources of methane gas and solid organic waste, Vermont defines an eligible renewable technology as one "…that has been found to be a renewable, sustainable and emerging electric generating technology...." This broad definition would likely include several of the technologies cited in this paper, but has not been included in the counts given in Table 2 or below.

The second example is Quebec's proposed legislation, which is perhaps the most specific in requiring a certain amount of electricity production to come from wind power and biomass energy, while not providing a definition of what is considered renewable energy.

Fuel Sources

Biomass: All 27 RPSs allow "biomass"-derived electricity, with 23 specifying what is meant by the term. The variability in the definition of "biomass" can be seen in the number of RPSs allowing different sources: wood waste (15), agricultural waste (13), dedicated crops (7), animal wastes (7), organic wastes (7), biofuels/biodiesel (1), plants (aquatic or otherwise) (4). The difficulty comes in cases where the meaning is not specified: in general usage, it is sometimes defined very narrowly to mean only energy derived from specific fuel crops or crop residues, whereas in other cases it can include any fuel derived from non-fossil fuel organic sources, or not defined at all. This paper assumes that if a particular fuel source is not mentioned specifically in the RPS as being considered as biomass, then it is not counted as such. As a result, the number of RPSs allowing landfill gas, digester gas and municipal solid waste-derived energy may be higher than indicated in the table.

The eligibility of biomass is also often limited or qualified in some manner, due to concerns over emissions and the perceived sustainability of the feedstock supply. There is concern that the greenhouse gas emissions should be matched or exceeded by that sequestered by the growth of the feedstock, and also over the possible depletion of soil quality and/or other forest impacts. There is also concern over the quality of the feedstock and the possibility of hazardous contaminants and resulting emissions. Of the 23 RPSs that qualify their inclusion of biomass, five specify that it must be available or harvested in a "sustainable" manner and four require that it be "clean" (no known pest-carriers, no lead paint or treated wood).

> *RPSs permitting:* Arizona, California, Colorado, Connecticut, Hawaii, Illinois, Iowa, Maine, Maryland, Massachusetts, Minnesota, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, Oklahoma, Pennsylvania, Quebec,Texas, Utah, Vermont, Washington, Wisconsin, United States federal government

Wind power: Twenty-six of the 27 RPSs allow wind power, without qualification or further specifications.

> *RPSs permitting:* Arizona, California, Colorado, Connecticut, Hawaii, Illinois, Iowa, Maine, Maryland, Massachusetts, Minnesota, Missouri, Montana, Nebraska, Nevada,

New Jersey, New Mexico, New York, Oklahoma, Pennsylvania, Quebec, Texas, Utah, Washington, Wisconsin, United States federal government

Solar power: Twenty-five of the 27 RPSs surveyed include solar power as an eligible resource. Most do not distinguish between photovoltaic or thermal. It seems reasonable to assume that most of the RPSs not so specifying would allow both.

RPSs permitting: Arizona, California, Colorado, Connecticut, Hawaii, Illinois, Iowa, Maine, Maryland, Massachusetts, Minnesota, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, Oklahoma, Pennsylvania, Texas, Utah, Washington, Wisconsin, United States federal government

Geothermal energy: Nineteen RPSs allow geothermal energy, all without any further qualification. The only environmental concerns associated with geothermal energy surround ground and surface water contamination with wastewater disposal. It is a likely candidate for a standard renewable definition, with possible specifications for wastewater reuse and disposal.

RPSs permitting: California, Colorado, Hawaii, Iowa, Maine, Maryland, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, Oklahoma, Pennsylvania, Texas, Utah, Washington, Wisconsin, United States federal government

Landfill gas*: Nineteen RPSs allow landfill gas, which is methane collected from landfill sites and then subsequently processed and combusted to produce electricity. Most of the concern surrounding this type of generation centers on the sustainability of landfilling itself, and on its associated impacts. There are also emissions concerns (nitrogen oxides); however, impacts from CO_2 emissions are more than offset by the reduction of methane emissions (a far more potent greenhouse gas).

RPSs permitting: Arizona, California, Connecticut, Hawaii, Iowa, Maryland, Massachusetts, Montana, Nebraska, New Jersey, New Mexico, New York, Pennsylvania, Texas, Utah, Vermont, Washington, Wisconsin, United States federal government

Hydroelectricity: Eighteen RPSs include hydropower, 10 of which put some limitation on the size of the facility. Hydropower causes concerns over watershed management, landscape disturbances, impacts on flora and fauna, greenhouse gas emissions (methane released from flooded lands), water quality (changes in dissolved nutrient and oxygen levels, presence of toxic substances, temperature and pH changes, turbidity, etc.), and noise and visual impacts for residents. The limitations placed on size range from under 1 MW to under 100 MW (see the raw data in the Appendix). Specifications relating to hydropower are not limited only to size: for example, one RPS specifies that the facility must be new. Several bills also specify that to qualify as renewable hydropower, the new power must not be the result of new water diversions, but instead come from increases in capacity or efficiency.

RPSs permitting: California, Connecticut, Hawaii, Illinois, Iowa, Maine, Minnesota, Missouri, Montana, New Jersey, New Mexico, Oklahoma, Pennsylvania, Texas, Utah, Washington, Wisconsin, United States federal government

Digester Gas*: Thirteen RPSs allow digester gas. Digester gas (mostly methane) is collected from the fermentation of sewage, animal waste, or food waste in anaerobic digesters. The issues are similar to those surrounding landfill gas, except that the raw materials in this case are seen as more readily renewable than landfill waste. Also, there is concern that the presence of pathogens

could pose threats to human health and/or cause disease transfer between animals. Precautions can be taken to minimize these concerns, however, and it seems likely that the relatively infrequent occurrence of digester gas in RPS legislation is more likely due to oversight or local irrelevance than to considered objection.

> *RPSs permitting:* California, Connecticut, Hawaii, Iowa, Maryland, Massachusetts, New Jersey, New Mexico, New York, Pennsylvania, Utah, Vermont, Washington

Fuel cells: Fuel cells are allowed by twelve RPSs, seven of which specifically disallow the use of fossil fuels in them. Concerns with fuel cells depend on the fuel being used, which can range from solar-derived pure hydrogen to fossil fuels. Fuel cell inclusion in more RPSs would then be a matter of specifiying which fuels are eligible to be used in them, and their omission from RPSs is not likely deliberate.

> *RPSs permitting:* California, Colorado, Connecticut, Hawaii, Maine, Massachusetts, Montana, Nebraska, New Jersey, New Mexico, New York, Wisconsin

Ocean powered generation technologies: Eleven RPSs named ocean powered generation technologies, and eight of them specified one or more of the following: tidal, wave, thermal, and current. While there are some concerns associated with the building of tidal barrages and their effects on water and sediment levels and ecosystems, it is likely that these technologies were not named in most RPSs due to a local lack of relevance rather than a deliberate decision to exclude them.

> *RPSs permitting:* California, Hawaii, Maine, Maryland, Massachusetts, New Jersey, Pennsylvania, Texas, Washington, Wisconsin, United States federal government

Municipal solid waste*: Ten RPSs allow municipal solid waste, which generally refers to the production of electricity through incineration. Incineration-derived energy causes more concern than that derived from landfills, largely because of the associated emissions of heavy metals and persistent organic pollutants in the air, ground, and water. Waste incineration is not a particularly efficient source of electricity, and is generally undertaken as part of an integrated waste management program. Opponents argue, however, that there are other preferred options for solid waste management, and that the resulting emission levels are too high a price to pay. Some RPSs prohibit the inclusion of municipal solid waste altogether.

> *RPSs permitting:* California, Colorado, Connecticut, Hawaii, Iowa, Maine, Nevada, New Jersey, Pennsylvania, United States federal government

Fuel sources unique to one RPS
Several fuel sources were also unique to only one RPS. Those were: mine-based methane (Pennsylvania), hydrogen fuels (Hawaii), and biodiesel or other biogases (Massachusetts).

Other Criteria

"New" renewables: Ten RPSs stipulated "new" renewables restrictions, so that in order to qualify, all renewable electricity generation must come from new facilities—i.e., those beginning operations or increasing their capacity after a specified date. Others stipulate new restrictions for particular fuels—such as Massachusetts, which requires the use of "Eligible New Renewable" fuels for fuel cells to be considered renewable. Two require that a specified percentage of the renewables must be new.

New production is privileged in order to ensure that the RPS results in the development of greater renewable capacity, and perhaps also because new technologies are assumed to be cleaner and/or more efficient. Critics of the "new" requirement argue that the latter assumption is not necessarily valid and that it would be better to set standards limiting the various impacts and apply them equally to old and new facilities. It has also been pointed out that to disqualify old facilities fails to reward producers who began supplying renewable electricity before it became mandated by law. However, for a more broadly based standard applied to multiple jurisdictions at different stages of renewable electricity development to require a level of new production might serve to level the playing field somewhat. This could require states with high levels of existing capacity to develop additional capacity, while allowing jurisdictions with less developed renewable electricity resources to meet the standards.

> *RPSs requiring:* Arizona, California, Maryland, Massachusetts, Oklahoma, Texas, Utah, Vermont, Washington, Wisconsin

In-state requirements: Seven states set some type of in-state requirements. Some RPSs require electricity from these sources to be produced in-state (e.g., Maine), whereas others (like New Mexico) require particular fuel sources to be in-state.

> *RPS with in-state requirements:* Arizona, California, Maine, Massachusetts, New Mexico, Utah, Quebec.

Proportion specifications: Six RPSs also specify the proportion requirements on the portfolio under the RPS. For example, they might prescribe the proportion that must come from solar energy. Of the six which specify a proportion, one sets a proportion for "new" production (i.e., facilities beginning operations or increasing their capacity after a specified date), two set proportions for hydropower and "[unsustainable] biomass" or "resource recovery," two set proportions for solar generation (30 to 60 percent), and one sets a proportion for "biomass." Requiring specific proportions of particular technologies would probably make less sense in a standard that is to be applied on a broad scale to areas with differing capacities and resource availabilities.

> *RPSs requiring:* Arizona, Connecticut, Minnesota, Nevada, New Jersey, Wisconsin

Extra credits: Five RPSs give extra credit toward meeting the portfolio standard for certain technologies they wish to emphasize. Solar energy is given preference in all four [state] laws such that, for example, one kilowatt-hour of solar-generated electricity might count for three kilowatt-hours [of regular generation]. Colorado gives extra credit to energy generated in rural areas. Maryland and New Mexico give preference to fuel cell technologies. New Mexico also gives extra credit for energy generated from biomass, geothermal and landfill gas.

> *RPSs permitting:* Arizona, Colorado, Maryland, New Mexico, US federal government

Specific Technologies

Specific technologies not associated with particular fuel sources are also included in RPSs.

Cogeneration and efficiency resources—i.e., those which are not renewable electricity, but which decrease the amount of energy needed to provide the same level of service—are named in Maine's RPS. Similarly, heat pump water heating is mentioned in Hawaii's.

Criteria Unique to One RPS

Generation offsets: These are considered eligible under the proposed US federal RPS. A generation offset is defined as reduced electricity usage metered at a site where a customer consumes energy from a renewable energy technology, such as solar water heating or geothermal heat pumps.

Research and development (R&D) options: One state (Arizona) allows utilities to gain renewable credits by investing in research and development of renewable resources. This might be an important option for states which, due to a lack of required natural resources or an early stage of renewable energy development, might find a national or continental standard difficult to attain.

Limit on size of any facility: One state (Maine) limits the size of any energy source that is to be considered as part of the portfolio. The size restriction is that the facility must qualify as a small power production facility under FERC rules and as a cogeneration facility, or be smaller than 100 MW.

Appendix - Raw Data

Raw Count of All Fuel Sources and Other Criteria Contained in Examined RPSs

Energy Type/Criteria	Tally
Fuel Source	
Biomass	27
Specifications on Biomass	23
Wind Power	26
Solar Generation	25
Any solar application	18
Solar photovoltaic	8
Solar thermal	8
Solar hot water	2
Geothermal Energy	19
Landfill Gas*	19
Landfill gas	19
Unspecified waste	3
Resource recovery	3
Solid Waste Conversion	4
Hydropower (with or without other restrictions)	18
Hydro	3
Hydro <100	1
Hydro <30	3
Hydro <5	2
Hydro <60	2
Hydro <80	1
Hydro low head	2
Hydro<1	1
Hydro (other restrictions)	2
Hydro incremental	5
New hydro	1
Hydro (with size restrictions)	10
Digester Gas*	13
Digester gas	6
Wastewater treatment plant gas	4
Unspecified waste	3
Resource recovery	3
Fuel Cell	12
Fuel cell	5
Fuel cell (no fossil fuels)	7
Ocean Powered Generation	11
Specifications on ocean powered generation	8
Municipal Solid Waste*	10
Municipal solid waste	6
Unspecified waste	3
Resource recovery	3

Energy Type/Criteria	Tally
Solid waste conversion	4
Fuel Sources Unique to One RPS	
Mine-based methane	1
Hydrogen fuels	1
Biodiesel or other biogases	1
Other Criteria	
"New" Restrictions	10
New renewables restrictions	4
Only new renewables	4
Percent new renewables specified	1
New hydro	2
In-state Requirements	7
In-state only	3
In-state restrictions	4
Percent specifications	6
Extra credits	5
Other Technologies	
Cogeneration	1
Heat pump water heating	1
Criteria unique to one RPS	
Generation offset	1
R&D option	1
Limit on size of any facility	1

Source: CEC Electricity and Environment Database - <www.cec.org/databases>

This count assumes that RPSs which allow for unspecified "waste," "resource recovery" or "solid waste conversion" would permit municipal solid waste and landfill gas. Thus, if "waste," "resource recovery" or "solid waste conversion" is allowed under an RPS, this was considered to include municipal solid waste and landfill gas, unless these sources of fuels were referred to elsewhere in the RPS. Both of these may also be underestimated in this count, to whatever extent unspecified references to "biomass" were intended to include one or more of them.