

Renewable Energy Question 23: *How have eligible “renewable”/ “clean”/ “sustainable” energy resources been defined in other jurisdictions? How has the possibility of new forms of energy been accommodated, if at all?*

Executive Summary

1. States have a wide range of definitions for “renewable” / “clean” / “sustainable” energy resources
2. State Renewable Portfolio Standard (RPS) targets cannot be compared without examining details of the standards, including the types of eligible renewable resources. Some states with higher RPS targets than Michigan actually allow a large portion of those targets to be met by non-renewable resources
3. Although many RPS programs include new and innovative energy sources as eligible resources, and some include the explicit option of adding additional sources, the vast majority of renewable generation capacity under RPS has come from wind

1. States have a wide range of definitions for “renewable” / “clean” / “sustainable” energy resources

Generally speaking, wind, solar, landfill gas, geothermal, and ocean technologies are eligible renewable resources across all the states that have Renewable Portfolio Standards (RPS). Some states do not include geothermal or ocean technologies because these are not indigenous or are not cost-effective when compared to other renewable resources in the state.

In many states, hydroelectric and biomass (including municipal solid waste) are also eligible, but states impose a number of requirements on these resources, such as size, in-service date, plant location, fuel source, plant technologies, etc.

Some states include fuel cells, anaerobic digestion, biofuel, biogas or integrated gasification combined cycle (IGCC) as eligible technologies in the state RPS.

Some states include certain technologies, distinct from all other states, as eligible resources for their RPS. For instance,

- Ohio is the only state that allows advanced nuclear power generation
- Pennsylvania is the only state that allows coal mine methane
- Massachusetts allows flywheel energy storage

Several states (e.g., CT, MI, NV, NC, OH, and PA) also include energy efficiency as an eligible renewable resource. (See Renewable Energy Question 20 for the detailed discussion)

Most renewable portfolio standards have been designed to support resource diversity, including a variety of renewable or advanced fuels and technologies. At the same time, many

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states also incentivize the natural resources that are abundant within the state territory and consider them eligible in the state RPS standards. For instance,

- North Carolina has specific carve-outs for poultry waste and swine waste
- Most of the coastal states make ocean, wave and tidal power eligible for meeting RPS targets

Eligible renewable resources for states’ RPS are summarized in Appendix I.

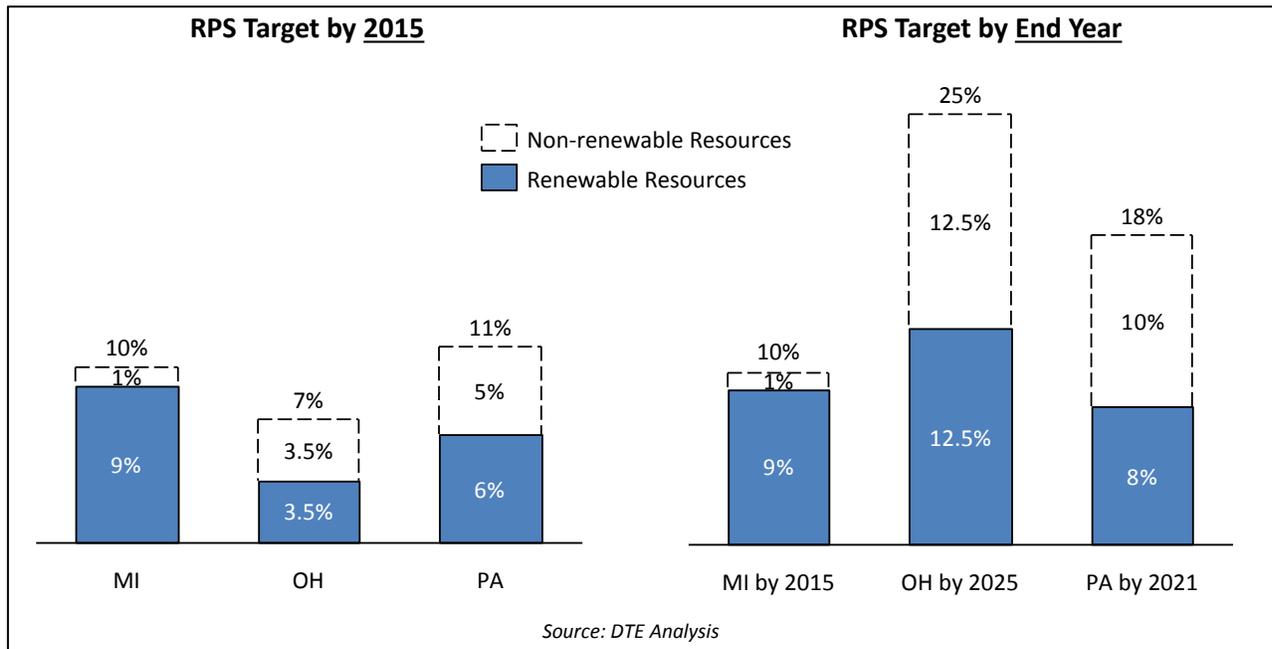
2. State Renewable Portfolio Standard (RPS) targets cannot be compared without examining details of the standards, including the types of eligible renewable resources. Some states with higher RPS targets than Michigan actually allow a large portion of those targets to be met by non-renewable resources

State RPS policies feature significant design differences, as demonstrated by the wide range of the eligible renewable resources. It is misleading to simply compare RPS targets without examining details of the standards. A close examination of Michigan, Ohio and Pennsylvania’s RPS provides a strong illustration of this.

Michigan has a 10% Renewable Portfolio Standard by 2015. On the surface, Ohio and Pennsylvania appear to have more stringent targets than Michigan, with targets of 25% by 2025 and 18% by 2021, respectively. However, a closer look at what counts toward these standards reveals that both Ohio and Pennsylvania allow a significant amount of non-renewable energy resources to count toward their RPS compliance. Ohio allows half of its RPS target (or 12.5% out of the 25% total) to be met by non-renewable resources including clean coal and advanced nuclear generation. Similarly, Pennsylvania allows more than half of its target (or 10% out of the 18% total) to be met by non-renewable or “Tier II” resources including waste coal and large hydropower. Michigan, in contrast, requires the vast majority of its 10% target to be met with true renewable energy resources, and only 1% can be met by energy efficiency or other advanced clean energy systems such as integrated gasification, industrial cogeneration and coal-fired facilities that capture and sequester (CCS) 85% of carbon dioxide emissions.

Comparing only the requirements for true renewable resources, Michigan’s target (9% by 2015) is actually more stringent than Ohio’s (12.5% by 2025) and Pennsylvania’s (8% by 2020-21).

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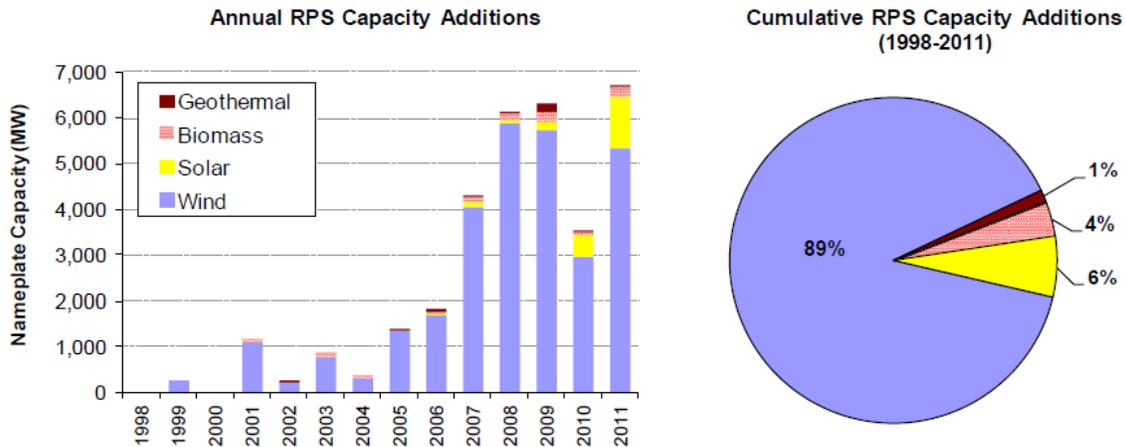
3. Although many RPS programs include new and innovative energy sources as eligible resources, and some include the explicit option of adding additional sources, the vast majority of renewable generation capacity under RPS has come from wind

Many states include as eligible resources some new and innovative forms of renewable or advanced energy – such as tidal and ocean energy – that are not yet widely commercially viable. Several states (e.g., AZ, IL, MO) also build in adaptability and flexibility by explicitly including the option of adding new resources to the eligibility list, presumably if new technologies emerge for other renewable resources.

However, only wind has been deployed at a large scale so far, and it provides the vast majority of renewable capacity in operation today, both in Michigan and nationally. As illustrated in the chart below, 89% of RPS-motivated renewable capacity has been wind and 6% has been solar.

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RPS-Motivated Renewable Energy Capacity Additions from 1998-2011, by Technology Type



* Renewable additions are counted as “RPS-motivated” if and only if they are located in a state with an RPS policy and commercial operation began no more than one year before the first year of RPS compliance obligations in that state. On an energy (as opposed to capacity) basis, wind energy represents approximately 86%, biomass 8%, geothermal 3%, and solar 3% of cumulative RPS-motivated renewable energy additions from 1998-2011, if estimated based on assumed capacity factors.

Source: “Renewable Portfolio Standards in the United States: A Status Update”, 2012 National Summit on RPS, Washington D.C., Dec 3, 2012

Most of the new forms of renewable generation capacity have not yet achieved the same level of commercial viability and grid penetration. These less typical sources of renewable energy entered into commercial operation because of subsidies from federal and local governments. This is illustrated by example projects described in the table below.

Highly Subsidized Renewable and Advanced Energy Projects

Projects	Subsidies/Loans	Comments
Flywheel-based energy storage	\$43 million loan from Department of Energy (DOE)	Filed for bankruptcy protection on Oct 20, 2011 and had to sell its 20 MW flywheel power plant in Stephentown, New York to repay the DOE loan
Tidal energy project in Eastport, Maine	\$10 million investment from DOE and 20-year power purchase agreements approved by Maine Public Utilities Commission at 21.5 cents / kWh, increasing by 2% per year	The nation’s first commercial, grid-connected tidal energy project went into service in July 2012
Kemper County IGCC	\$270 million grant from DOE and \$133 million in investment tax credits approved by the Internal Revenue Service	Expected to be online in mid-2014

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Appendix I State Eligible Renewable Energy Resources

State	Main Class or Tier I of Eligible Renewable Energy Resources	Other Classes, Tiers, or Alternative Resources
AZ	Eligible renewable resources: - Solar heating, cooling and photovoltaic (PV) - Wind - Landfill gas - Hydroelectric - Biomass - Anaerobic Digestion - Geothermal thermal and electric - Fuel cells using renewable fuels - Combined heat and power (CHP)/Cogeneration using renewable fuels - Day lighting (non-residential) - Additional technologies upon approval	
CA	Eligible technologies: - Solar thermal electric and PV - Wind - Landfill gas - Certain hydroelectric facilities - Ocean wave - Thermal and tidal energy - Certain biomass resources - Municipal solid waste (MSW) conversion (no direct combustion) - Geothermal electric - Fuel cells using renewable fuels	
CO	Eligible renewable resources: - Solar electric - Wind - Landfill gas - Hydropower - Biomass facilities that burn nontoxic plants - Anaerobic digestion - Animal waste - Geothermal electric - Recycled energy - Fuel cells using hydrogen derived from renewables	
CT	Class I renewable sources: - Solar - Wind - Methane gas from landfill or anaerobic digestion - Certain newer run-of-the-river hydropower 5 MW and below - Ocean thermal power - Wave or tidal power - Fuel cells (using renewable or non-renewable fuels) - Low-emission advanced renewable energy conversion	Class II: - Trash-to-energy facilities - Certain biomass facilities not included in Class I - Certain older run-of-the-river hydropower facilities Class III: - Certain customer-sited CHP with a minimum 50% operating efficiency, installed in CT on or after Jan 1, 2006 - Electricity savings from conservation and load

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	<p>technologies</p> <ul style="list-style-type: none"> - Sustainable biomass 	<p>management on or after Jan 1, 2006</p> <ul style="list-style-type: none"> - Waste heat and pressure recovery system installed on or after Apr 1, 2007
DE	<p>Electricity derived from:</p> <ul style="list-style-type: none"> - Solar - Wind - Landfill methane gas - Small hydroelectric facility (30 megawatts or less) - Ocean - Sustainable biomass excluding waste to energy - Combustion of gas from the anaerobic digestion of organic material - Geothermal - Fuel cell capable of being powered by Renewable Fuels 	<p>“New Renewable Generation Resources” are those in commercial operation after 12/31/1997. No more than 1% of each year’s sales may come from resources that are not New.</p>
HI	<p>Renewable electrical energy from</p> <ul style="list-style-type: none"> - Solar - Wind - Biogas (including landfill gas and sewage-based digester gas) - Hydrogen produced from renewables - Falling water - Ocean water, currents and waves (ocean thermal energy conversion) - Biomass (crops, agricultural and animal residues and wastes, and municipal solid waste) - Geothermal - Biofuel 	<p>Electrical energy savings from</p> <ul style="list-style-type: none"> - Renewable displacement (e.g. solar heating and cooling) - Energy efficiency technologies <p>Electrical energy savings can be applied up to 50% RPS prior to Jan 2015 and will be no longer applicable after Jan 2015</p>
IL	<p>Renewable energy resources:</p> <ul style="list-style-type: none"> - Solar thermal energy, photovoltaic cells and panels - Wind - In-state landfill gas - Hydropower that does not involve new construction or significant expansion of hydropower dams - Crops and untreated and unadulterated organic waste biomass - Tree waste - Anaerobic digestion - Biodiesel - Other alternative sources of environmentally preferable energy 	
IA	<p>Eligible renewable resources:</p> <ul style="list-style-type: none"> - Solar - Wind - Refuse-derived fuel - Small hydropower - Wood burning facilities - Agricultural crops or residues - Waste management - Resource recovery 	

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KS	<p>Eligible renewable resources:</p> <ul style="list-style-type: none"> - Solar thermal and PV - Wind - Landfill gas - Existing hydroelectric and new hydro 10 MW or less - Biomass (untreated wood) - Fuel cells using renewable fuels 	
ME	<p>Class I includes new renewables up to 100 MW after Sep 1, 2005</p> <ul style="list-style-type: none"> - Solar thermal and PV - Wind - Hydro - Biomass (MSW) - Geothermal - Fuel cells - Tidal - CHP and other systems qualified as small power production facilities 	<p>Class II includes existing renewables before September 1, 2005, eligible to meet the 30% requirements</p>
MD	<p>Tier 1 includes renewable resources:</p> <ul style="list-style-type: none"> - Solar - Wind - Methane from landfill or wastewater treatment plant - Hydroelectric less than 30 MW - Ocean (waves, tides, currents and thermal differences) - Qualifying biomass - Geothermal 	<p>Tier 2 includes renewable resources:</p> <ul style="list-style-type: none"> - Hydroelectric - Poultry litter - Waste-to-energy
MA	<p>Tier 1 Renewable sources:</p> <ul style="list-style-type: none"> - Solar and solar water heat - Wind - Methane from a landfill or wastewater treatment plant - A small hydroelectric plant (less than 30 MW) - Ocean - Qualifying biomass - Poultry litter incineration facilities in Maryland - Geothermal - A fuel cell powered by methane or biomass - waste-to-Energy facilities in Maryland 	<p>Tier 2 Renewable sources:</p> <ul style="list-style-type: none"> - Hydroelectric power other than pump storage generation <p>Alternative energy portfolio standards include</p> <ul style="list-style-type: none"> - CHP - IGCC - Flywheel energy storage - Paper-derived fuel - Energy efficient steam technology - Useful thermal energy (under review)
MI	<p>Eligible Renewables include:</p> <ul style="list-style-type: none"> - Solar and solar thermal - Wind - Landfill gas - Water released through a dam - Waves, tides or currents - Biomass - Municipal solid waste - Geothermal <p>Credits from Energy Optimization and Advanced Cleaner Energy Systems can be used to satisfy up to 10% of the renewable energy requirement</p>	<p>Energy Optimization may include: energy efficiency load management or energy conservation</p> <p>Advanced Cleaner Energy System is any of the following:</p> <ul style="list-style-type: none"> - Gasification - Industrial cogeneration - Coal-fired facilities that capture and sequester (CCS) 85% of carbon dioxide emissions

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<p>MN</p>	<p>Electricity derived from:</p> <ul style="list-style-type: none"> - Solar - Wind - Landfill gas - Hydroelectric less than 100 MW - Qualifying Biomass - Anaerobic digestion - Municipal solid waste - Co-firing - Hydrogen 	
<p>MO</p>	<p>Electricity derived from:</p> <ul style="list-style-type: none"> - Solar thermal and PV - Wind - Landfill and wastewater treatment plants - Small hydro - Qualifying biomass - Pyrolysis and thermal depolymerization of waste materials - Biogas from agriculture operation - Fuel cells using renewable resources - Other renewable-energy resources approved 	
<p>MT</p>	<p>Eligible renewable resources:</p> <ul style="list-style-type: none"> - Solar - Wind - Landfill or farm-based methane gas - Existing hydroelectric 10 MW or less - Certain new hydroelectric projects - Low-emission, non-toxic biomass - Geothermal - Wastewater-treatment gas - Fuel cells using renewable fuels 	
<p>NV</p>	<p>Eligible renewable resources:</p> <ul style="list-style-type: none"> - Solar - Wind - Certain hydropower - Biomass - Waste tires (using microwave reduction) - Geothermal - Energy recovery processes <p>Energy efficiency measures can be used to meet 25% of the RPS standards</p>	
<p>NH</p>	<p>Class I includes new renewable energy from</p> <ul style="list-style-type: none"> - Solar and solar thermal - Wind - Methane gas - Hydrogen derived from biomass fuels or landfill gas - Ocean thermal, wave, current or tidal energy - Eligible biomass - Geothermal - Useful thermal energy derived from Class I sources 	<p>Class III includes existing biomass/methane Class IV includes existing small hydroelectric facilities up to 5 MW</p>

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	Class II includes new solar generator installed after Jan 1, 2006	
NJ	<p>Class I renewable sources:</p> <ul style="list-style-type: none"> - Solar and solar PV - Wind - Methane gas from landfills or a biomass facility provided that the biomass is cultivated and harvested in a sustainable manner - Wave or tidal action - Fuel cells powered by renewable fuels - Geothermal 	<p>Class II renewable sources:</p> <ul style="list-style-type: none"> - resource recovery facility (subject to qualifications) - small hydro power facility (less than 30 MW)
NM	<p>Electricity generated by low- or zero-emission generation technology with substantial long-term production potential:</p> <ul style="list-style-type: none"> - Solar - Wind - Landfill gas and anaerobically digested waste biomass - Hydropower in service after July 1, 2007 - Biomass - Geothermal - Fuel cells that are not fossil fueled 	
NY	<p>Main Tier renewable resources:</p> <ul style="list-style-type: none"> - Solar PV - Wind - Methane digesters and other forms of biomass - Hydroelectric power - Ocean power - Tidal power - Liquid biofuels - Fuel cells 	<p>Customer-sited Tier:</p> <ul style="list-style-type: none"> - Fuel cells - Solar PV - Solar hot water - Wind - Methane digester - Solar hot water
NC	<p>Renewable sources:</p> <ul style="list-style-type: none"> - Solar thermal and PV - Wind - Landfill gas - Hydropower up to 10 MW - Ocean or wave energy - Biomass - Anaerobic digestion and animal wastes - Waste heat from renewables - Hydrogen derived from renewables. - Energy efficiency technologies (up to 25% of requirement) including CHP systems powered by non-renewable fuels. - Electricity demand reduction (up to 100%) 	

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<p>OH</p>	<p>Renewable Energy sources:</p> <ul style="list-style-type: none"> - Solar thermal and PV - Wind - Landfill gas - Biologically derived methane gas - Qualified hydroelectric facilities - Biomass - Certain non-treated waste biomass products - Geothermal - Fuel cells that generate electricity and - Certain cogeneration and waste heat recovery system technologies 	<p>Advanced Energy Resources include:</p> <ul style="list-style-type: none"> - Clean coal - Generation III advanced nuclear power - Distributed combined heat and power (CHP) - Fuel cells that generate electricity - Certain solid waste conversion technologies - Demand side management or efficiency improvements. - Any new retrofitted refueled or repowered generating facility in Ohio
<p>OR</p>	<p>Eligible renewable resources:</p> <ul style="list-style-type: none"> - Solar - Wind - Hydropower - Ocean, wave and tidal - Municipal solid waste - Biomass (biogas) - Geothermal - Hydrogen using anhydrous ammonia derived from certain renewables 	
<p>PA</p>	<p>Tier I alternative Energy sources:</p> <ul style="list-style-type: none"> - Solar thermal and PV - Wind - Biologically derived methane gas - Coal mine methane - Low-impact hydropower - Biomass Energy - Geothermal Energy - Fuel cells 	<p>Tier II alternative Energy sources:</p> <ul style="list-style-type: none"> - Waste coal - Distributed generation systems - Demand-side management - Large-scale hydropower (including pumped storage) - Municipal solid waste - Generation of electricity utilizing by-products of the pulping process and wood manufacturing process including bark wood chips sawdust and lignin in spent pulping liquors (in-state resources are now Tier 1) - Integrated combined coal gasification technology
<p>RI</p>	<p>Eligible renewable resources:</p> <ul style="list-style-type: none"> - Solar - Wind - Movement or the latent heat of the ocean - Hydroelectric up to 30 MW - Biomass facilities using eligible fuels and compliant with current air permits - Earth's heat - Fuel cells using renewable resources 	

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TX	<p>Eligible renewable resources:</p> <ul style="list-style-type: none"> - Solar - Wind - Landfill gas - Hydroelectric - Biomass - Biomass-based waste products - Geothermal - Wave or tidal energy 		
WA	<p>Electricity derived from:</p> <ul style="list-style-type: none"> - Solar - Wind - Landfill gas - Water - Wave, ocean or tidal power - Certain biomass - Gas from sewage treatment facilities - Geothermal energy - Certain biodiesel fuel 		
WI	<p>Eligible technologies:</p> <ul style="list-style-type: none"> - Solar thermal and PV - Wind - Landfill gas - Hydropower - Tidal and wave action - Biomass - Fuel cells using renewable fuels - Geothermal - Ground source heat pumps - Thermal output from biomass, biogas, synthetic gas, densified fuel pellets, or fuel produced by pyrolysis 		
DC	<table border="0" style="width: 100%;"> <tr> <td style="vertical-align: top; width: 50%;"> <p>Tier 1 Renewable sources:</p> <ul style="list-style-type: none"> - Solar (including solar thermal) - Wind - Methane from a landfill or wastewater treatment plant - Ocean including Energy from waves tides currents and thermal differences and - Qualifying biomass - Geothermal - Qualifying fuel cells </td> <td style="vertical-align: top; width: 50%;"> <p>Tier 2 Renewable sources:</p> <ul style="list-style-type: none"> - Hydroelectric power other than pump storage generation - Waste-to-Energy <p>For Tier 2 sources the facility must have existed and been operational as of Jan 1, 2004</p> <p>The incineration of solid waste cannot be used to meet more than 20% of the standard for tier two renewable sources for a given year After December 31 2012 the incineration of solid waste shall not be eligible to generate renewable Energy credits</p> </td> </tr> </table>	<p>Tier 1 Renewable sources:</p> <ul style="list-style-type: none"> - Solar (including solar thermal) - Wind - Methane from a landfill or wastewater treatment plant - Ocean including Energy from waves tides currents and thermal differences and - Qualifying biomass - Geothermal - Qualifying fuel cells 	<p>Tier 2 Renewable sources:</p> <ul style="list-style-type: none"> - Hydroelectric power other than pump storage generation - Waste-to-Energy <p>For Tier 2 sources the facility must have existed and been operational as of Jan 1, 2004</p> <p>The incineration of solid waste cannot be used to meet more than 20% of the standard for tier two renewable sources for a given year After December 31 2012 the incineration of solid waste shall not be eligible to generate renewable Energy credits</p>
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Source: DSIREUSA.org and Comparison of Renewable Portfolio Standards (RPS) Programs in PJM States, PJM Environmental Information Services