RENEWABLE THERMAL IN STATE RENEWABLE PORTFOLIO STANDARDS

Prepared for the

The RPS Collaborative

by

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Disclaimer

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Introduction: Renewable Thermal in RPSs

State Renewable Portfolio Standard (RPS) programs have historically focused on electricity generation. However, some states have incorporated renewable thermal power for heat generation into their RPS as a way to support the development and market growth of solar thermal, biomass thermal, geothermal, and other renewable thermal technologies. But because RPS programs were originally designed to measure electrical output, not heat output, it is complicated to incorporate renewable thermal energy into state RPS programs.

The reasons that some states have added renewable thermal technologies to their RPS include:

- Adding clean energy technologies to an RPS is a powerful way to promote their development and market growth.
- Using certain renewable energy sources, like biomass, to produce heat is more efficient than using them to produce electricity.
- Renewable thermal heat achieves a main policy goal of an RPS: it helps people transition away from fossil fuels to cleaner, renewable and local technologies.

Renewable thermal energy has many of the same benefits as other renewable technologies, including improved air quality, economic development and job creation, and the promotion of regional energy security.

Among the fourteen state RPS programs that include renewable thermal, there is significant variation in terms of (1) which renewable thermal technologies are eligible, (2) how energy output is measured and monitored, (3) how REC values are determined, and (4) how the technologies are classified in the RPS.

This paper provides an overview of how states across the country are incorporating renewable thermal technologies into their RPS programs. Its purpose is not to advocate for including renewable thermal technologies into RPSs, but rather to provide a general introduction to the topic.

Eligible Renewable Thermal Technologies

There are several different renewable thermal technologies, but the most common renewable thermal technologies incorporated into an RPS program are the following:

1. **Solar Thermal:** Several technologies are included in this category: solar hot water, solar space heat, solar thermal process heat, solar pool heating, and solar space cooling.

2. **Biomass**: Biomass can take three different forms, solid (pellets or chips, usually made of wood), liquid (biodiesel, pyrolysis oil, ethanol – usually made with plant matter), or gas (produced by the anaerobic digestion of animal or food waste). [1]
3. **Geothermal**: Air, water, and ground source. Geothermal can be used for both heating and cooling.

Some states allow all these technologies to be eligible under the RPS, and other states include only specific ones, as shown in Table 1. How states determine which renewable thermal technologies count towards their RPS has a lot to do with regional resource availability and local preferences. For example, some states have large quantities of agricultural waste available, and therefore might include biomass. Some states have suitable geological ground conditions for extensive geothermal energy use. States in cool climates have more heating needs and might be inclined to support a wider variety of renewable thermal technologies. States in warmer climates may need cooling rather than heating, which suggests a different set of renewable thermal technologies.

Table 1: States that include each of these renewable thermal technologies in their RPS:[2]

All	Solar Thermal	Biomass	Geothermal
AZ, IN, MA, MD, NH, TX, VT, WI	**AZ, DC, IN, MA, MD*, NV, NH, NC, PA, TX, UT, WI**	**AZ, IN, MA, MD**, NC***, NH, OR***, TX, WI**	**AZ, IN, MA, MD, NV, NH, TX, WI**

** Solar hot water only*
*** Excludes woody biomass*
****Only useful thermal energy that is produced as a byproduct by biomass electricity generators is eligible*

The most common renewable thermal technology included in state RPS programs is solar hot water used in buildings. This is the most widely accepted renewable thermal technology added to RPS programs, for a variety of reasons: it is a simple, mature technology that is well known

[1] Combined Heat and Power (CHP), also known as cogeneration, produces electricity and useful thermal energy from the same fuel source. CHP is usually powered by natural gas, but is sometimes fueled by biomass. CHP qualifies for some states' RPSs. In most cases, only the electricity generation from CHP systems receives RECs, but in a few states, such as Massachusetts and Oregon, the thermal output of biomass-fueled systems is eligible for RECs and those states are included in this paper. Comprehensive information about CHP in RPS programs is available in the U.S. Environmental Protection Agency's March 2016 publication "Portfolio Standards and the Promotion of Combined Heat and Power," available at https://www.epa.gov/sites/production/files/2015-07/documents/portfolio_standards_and_the_promotion_of_combined_heat_and_power.pdf.

[2] The same energy sources that generate renewable thermal heat can also be used to generate electricity. This includes solar thermal electric, geothermal electric, and biomass electric, all of which are included in various state RPS programs. In the case of thermal electric technologies, their incorporation into the RPS is straightforward. However, heat technologies, not electric, are the focus of this paper.

and uncontroversial. By contrast, biomass technologies can be controversial because they release greenhouse gas emissions and, in the case of woody biomass, may lead to concerns about particulates and deforestation in certain locations. For this reason, eligible biomass systems are sometimes restricted to animal waste biomass only and/or non-woody biomass.

Assigning a REC Value to Renewable Thermal Energy

In order to count towards an RPS requirement or goal, the renewable thermal energy generated must be connected to a value that can be converted into a Renewable Energy Certificate (REC). RECs were designed to measure electricity, not energy or heat. In most RPS programs, one REC is equal to one MWh of electricity generated. Because renewable thermal heat is not measured in megawatt-hours (MWh), states have developed various methods of assigning REC values for these technologies.

- Some states base RECs for thermal energy on a BTU to MWh conversion. This is sometimes called the "**electric equivalency basis**." In this situation, the heat produced is measured. A frequent REC conversion rate is 3,412,000 BTUs = 1 MWh = 1 REC.

- Other states calculate RECs based on the MWh of **conventional electricity displaced**. In this situation, the electricity displaced is measured. This equation is typically 1 MWh displaced = 1 REC.

Table 2 below shows how REC values are awarded in different states. How a state awards REC values can vary by technology and metering type.

Table 2: How REC values are awarded by state

RECs awarded based on energy generated, 1 REC = 3,412,000 BTUs = 1 MWh[3]	RECs awarded based on electricity displaced, 1 REC = 1 MWh displaced
AZ, DC (for metered output), IN, MA, MD, NV (for solar thermal), NH, NC, OR, TX (for landfill gas)	**DC (for estimated output), PA, TX (for solar hot water and geothermal), UT, VT, WI**

[3] In Arizona and Nevada, 1 REC = 1 kWh, whereas in other states 1 REC = 1 MWh. In Nevada, 1 REC = 1 kWh = 3,412 BTUs. Arizona's conversion rate is unique: 1 REC = 1 KWh = *3,415* BTUs.

Monitoring and Metering Renewable Thermal Energy Production

Approaches to monitoring and metering renewable thermal systems vary by state and by technology, as well as by the size of the system and whether it is a residential or commercial/ industrial system. Some states have stricter standards for monitoring and metering than others.

Monitoring means verifying that the renewable thermal system is in good working order, as well as verifying that measuring systems are fully functional. Some states require that independent licensed monitors verify and report energy production and technical specifications. In addition to or instead of monitoring, some states require that renewable thermal systems meet certification requirements in order to be eligible for the RPS. For example, many states require solar thermal systems to be certified by the Solar Rating and Certification Corporation (SRCC).

Metering means measuring the heat produced and/or the electricity displaced. Approaches to metering vary: some states allow estimates of heat production while others require direct measurement. Most states do a combination of both methods. In Washington, DC, for instance, heat output is measured only for metered systems; for systems without meters, the electricity displaced is measured.

Metering requirements can vary by system size. Many states have less stringent metering requirements for smaller systems because metering equipment is not standard in many smaller renewable thermal systems and can add significantly to the cost of the system. In some states, small systems are allowed to estimate output with periodic system verification by independent monitors, while larger systems are required to perform actual metering overseen by independent monitors; variations of this approach exist in the District of Columbia, Nevada, New Hampshire, Texas and Wisconsin.

Metering requirements can also vary by technology type. For instance, biomass systems can be measured by heat output or by fuel input, whereas the "fuel input" from solar thermal cannot be measured; a solar thermal system might instead be measured by heat produced or by electricity displaced. In Maryland, for example, solar and biomass thermal systems must be metered, while geothermal output is estimated.

Approaches used to estimate renewable thermal heat production can vary. Some states offer an approved formula for estimating output ("modeled output"). For solar hot water, performance estimates based on the SRCC's solar water heating rating system are commonly used as a proxy for actual system output (as in Arizona, DC, Maryland and Nevada). For biomass thermal systems, the heat output can be estimated based on the fuel input.

Those states that use the amount of electricity displaced as the basis for awarding RECs often use the average expected system performance of the electrical system that the renewable

thermal system is replacing. In Texas, for example, solar hot water and geothermal heat pumps earn REC offsets based on the average annual MWh of the system they are replacing.

For the states that measure heat output, many specify that only "useful thermal energy" counts towards their RPS program. Various states define this term differently. Some states use this term to differentiate between the total amount of heat produced (system output) and the amount of heat used by the end user, the latter being the amount that should be counted towards the RPS. Other states use the term "useful thermal energy" to also refer to the need to subtract the parasitic load (the energy used to run the system) from the total amount of heat produced in order determine the amount of useful heat that should be applied to the RPS. Depending on the state and the size of the system, one can either directly meter the parasitic load or use a percentage estimate of energy lost. What needs to be measured—total system output or actual energy used—determines where the metering device will be placed on the renewable thermal system.

Besides parasitic load, another discount factor that is sometimes included when developing a metering system to measure heat output is a meter accuracy discount factor. This is the estimated margin of error for the metering system. It is calculated based on the manufacturer's guarantee of meter accuracy.

An added factor in the complexity of determining a metering approach is that the U.S. does not have an official heat meter standard by which thermal energy is measured, although the Environmental Protection Agency is in the process of drafting one.[4] In the meantime, many states have opted to use the European heat meter standard, which measures heat in BTUs (British Thermal Units).

Classifying Renewable Thermal in the RPS

States have classified renewable thermal technologies into their RPS in a variety of different ways.

In several states, renewable thermal technologies are classified separately from electricity-generating renewable technologies. For instance, in Pennsylvania, renewable thermal technologies are classified as Tier II demand-side management resources, and they earn Tier II energy efficiency credits. In Arizona, renewable thermal technologies are classified as customer-sited resources, and in Texas they are classified as generation-offset technologies. Wisconsin has an RPS tier for non-electric resources which displace electricity, and renewable thermal technologies fall into this category.

[4] The group that is working on this is ASTM E44.25 Subcommittee on Heat Metering. See: http://www.astm.org/COMMITTEE/E44.htm

In other states, renewable thermal technologies are included alongside electricity-generating renewable technologies. In the District of Columbia's RPS, for example, solar thermal is included as a Tier I technology along with solar electric and other renewable technologies. Renewable thermal technologies are also classified as Tier I resources in Maryland and North Carolina.

In the case of solar thermal, many states count the energy generated or displaced as part of a solar carve-out. In these cases, solar thermal may be awarded Solar Renewable Energy Certificates (SRECs). This is the case in Maryland and North Carolina. In other states, solar thermal technologies may be eligible for solar multipliers.

How renewable thermal RECs are classified can vary by technology within a state. For example, in Nevada, solar thermal counts towards the RPS as a renewable resource, while geothermal counts towards the RPS as an energy efficiency measure.

To promote the growth of renewable thermal technologies, New Hampshire has established a separate carve-out for these technologies. This ensures that a minimum amount of renewable thermal energy must be produced. New Hampshire is the only state that has created a specific carve-out for renewable thermal technologies.

States with Renewable Thermal in the RPS

The following is an overview of the state RPS programs that include renewable thermal technologies as of May 2018. For the purposes of this paper, all programs are referred to as RPSs, and all renewable energy certificates are referred to as RECs. However, significant variation exists among state programs as to what terminology is used.

ARIZONA

RPS Type: Mandatory

Eligible Technologies: Biomass thermal, biogas thermal, commercial solar pool heaters, geothermal space heating and process heating systems, solar industrial process heating and cooling, solar space heating, and solar water heaters. Eligible biogas and biomass thermal systems specifically exclude biomass and wood stoves, furnaces and fireplaces. All eligible technologies in the RPS must offset conventional energy resources.

RPS Classification: Arizona's RPS includes two main categories of eligible technologies: "Eligible Renewable Energy Resources" and "Distributed Renewable Energy Resources," which are defined as "technologies that are located at a customer's premises and that displace conventional energy resources that would otherwise be used to provide electricity to Arizona

customers." Certain specified renewable thermal technologies (see eligible technologies list above) and wind generators (1 MW or less) are classified as Distributed Renewable Energy Resources. Arizona's RPS includes a distributed renewable energy requirement of 30 percent after 2011, one half of which must come from residential applications.

REC Creation: 1 REC = 1 kWh = 3,415 BTUs

Metering & Monitoring: Arizona's rules do not specifically require meters to monitor renewable thermal heat output. Residential solar water heating systems use the Solar Rating and Certification Corporation's (SRCC) OG-300 standard as a proxy for actual system output. Larger solar thermal systems usually include a meter to monitor solar thermal system output. On smaller commercial (non-residential) systems, Arizona accepts reasonable engineering calculations as a proxy for actual system output, particularly if they are based, in part, on SRCC's OG-100 collector ratings.

Sources:

- Arizona Administrative Code, Article 18: Renewable Energy Standard and Tariff, Pages 172-178 http://apps.azsos.gov/public_services/Title_14/14-02.pdf

DISTRICT OF COLUMBIA

RPS Type: Mandatory

Eligible Technologies: Solar thermal (solar water heat, solar space heat, solar thermal process heat and solar space cooling)

RPS Classification: Solar thermal is included as a Tier I technology in the DC RPS, along with solar electric and other renewable technologies.

REC Creation: When solar thermal heat output uses an approved energy meter, RECs are awarded based on energy generated. 1 kWh = 3,412 BTUs.

For estimated output of solar thermal heat, RECs are awarded based on kilowatt-hour savings for the system.

Metering & Monitoring: Behind-the-meter generators with a capacity of less than 10kW may submit engineering-based estimates of their output if the generator is not directly measured by a revenue grade utility meter. For solar thermal energy systems that do not generate electricity, if the output is to be estimated, the Commission will provide PJM-EIS with the output in kilowatt-hour savings for the system, based on SRCC's estimated annual system performance of OG-300 certified systems.

The energy output of the non-residential solar heating, cooling or process heat property systems producing or displacing greater than 10 kWh per year is determined by an on-site

energy meter that meets performances standards established by the International Organization of Legal Metrology (OIML) and the solar collectors used have a OG-100 certification from the SRCC, If applicable.

Solar thermal installations must generally use SRCC certified components in order to qualify as an eligible resource. The Solar Collector Certification Temporary Amendment Act of 2010 requires certification of residential solar thermal systems and certification of nonresidential solar thermal collectors. Read the full act at http://dcclims1.dccouncil.us/images/00001/20101129160151.pdf

Sources:

- See page 10 of DC's RPS Final Rules for details on assigning REC values: http://www.dcpsc.org/pdf_files/commorders/dcmr15/Chapter29.pdf
- DC PSC RPS page: https://www.dcpsc.org/Utility-Information/Electric/Renewables/Renewable-Energy-Portfolio-Standard-Program.aspx

INDIANA

RPS Type: Voluntary

Eligible Technologies: Clean energy resources that provide thermal energy for heating, cooling or mechanical work are eligible for the RPS.

RPS Classification: Renewable thermal technologies are classified alongside renewable electricity-generating technologies.

REC Creation: For clean energy resources that provide thermal energy, one clean energy credit (REC) is earned for every 3,412,000 BTUs of useful thermal energy produced. Utilities can seek approval of an alternative equation to determine the number of clean energy credits earned for the useful thermal energy produced.

Metering & Monitoring: In order to measure thermal energy for the purpose of goal compli-ance, it may be measured directly through a meter, calculated using the equation set forth in IAC 17.1, or a utility may seek approval from the commission to use an alternative equation.

Sources:

- Indiana Administrative Code (IAC) Title 170, Article 17.1, Indiana Voluntary Clean Energy Portfolio Standard Program http://www.in.gov/legislative/iac/title170.html

MARYLAND

RPS Type: Mandatory

Eligible Technologies: Residential solar water heating (excluding systems used solely to heat a pool or hot tub), geothermal heating and cooling, and thermal energy associated with biomass systems using primarily food waste, crop waste, crops grown for energy production, or animal manure, including poultry litter, and specifically excluding woody biomass.

RPS Classification: Renewable thermal technologies are classified as Tier I resources. Solar water heating is eligible for the solar carve out.

REC Creation: Tier 1 RECs for renewable thermal are awarded at a 3,412,000 BTU = 1 MWh = 1 REC conversion rate. SRECs are awarded for solar thermal. A residential solar hot water system may not produce more than 5 RECs in one year.

Metering & Monitoring: Residential solar hot water can either be measured by a meter that meets the required standards of the International Organization for Legal Metrology (IOLM) or measured by the SRCC's OG-300 thermal performance rating for the system, and certificated to the OG-300 standard of the SRCC. Non-residential and commercial solar hot water systems must be measured by an on-site meter that meets the required performance standards of the IOLM.

Biomass thermal systems must be metered by an on-site meter that meets IOLM performance standards. Geothermal output is estimated.

Legislative activity: The Maryland Energy Administration's Thermal Energy Task Force submitted a report to the legislature in January 2014 with recommendations on how to more fully incorporate renewable thermal energy sources into the state RPS.

Sources:

- Biomass Thermal regulations http://mlis.state.md.us/2012rs/bills/sb/sb1004f.pdf
- Geothermal regulations http://mlis.state.md.us/2012rs/bills/sb/sb0652e.pdf
- Solar thermal regulations http://mgaleg.maryland.gov/2011rs/chapters_noln/Ch_407_sb0717E.pdf
- *Report of the Thermal Renewable Energy Credit Task Force*, Maryland Energy Administration, January 2014 http://msa.maryland.gov/megafile/msa/speccol/sc5300/sc5339/000113/018000/018939/unrestricted/20140015e.pdf

MASSACHUSETTS

RPS Type: Mandatory

Eligible Technologies: Any facility that generates useful thermal energy using sunlight, biomass, biogas, including renewable natural gas that is introduced into the natural gas distribution system, liquid biofuel or naturally occurring temperature differences in ground, air or water. Facilities using biomass fuel shall be low emission, use efficient energy conversion technologies and fuel that is produced by means of sustainable forestry practices.

RPS Classification: Renewable thermal energy is eligible for the state's Alternative Energy Portfolio Standard (APS), which requires meeting 5 percent of Massachusetts' electric load with "alternative energy" by 2020. Massachusetts' APS is distinct from the RPS, but essentially acts as a separate tier. The APS also includes non-renewable energy sources, such as CHP, flywheel storage, and efficient steam technologies.

REC Creation: An alternative energy credit (AEC) equivalent to one megawatt-hour of electricity is earned for every 3,412,000 British thermal units of net useful thermal energy produced. The Massachusetts Department of Energy Resources may provide a credit multiplier for certain non-emitting renewable thermal technologies, so as to stimulate the development of new on-site renewable thermal energy generating sources.

Metering & Monitoring: Energy production must be verified through an on-site utility grade meter or other means satisfactory to the department. Small systems will not have to meter, but will instead receive AECs based on a calculation of their expected net thermal energy output.

Legislative activity: On June 2, 2017, the Massachusetts Department of Energy Resources (DOER) filed Regulation 225 CMR 16.00 with the Secretary of State's office to add additional eligible technologies, including renewable thermal, in the APS pursuant to Chapter 251 of the Acts of 2014. The final regulations were promulgated and went into effect on December 29, 2017.

Sources:

- Bill S.2214 188th (2013 - 2014): An Act relative to credit for thermal energy generated with renewable fuels https://malegislature.gov/Bills/188/Senate/S2214
- 225 CMR 16.00: Alternative Energy Portfolio Standard (APS) https://www.mass.gov/regulations/225-CMR-16-alternative-energy-portfolio-standard-aps
- Renewable Heating and Cooling in the Alternative Portfolio Standard https://www.mass.gov/guides/aps-renewable-thermal-statement-of-qualification-application
- Alternative Energy Portfolio Standard Guideline on Metering and Calculating the Useful Thermal Output of Eligible Renewable Thermal Generation Units (December 2017) https://www.mass.gov/files/documents/2017/12/14/Guideline%20on%20Metering%20

and%20Calculating%20Useful%20Thermal%20Output%20of%20Eligible%20Renewable%20Thermal%20Generation%20Units-%20Part%201%20FINAL.pdf

- *Commonwealth Accelerated Renewable Thermal Strategy – Final Report*, prepared for the Massachusetts Department of Energy Resources (DOER) (January 2014). www.mass.gov/eea/docs/doer/renewables/thermal/carts-report.pdf
- *Massachusetts Heating and Cooling: Opportunities and Impacts Study*, prepared by Meister Consultants Group for the Massachusetts Clean Energy Center and the Massachusetts Department of Energy Resources (March 2012). www.mass.gov/eea/docs/doer/renewables/renewable-thermal-study.pdf

NEVADA

RPS Type: Mandatory

Eligible Technologies: Solar water heat, solar space heat, geothermal electric, solar thermal electric, solar thermal process heat, geothermal heat pumps

RPS Classification: Renewable solar thermal technologies count towards the RPS as renewable resources. Geothermal energy systems providing heated water to one or more customers are classified as an energy efficiency measure.

REC Creation: Solar thermal energy systems are credited with 1 kilowatt-hour of electricity for each 3,412 British thermal units of heat generated.

The energy, measured in BTUs, generated by a geothermal energy system providing heated water to one or more customers must be calculated as (F x T) x 500, less the system losses as calculated by a professional engineer and accepted by the Administrator, where "F" equals the flow rate, measured in gallons per minute; and "T" equals the change in temperature across a heat exchanger or system, measured by the difference in temperature of the incoming fluid in degrees Fahrenheit and the temperature of the outgoing fluid in degrees Fahrenheit after it has passed through the heat exchanger or system. For heat exchangers used by end-use customers, it is assumed that no system losses occur, and no calculation of system losses by a professional engineer is required.

Metering & Monitoring: Solar water heating systems that are not rated by the SRCC must use a thermal energy meter. For solar water heating systems with an SRCC rating of 34 million BTUS or more, a thermal energy meter is required. For a solar water heating system that has an SRCC rating of less than 34 million BTUs, the annual performance estimates of the SRCC for the solar water heating system may be used.

A solar thermal system that is used for a purpose other than as a solar water heating system qualifies as a renewable energy system only if the Commission determines that the provider

can adequately measure or estimate the number of equivalent kWh attributable to the solar thermal system.

Sources:

- NV-PUC http://puc.nv.gov/Renewable_Energy/Portfolio_Standard/ and http://puc.nv.gov/Renewable_Energy/RPS/PEC_Trading_Program/
- Nevada Revised Statutes (NRS) 704.7801-704.7828, Portfolio Standard http://www.leg.state.nv.us/NRS/NRS-704.html#NRS704Sec7802
- Nevada Administrative Code (NAC) 704.8831-704.8937, Portfolio Standard http://nvrules.elaws.us/nac/chapter704_27_4

NEW HAMPSHIRE[5]

RPS Type: Mandatory

Eligible Technologies: Solar thermal, geothermal (ground source heat pumps), and thermal biomass renewable energy technologies.

RPS Classification: New Hampshire is the first and only state to require that a portion of its RPS come from thermal energy (2 percent by 2023 and thereafter). The New Hampshire RPS includes a Class I sub-class for useful thermal energy. Since 2014, providers of electricity have been required to meet the Class I thermal RPS obligation.

REC Creation: Thermal RECs are calculated based on the measured thermal output and converted assuming that 3,412,000 BTUs equals one megawatt-hour of electricity.

Metering & Monitoring: Systems larger than 150,000 BTUs/hr are required to install thermal meters. Systems smaller than 150,000 BTUs/hr can either install thermal meters or meters to measure a parameter that can be used to calculate the thermal output such operating hours or fuel input.

Legislative activity: Legislation requiring the creation of a renewable thermal RPS sub-class was passed in July 2012 with subsequent amendments. The New Hampshire Public Utilities Commission finalized the rulemaking in December 2014, but RECs were issued retroactively back to January 1, 2014. Order No. 25,978 (1/17/2017) reduced the Thermal Class I obligation from 1.3 percent to 0.6 percent.

SOURCES:

[5] A detailed case study of thermal technologies in the New Hampshire RPS is included as chapter three in Jenny Heeter et al., *Case Studies of RPS Best Practices: Solar Carve-Outs, SREC Tracking, and Thermal Inclusion* (Montpelier: Clean Energy States Alliance, 2018), https://www.cesa.org/resource-library/resource/case-studies-of-rps-best-practices-solar-carve-outs-srec-tracking-and-thermal-inclusion.

- NH PUC – RPS Class I Thermal Renewable Energy Certificate Program http://www.puc.state.nh.us/Sustainable%20Energy/Class%20I%20Thermal%20Renewable%20Energy.html
- PUC 2500 Electric Renewable Portfolio Standard http://www.puc.nh.gov/Regulatory/Rules/Puc2500.pdf
- *Metering and Measurement of Thermal Energy – Draft Report* (Antares Group for the New Hampshire Public Utilities Commission, September 2013) www.puc.state.nh.us/sustainable%20Energy/RPS/Class%20I%20Thermal/NH%20Thermal%20Metering%20Report%20V4.pdf

NORTH CAROLINA

RPS Type: Mandatory

Eligible Technologies: Solar thermal, and waste heat derived from a renewable energy resource (biomass, including poultry waste) and used to produce useful, measurable thermal energy at a retail electric customer's facility.

RPS Classification: Solar thermal is included in the solar-specific target.

REC Creation: Renewable energy certificates shall be earned based on one certificate for every 3,412,000 BTUs of useful thermal energy produced.

Metering & Monitoring: The useful thermal energy may be measured by meter, or if that is not practicable, by other industry-accepted means that show what measurable amount of useful thermal energy the system or facility is designed and operated to produce and use. Meter devices, if used, shall be located so as to measure the actual thermal energy consumed by the load served by the facility.

Sources:

- NC Code 62-133.8 Renewable Energy and Energy Efficiency Portfolio Standard (REPS) http://www.ncleg.net/EnactedLegislation/Statutes/HTML/BySection/Chapter_62/GS_62-133.8.html
- NC Code, Chapter 8, Electric Light and Power, Pages 88-102 http://www.ncuc.net/ncrules/Chapter08.pdf
- North Carolina Utilities Commission – Renewable Energy and Energy Efficiency Portfolio Standard webpage http://www.ncuc.commerce.state.nc.us/reps/reps.htm

OREGON

RPS Type: Mandatory

Eligible Technologies: Biomass electric facilities that generate useful thermal energy as a byproduct.

RPS Classification: "Thermal Renewable Energy Certificates" (T-RECs) are treated as a sub-category of RECs.

REC Creation: "Thermal Renewable Energy Certificate" (T-REC) means a REC created in association with the generation of 3,412,000 British thermal units of qualifying thermal energy, which is equivalent to one REC created in association with the generation of one megawatt hour of Qualifying Electricity.

Metering & Monitoring: Meters measuring thermal output are required for large facilities (those that can produce at least one T-REC – 3,412,000 BTUs of qualifying thermal energy – per hour).

Small systems (generating less than one T-REC per hour) must also meter delivered qualifying thermal energy. However, certain directly measured parameters with low variance may be evaluated on an annual basis and used as a constant in the calculation methodology.

For complete details on Oregon's metering and monitoring requirements for thermal energy, see pages 6-8: https://www.oregon.gov/energy/Get-Involved/rulemakingdocs/2016%2012%20TRECs%20Rules.pdf.

Legislative activity: In 2016, SB 1547 added thermal energy as an eligible resource. The Oregon Department of Energy filed their final rules incorporating thermal energy into the RPS in December 2017.

Sources:

- Oregon Department of Energy's RPS webpage: http://www.oregon.gov/energy/Get-Involved/Pages/RPS-Rulemaking.aspx
- OAR 330-160-0080: Thermal Energy from the Generation of Electricity Using Biomass https://secure.sos.state.or.us/oard/view.action?ruleNumber=330-160-0080
- Draft Rules for Thermal Renewable Energy Certificates (R-RECs) Companion Issues Document https://www.oregon.gov/energy/Get-Involved/rulemakingdocs/ODOE_TRECs_Draft_Rule_ISSUES-August2016.pdf

PENNSYLVANIA

RPS Type: Mandatory

Eligible Technologies: Solar hot water. Other renewable thermal technologies might be considered for inclusion on a case-by-case basis.

RPS Classification: Solar thermal technologies that do not produce electricity (e.g., domestic solar water heaters) are considered Tier II demand-side management resources. A solar hot water system will qualify for Tier II Energy Efficiency Credits provided that the system has replaced an electric hot water system for which the electricity savings would need to be proven in kilowatt-hours, not BTU output. Please note that these credits are not the same as Solar Photovoltaic credits that are qualified as a separate Tier.

REC Creation: RECs for renewable thermal are assigned based on the electricity displaced. 1 REC = 1 MWh of electricity generated or displaced.

Metering & Monitoring: Solar hot water systems must have a meter demonstrating energy savings.

Legislative activity: In October 2016, the Pennsylvania Public Utility Commission voted to implement modified regulations related to the AEPS Act of 2004, including defining the term "useful thermal energy" to mean thermal energy created from the production of electricity. This technology and fuel neutral definition of useful thermal energy essentially allows CHP facilities to qualify as a Tier II resource, however, this definition expressively prohibits combined-cycle electric generation facilities from being considered as an eligible resource.

Sources:

- PA Code Chapter 75, Alternative Energy Portfolio Standards http://www.pacode.com/secure/data/052/chapter75/chap75toc.html
- Pennsylvania Alternative Energy Portfolio Standard Program website http://www.puc.pa.gov/consumer_info/electricity/alternative_energy.aspx

TEXAS

RPS Type: Mandatory

Eligible Technologies: Solar hot water, geothermal heat pumps, and landfill gas.

RPS Classification: Solar hot water and geothermal heat pumps are classified as generation offset technologies.

REC Creation: Solar hot water and geothermal heat pumps earn REC offsets based on the average annual MWh output of the system they are replacing.

For a municipally owned utility operating a gas distribution system, any production or acquisition of landfill gas that is directly supplied to the gas distribution system is eligible to produce RECs based upon the conversion of the thermal energy in BTUs to electric energy in kWh using as the conversion factor the system wide average heat rate of the gas-fired units of the combined utility's electric system as measured in BTUs per kWh.

Metering & Monitoring: Customer-owned eligible renewable energy generating units with a rated capacity of less than 1MW operating on the customer's side of the utility meter may report generation based on metered or estimated output. For all other generating units, the output of the facility must be readily capable of being physically metered and verified in Texas by the program administrator.

Sources:

- Texas Code 25.173, Goal for Renewable Energy
  http://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/25.173/25.173.pdf

UTAH

RPS Type: Voluntary

Eligible Technologies: Solar thermal and geothermal.

RPS Classification: There are no tiers in Utah's program of voluntary renewable energy goals. Renewable thermal technologies are classified as renewable energy sources, but are categorized separately from electricity-generating sources.

REC Creation: REC value is determined by the equivalent kilowatt-hours saved, except to the extent the commission determines otherwise with respect to net-metered energy.

Metering & Monitoring: Utah does not engage in the inspection or awarding of REC values. The Western Renewable Energy Generation Information System (WREGIS), which tracks RECs in Utah, allows small, customer-sited distributed generating units to self-report generation data.

Sources:

- Utah Code Chapter 17, Energy Resource Procurement Act
  http://le.utah.gov/UtahCode/section.jsp?code=54-17
- WREGIS Operating Rules
  https://www.wecc.biz/Corporate/WREGIS%20Operating%20Rules%20072013%20Final.pdf

VERMONT

RPS Type: Mandatory

Eligible Technologies: All renewable thermal technologies are eligible.

RPS Classification: Eligible thermal technologies are classified as Tier 3 "energy transformation" technologies, defined as measures that produce energy-related goods and services and result in a net reduction in fossil fuel consumption and greenhouse gas emissions, but do not generate electricity. Examples include cold-climate heat pumps, weatherization, and wood pellet boilers. Law requires utilities to hold Tier 3 RECs, which are not tradable. Distributed biomass projects

count towards Tier 2 (distributed generation requirement) if they produce combined heat and power.

REC Creation: For Tier 3, RECs are created as MWh equivalents of displaced fossil fuels. A technical advisory group determines how much fossil fuel is displaced by eligible technologies and converts the displaced fossil fuel to a MWh equivalent based on the utility's individual mix of power supply resources. Utilities can also submit savings claims outside of the technical advisory group process, but they run the risk of the Vermont Public Utility Commission not accepting the claims. Thus, the utilities are generally deploying technologies that have agreed-on savings values. If an energy transformation project is funded by both a distribution utility and the state's efficiency utility, the Commission allows credits to be shared between the two.

Metering & Monitoring: There is no metering requirement for renewable thermal systems. Monitoring and verification are performed annually through audits of utility claims and empirical studies of measured savings.

Legislative activity: In June 2015, Vermont H.40 established a mandatory renewable portfolio standard. The first compliance year was 2017. Prior to H.40, Vermont's voluntary renewable goal did not allow thermal systems to earn RECs.

Sources:

- Vermont Statutes, Title 30: Public Service, Chapter 89: Renewable Energy Programs http://legislature.vermont.gov/statutes/chapter/30/089
- State of Vermont Public Utility Commission – Renewable Energy Standard http://puc.vermont.gov/electric/renewable-energy-standard

WISCONSIN

RPS Type: Mandatory

Eligible Technologies: All categories of renewable thermal technologies are eligible.

RPS Classification: Renewable thermal technologies count towards the RPS as non-electric resources to the extent they displace electricity from conventional resources.

REC Creation: Under the RPS, electricity providers, or customers who own displacement facilities, may create and sell or transfer both Renewable Resource Credits (RRCs) and Renewable Energy Certificates (RECs). An RRC is defined as either 1) a REC that exceeds a utility's minimum requirements or 2) a certificate representing one MWh of displaced conventional electricity. To create a RRC, displaced electricity must be multiplied by a displacement percentage that represents only the portion of electricity from conventional resources. The displacement percentage is determined by the Public Service Commission (PSC) on an annual basis per administrative code. Details at http://docs.legis.wisconsin.gov/code/admin_code/psc/118/09.

Metering & Monitoring: Metering is required for utility-owned systems. For customer-owned systems, estimating the amount of displaced electricity is allowed through methods approved by the PSC.

Sources:

- Chapter PSC 118, Renewable Resource Credit Tracking Program
  http://docs.legis.wisconsin.gov/code/admin_code/psc/118.pdf
- Wisconsin State Legislature 196.378 Renewable Resources
  http://docs.legis.wisconsin.gov/statutes/statutes/196/378

Sources for More Information

WEBINARS

Renewable Thermal Technologies in the Massachusetts APS
Clean Energy States Alliance, January 2018
https://www.cesa.org/webinars/renewable-thermal-technologies-in-the-massachusetts-aps

Since 2014, the Massachusetts Department of Energy Resources (DOER) has been working on designing rules and regulations for including renewable thermal technologies in the Alternative Portfolio Standard (APS). This webinar featured a presentation on the draft regulations by Samantha Meserve, Renewable Thermal Program Coordinator at DOER.

State Leadership in Clean Energy: Award-Winning Programs in New Hampshire and Rhode Island
Clean Energy States Alliance, July 2016
https://cesa.org/webinars/state-leadership-in-clean-energy-award-winning-programs-in-new-hampshire-and-rhode-island/

This webinar highlighted two winning programs from CESA's 2016 State Leadership in Clean Energy Awards, including New Hampshire's Useful Thermal Energy Certificate (T-REC) Program. Elizabeth Nixon and Barbara Bernstein from the New Hampshire Public Utilities Commission Sustainable Energy Division presented.

State of the States – Biomass Thermal Policy Incentives on the State Level
Biomass Thermal Energy Council Webinar, August 2014
https://vimeo.com/102768333

This webinar provides an overview of state-supported biomass thermal incentives and rebates across the country, including renewable portfolio standards. Guest speaker John Ackerly from

the Alliance for Green Heat discussed residential incentives; Adam Sherman from the Biomass Energy Resource Center discussed commercial incentives; and Ellen Burkhard and Ryan Moore from NYSERDA discussed a new renewable heat program in New York State.

Massachusetts Renewable Thermal Opportunities and Impacts
Clean Energy States Alliance, May 2012
www.cesa.org/webinars/cesa-rps-webinar-renewable-solar-thermal

The webinar reported on the findings of the "Massachusetts Renewable Heating and Cooling: Opportunities and Impacts Study." Guest speakers were Bram Claeys, Renewable Energy Policy Director, Massachusetts Department of Energy Resources; Christie Howe, Project Manager, Massachusetts Clean Energy Center; and Neil Veilleux, Senior Consultant, Meister Consultants Group.

Solar Thermal Trends, Performance-Based Incentives, and RPS
Clean Energy States Alliance Webinar, March 2012
www.cesa.org/webinars/joint-cesa-state-federal-rps-collaborative-webinar-solar-thermal-trends-performance-based-incentives-and-rps

This webinar featured three presentations looking at solar thermal from different vantage points. Les Nelson of the International Association of Plumbing & Mechanical Officials summarized market and costs trends for solar thermal technologies. James Critchfield discussed U.S. EPA's initiative to work with stakeholders to create a U.S. Heat Meter Standard, which will set requirements for the instrumentation and application of equipment used to measure the energy generation of thermal energy systems. Sam Watson of the North Carolina Utilities Commission described his state's experiences with including solar thermal in its RPS and discussed lessons learned.

REPORTS

Case Studies of RPS Best Practices: Solar Carve-Outs, SREC Tracking, and Thermal Inclusion
Clean Energy States Alliance, July 2018
https://www.cesa.org/resource-library/resource/case-studies-of-rps-best-practices-solar-carve-outs-srec-tracking-and-thermal-inclusion

This report's third chapter, written by Val Stori, is a detailed case study of thermal technologies in the New Hampshire RPS. It traces the history of the state's thermal RPS provisions, describes the results, and identifies the program's strengths and limitations.

A Summary Guide to Wood Biomass Heating Programs of CESA Members
Clean Energy States Alliance, March 2016
https://www.cesa.org/resource-library/resource/a-summary-guide-to-wood-biomass-heating-programs-of-cesa-members

This document surveys current and planned activities of CESA member states that are focused on the deployment of modern, high-efficiency, wood heating systems.

Portfolio Standards and the Promotion of Combined Heat and Power
U.S. Environmental Protection Agency, Combined Heat and Power Partnership, March 2016
https://www.epa.gov/sites/production/files/2015-07/documents/portfolio_standards_and_the_promotion_of_combined_heat_and_power.pdf

This publication contains a comprehensive overview of the incorporation of CHP into RPS programs around the country.

Solar Heating and Cooling Best Practices in State Policies to Support Commercial and Industrial Market Development
U.S. Environmental Protection Agency, December 2012
https://www.epa.gov/sites/production/files/2014-11/documents/solar-heating-cooling-state-policy-paper.pdf

This paper reviews policies and implementation programs that support commercial and industrial applications of solar heating and cooling technologies. For information on eligibility within the state clean energy standards, see pages 3-8.

OTHER

The Database of State Incentives for Renewables & Efficiency (DSIRE)
www.dsireusa.org

The DSIRE website contains extensive information about state renewable energy policies and incentives, including RPSs. DSIRE is run by the NC Clean Energy Technology Center.




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The Clean Energy States Alliance (CESA) is a national, non-profit coalition of public agencies and organizations working together to advance clean energy. CESA members—mostly state agencies—include many of the most innovative, successful, and influential public funders of clean energy initiatives in the country.

CESA works with state leaders, federal agencies, industry representatives, and other stakeholders to develop and promote clean energy technologies and markets. It supports effective state and local policies, programs, and innovation in the clean energy sector, with an emphasis on renewable energy, power generation, financing strategies, and economic development. CESA facilitates information sharing, provides technical assistance, coordinates multi-state collaborative projects, and communicates the views and achievements of its members.