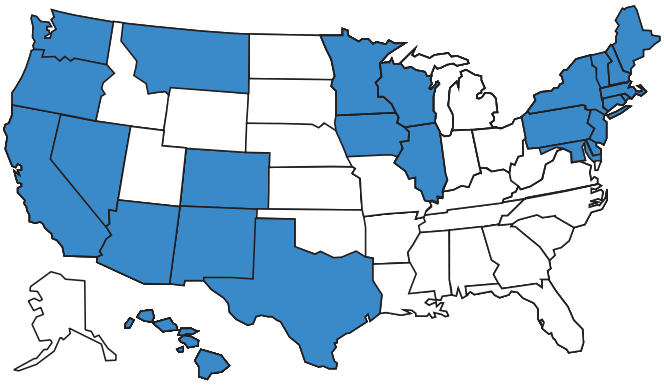
Energy Portfolio Standards and the Promotion of Combined Heat and Power

Energy Portfolio Standards

Energy portfolio standards (EPS) are becoming a widely applied method of encouraging the development of renewable and efficient energy resources. The most commonly implemented portfolio standards are renewable portfolio standards (RPS), although there is increasing discussion about Energy Efficiency Resource Standards (EERS). An RPS requires electric utilities and other retail electric providers to supply a specified minimum amount of customer load with electricity from eligible renewable energy sources. This amount usually begins as a small percentage of the total electricity load that increases gradually over time (e.g., 5 percent by 2010, increasing 1 percent per year to 15 percent by 2020). Through April 2007, EPS requirements or goals have been established in 24 states plus the District of Columbia (see Figure 1).[1] Two additional states, North Carolina and Illinois, are currently considering bills that would establish mandatory EPS targets. Most EPSs have been established within the last five years, with 10 states enacting RPS policies in 2004 and 2005 alone.[2]

The type of resources that are eligible under an RPS or EPS varies by state. Most states include renewable resources such as solar, wind, small hydropower and ocean/tidal/thermal systems, biomass, and landfill gas. Some states also include advanced technologies, such as fuel cells, that possess beneficial energy and environmental attributes. In addition, states are increasingly recognizing the energy, environmental, and economic benefits of energy efficiency and combined heat and power (CHP), and are including these technologies in expanded or alternative EPS policies. For example, some states, like Connecticut, are promoting a variety of energy efficient technologies in their EPS policies through a system of different technology classes or tiers; each tier requires a specific percentage or amount (in megawatts) of energy production to come

Figure 1 - States With RPS Requirements



Source: U.S. EPA Clean Energy-Environment *Guide to Action* (2006), www.epa.gov/cleanenergy/stateandlocal/guidetoaction.htm; Database of State Incentives for Renewable Energy (DSIRE) last accessed July 2007, www.dsireusa.org.

[1] Illinois currently has a voluntary RPS, but the state legislature is considering a mandatory standard. Vermont's RPS is voluntary, but if the utilities have not met their goal by 2012, then the RPS will become mandatory in 2013. EERE State Activities and Partnerships, www.eere.energy.gov/states/maps/renewable_portfolio_states.cfm, EPA CHP Partnership, State Resources, Renewable Portfolio Standards, www.epa.gov/chp/state_resources/rps.htm.

[2] Rabe, B. *Race to the Top: The Expanding Role of U.S. State Renewable Portfolio Standards* (2006), Pew Center on Global Climate Change, www.pewclimate.org/global-warming-in-depth/all_reports/race_to_the_top/index.cfm.

from specified renewable or efficient technologies. Connecticut and Pennsylvania have both included energy efficiency and CHP in a separate tier in their EPSs.

Six states—Connecticut, Hawaii, Maine, Nevada, Pennsylvania, and Washington—include CHP and/or waste heat recovery as an eligible resource, with Arizona explicitly including renewably fueled CHP systems. CHP, also known as cogeneration, is the simultaneous production of electricity and heat from a single fuel source such as natural gas or biomass/biogas. CHP systems offer considerable environmental benefits when compared to traditionally purchased electricity and onsite-generated thermal.

Combined Heat and Power (CHP)

By capturing and utilizing heat that is normally wasted, CHP systems typically achieve total system efficiencies of 60 to 80 percent—compared to less than 50 percent for equivalent separate heat and power systems. With this increased efficiency, a CHP system uses 35 percent less fuel to achieve the same energy output as separate heat-and-power systems.

Because less fuel is combusted and CHP is a form of distributed generation (DG), it offers a number of environmental and economic benefits:

- Reduced emissions of all air pollutants
  - Fewer greenhouse gas emissions, such as carbon dioxide (CO_2)
  - Fewer criteria air pollutants, including nitrogen oxides (NO_X) and sulfur dioxide (SO_2)
- Reduced grid congestion and avoided distribution losses
- Increased reliability and power quality
- Lower operating costs

For more specific information about how CHP works and what its benefits are, see the addendum at the end of this paper or visit EPA's CHP Partnership at <www.epa.gov/chp>.

RPS Design and Implementation

States have recognized the increasing need to encourage efficient and nonpolluting sources of energy. RPSs are the favored approach for most states because they can stimulate market and technology development using a cost-effective, market-based approach that is also administratively efficient.

Most RPS requirements work through the application of a trading program in either the state or on a regional basis. Qualifying renewable resources receive a certain number of certificates per year, usually based upon their generation (e.g., 1 megawatt-hour [MWh] = 1 certificate). These certificates are most often referred to as renewable energy certificates (RECs). Renewable energy generators can then sell RECs to electricity suppliers, such as large utilities, that must also fulfill the RPS. RECs not only generate revenue for renewable generators, but they are the measure of compliance for the RPS policy. REC trading programs provide flexibility and reduce administrative program costs in several ways:

- Not every electricity supplier needs to develop and operate renewable generation assets to comply.
- Independent renewable developers have access to the market.
- Renewable energy can be supplied from the most advantageous sites to electricity suppliers throughout a state or a region.

RPSs often contain an alternative compliance mechanism under which an electric supplier or distributor can pay a fee to the state if they are unable to procure a sufficient supply of RECs. The Alternative Compliance Payment (ACP) is often set at a high level to encourage the development of renewable projects. Payments to an ACP fund are usually used by the state to promote the development of renewable projects. For example, in Massachusetts, the ACP goes to the Massachusetts Technology Collaborative. This organization then uses the money to fund clean energy and green buildings and infrastructure programs. The clean energy program's goal is to support community and utility projects that use wind, solar, and bioenergy and to educate citizens about green electricity markets. The green buildings and infrastructure program provides funding to renewable energy technologies in all types of buildings. In Connecticut, the ACP goes to the Connecticut Clean Energy Fund to promote Class I and Class II resources (new renewable generation) and to the conservation and load management program to support Class III resources (energy efficiency and CHP).

Elements of a Successful RPS Policy

There are several key components to the design and implementation of an RPS, discussed below.

Eligibility

The definition of which technologies are eligible for inclusion is quite varied. Table 1 summarizes the technology eligibility for state RPS programs as of April 2007.[3] While states identify renewable technologies differently, most tend to include, at a minimum, solar, wind, biomass, and landfill gas/biogas. Some programs only allow combustion technologies that use biomass or other renewable fuels; others allow the use of any fuel as long as it is in an approved technology. In the case of CHP, inclusion may require a minimum efficiency requirement (e.g., 50 percent total efficiency in Connecticut) or designation as a "qualifying facility" under the Public Utilities Regulatory Policy Act (such as in Maine). These efficiency requirements also usually require some minimum threshold of recovered electric and/or thermal energy, such as Connecticut's 20 percent minimum thermal threshold. The RPS eligibility requirements might also set emission limits for emitting technologies. For example, through 2005, California sources were required to produce zero emissions or meet the 2007 state emission limits for DG to qualify as eligible. In Connecticut, emission limits apply to biomass facilities.

CHP systems that are fueled with a qualifying renewable resource, such as biomass, are eligible under RPS. In this context, typically only the electric output of the CHP system is eligible. States can also include the thermal output for these systems in RPS to fully value the benefits of CHP. There are numerous states that credit thermal output in their environmental regulations. For example, California, Maine, Rhode Island, and Texas include thermal output in their Small DG Rule.[4] So do EPA's Combustion Turbine New Source Performance Standards.[5] To account for the thermal output of CHP units, these states convert the measured steam output (British thermal unit, or Btu) to an equivalent electrical output (MWh). This is done through a unit conversion factor (1 MWh = 3.413 MMBtu). By adding the thermal and electric output together, states are recognizing the full environmental and emissions benefits of CHP. RPS language can be modified to state that CHP output will be calculated as the electric output plus the thermal output in MW, based on the conversion of 1 MWh = 3.413 MMBtu of heat output.

Table 1 - Summary of State Energy Portfolio Standards

Energy Source	AZ	CA	CO	CT	DE	DC	HI	IA	IL	MA	MD	ME	MN	MT	NH	NJ	NM	NV	NY	OR	PA	RI	TX	VT	WA	WI
Biomass	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
CHP/Waste Heat	●*			●			●					●						●			●				●	
Energy Efficiency							●											●		●	●					
Fuel Cells‡				●								●				●					●					
Geothermal	●	●	●		●	●	●				●	●		●	●	●	●	●		●	●	●	●		●	●
Hydro	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Landfill Gas	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Municipal Waste		●		●		●	●	●			●	●	●	●	●	●		●			●			●		
Ocean Thermal		●		●	●	●	●			●	●				●				●	●		●	●		●	
PV	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Solar Thermal Electric	●	●		●	●	●	●		●	●	●	●	●	●	●		●	●		●	●		●	●	●	●
Tidal		●		●	●	●				●	●	●			●	●			●	●		●	●		●	●
Transportation Fuels							●																			
Waste Tire		●										●														
Wave		●		●	●	●	●			●	●				●	●			●	●		●	●		●	●
Wind	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

* Renewable CHP systems are eligible; fossil-fueled CHP systems are not eligible.

‡Includes only those states that allow fuel cells using nonrenewable energy sources of hydrogen. Some states allow only renewable fuel cells (Arizona, California, Colorado, Delaware, Massachusetts, Maryland, New Mexico, New York, Rhode Island, Wisconsin) as eligible technologies.

Source: U.S. EPA Clean Energy-Environment Guide to Action (2006), www.epa.gov/cleanenergy/stateandlocal/guidetoaction.htm; Database of State Incentives for Renewable Energy (DSIRE) last accessed July 2007, www.dsireusa.org.

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3 U.S. EPA Clean Energy-Environment *Guide to Action* (2006), www.epa.gov/cleanenergy/stateandlocal/guidetoaction.htm and U.S. EPA Renewable Portfolio Standards: An Effective Policy to Support Clean Energy Supply (2007), www.epa.gov/chp/state_resources/rps.htm.

4 www.arb.ca.gov/energy/dg/dg.htm.
www.eea-inc.com/rrdb/DGRegProject/Documents/MEDGRuleChapter148.pdf.
www.tceq.state.tx.us/assets/public/permitting/air/Guidance/NewSourceReview/segu_final.pdf.
www.dem.ri.gov/pubs/regs/regs/air/air43_07.pdf

5 www.epa.gov/ttn/atw/combust/turbine/turbnsps.html.

RPSs often include several tiers or classes of generators in order to differentiate between different technologies and allow different targets to be set for different classes. Often, Tier I includes primarily zero-emitting renewables, while other tiers include biomass or other emitting renewable technologies or advanced low-emitting non-renewables. Some states, such as Connecticut and Pennsylvania, can utilize a separate tier for energy efficiency and CHP, ensuring these resources do not compete with renewable energy technologies. Different generation targets are then set for each tier according to state goals, resources, and interests. RECs for different tiers typically garner different prices, with the zero-emitting renewables typically having the highest prices (see Table 2). For example in New Jersey, the price for a solar REC for the 2006–2007 calendar years was $260.

Consistency among state portfolio standards in a region provides large benefits to the electric market. Considering state and regional resource availability is central to the success of a portfolio standard.

Size of Requirement

The basis of the renewable requirement can vary but is typically a percentage of annual generation or sales of electricity. The size of the requirement is also quite varied. Requirements normally start from a small percentage and then grow by some increment each year, to achieve a plateau level by a specific target year, subject to review. Table 3 shows the range of target values in states with an RPS.

The size of both the initial and target values also depend on which technologies and vintages are allowed in the program. For example, the Maine requirement is 30 percent, but it includes many existing biomass facilities, which already comprise more than 30 percent of the state's generation. It is also important for states to conduct renewable energy, energy efficiency, and CHP potential studies as a portfolio standard is created. These studies ensure that the standard can be met without placing too much strain on the affected utilities.

Alternative Compliance Payment

Many RPS programs include an Alternative Compliance Payment (ACP) provision. The ACP sets a limit on the price of RECs in case renewable generation does not keep up with the requirements. If the regulated entities cannot purchase RECs at a price below the ACP, they are allowed to pay the state the ACP price as an alternative. The state then uses the ACP funds to promote renewable projects. The ACP price usually escalates over time. This structure prevents the REC price from being too high while at the same time provides funding for renewable development when supply is scarce.

Table 2 - REC Prices as of April 2007
(1 Rec = 1 MW)

Connecticut	
Class I	
2006	$30.00
2007	$49.50
Class II	
2006	$0.50
2007	$0.60
Maine	
2006	$0.15
2007	$0.20
Massachusetts	
2006	$54.00
2007	$54.00
Texas	
2006	$2.75
2007	--
New Jersey	
Solar	
2006-2007	$260.00
Class I	
2006-2007	$9.75
Class II	
2006-2007	$1.35
Maryland	
Tier I	
2006	$1.25
Tier II	
2006	$0.60
2007	$0.75
District of Columbia	
Tier I	
2007	$2.10
Tier II	
2007	$0.75

Source: Evolution Markets. April 2007 Monthly Market Update (2007) www.evomarkets.com.

Vintage

Because the goal of an RPS is to encourage new sources of renewable or efficient generation, many RPS requirements state that eligible resources are those constructed after a certain date, such as after or shortly before the rule is promulgated. Some states credit incremental generation added after the required vintage date; CHP systems in Connecticut and biomass facilities in Massachusetts are allowed such flexibility. In a few cases, existing facilities are allowed full credit under the RPS, such as renewable facilities in Maine. As previously noted, the decision on vintage also affects the appropriate size of the target.

Table 3 - State Portfolio Targets

State	Target	Other
AZ	15% by 2025	30% by 2025 from distributed energy resources
CA	20% by 2017	
CO	Investor-owned utilities (IOUs) 20% by 2020; electric cooperatives and municipal utilities 10% by 2020	IOUs: 4.0% solar by 2020
CT	14% by January 1, 2010	
DC	11% by 2022	0.386% solar by 2022
DE	10% by 2019	
HI	8% by 2005, 20% by 2020	
IA	105 MW (2% by 1999)	
IL	8% by 2013	75% wind
MA	4% by 2009 (+1%/year after)	
MD	9.5% by 2019	2% solar by 2022
ME	30% by 2000 including some non-renewable energy	
MN	Xcel Energy (utility) 30% by 2020; other utilities 25% by 2025	
MT	15% by 2015	
NH	25% by 2025	
NJ	22.5% by 2021	2.12% from solar by 2021
NM	IOUs 20% by 2020; rural electric cooperatives 10% by 2020	
NV	20% by 2015	5% of RPS solar by 2013
NY	24% by 2013	0.154% customer-sited by 2013
OR	Large utilities (>3% state's total electricity sales) 25% by 2025	Smaller utilities 5-10% by 2025 (depending on size)
PA	18% by 2020 (8% is renewable energy)	0.5% solar by 2020
RI	16% by 2019	
TX	2,280 MW by 2007; 5,880 MW by 2015	
VT	Total incremental energy growth between 2005 and 2012 to be met with new renewables (10% cap)	
WA	3% of utility load for 2012-2015; 9% for 2016-2019; 20% for 2020 forward	
WI	10% by December 31, 2015	

Source: U.S. EPA Clean Energy-Environment *Guide to Action* (2006), www.epa.gov/cleanenergy/stateandlocal/guidetoaction.htm; Database of State Incentives for Renewable Energy (DSIRE) last accessed July 2007, www.dsireusa.org.

Point of Origin

RPS programs are typically state programs and allow only the use of RECs generated in that state. However, some programs do allow trading of RECs from other states with harmonious RPS programs that are in the same or an adjacent power pool. The Northeast includes multiple states in this category. However, some mechanism must still ensure that RECs from other states meet appropriate eligibility criteria. If both states are in the same power pool with a consistent attribute tracking system, ensuring eligibility across state lines is easier. For example, states in the New England Power Pool (NEPOOL) can rely on the power pool's Generation Information System (GIS) to track and compare RECs.

Monitoring

In most cases, the formation of a REC is based on the amount of electricity generated. Therefore, a program must have a system of tracking the generation to ensure that it comes from a qualifying resource. Many states already have such tracking systems to meet emissions disclosure requirements. NEPOOL's GIS tracks generation and even classifies RECs according to their eligibility to meet different state RPS requirements. The PJM Generation Attributes Tracking System (GATS) can be used to track generation attributes in the Mid-Atlantic region and can form the basis for awarding RECs, as it is in Pennsylvania. In California and other western states, the Western Renewable Energy Generation Information System (WREGIS) is being created to track RECs. This system is expected to become operational in summer 2007 and will track RECs in the Western Electricity Coordinating Council (WECC). Draft operating rules have been released for WREGIS and training of prospective users will begin in June 2007. WECC extends from Canada to New Mexico and includes 14 western states. Until the completion of this system, states must individually track eligibility and generation.

In Texas, the Electric Reliability Council of Texas (ERCOT) allocates RECs to renewable generators each year for every MWh metered on the grid. ERCOT then uses a pro-rata basis to determine renewable requirements for each retail electricity provider (REP). The requirements are based on total electricity sales for a given year, not on generation. REPs are required to retire RECs; they do not have to buy the associated generation.

Trading

In most RPS states, affected entities must meet the RPS through the surrender and retirement of RECs. The affected entity can generate, purchase, or trade the RECs. States typically utilize a regional tracking system that allows renewable generators located anywhere within the region to participate in the market. RECs are the currency

used to represent renewable generation creditable against the RPS responsibility for a seller or generator of electricity. The affected entity can create the RECs itself or purchase them from another eligible generator.

Trading RECs increases flexibility and reduces the cost of compliance. This method provides a market that encourages the development of eligible resources by many independent developers by providing an important income stream for project developers. This income can be an important component of the pro-forma financial package needed to attract capital to finance a new project.

Trading allows the flexibility to develop renewable resources wherever the available resource is most favorable, either within the state or between states, allowing the development of the most cost-effective resources. However, accepting out-of-state RECs might reduce the amount of in-state environmental improvement and economic development resulting from the RPS. This tradeoff must be evaluated against cost and resource availability to determine the appropriate structure for any given state.

One state that deviates from the common RPS compliance options is New York. New York's RPS works though a method called a central procurement model. Under this model, electric utilities collect a surcharge on electricity sold to consumers. These funds are turned over to the New York State Energy Research and Development Authority (NYSERDA), which purchases RECs on behalf of all the regulated entities.

State Examples of EPS That Include CHP

The inherent flexibility in RPS design allows states to identify and promote specific resources or technologies that support their environmental, energy, and economic development goals. CHP is one of the technologies that supports each of these goals. Table 1 summarizes the characteristics of current state portfolio standards, including the six states that include CHP.[7] State EPS programs that include CHP are summarized below.

Connecticut

The Connecticut RPS was originally promulgated in 1998 and started in 2004, establishing requirements for two classes of renewable generating resources. In June 2005, Connecticut passed "An Act Concerning Energy Independence," establishing a new RPS Class III that must be fulfilled with CHP, demand response[8] and electricity savings from conservation and load management (CL&M) programs.[9] The new standard will require electric suppliers and distribution companies to obtain 1 percent of their generation from Class III resources beginning in 2007 and increasing by 1 percent per year until leveling out at 4 percent in 2010 and thereafter. The total RPS requirement started at 4 percent in 2004 and will rise to and remain at 14 percent in 2010 and thereafter (including the new Class III).

The Connecticut Department of Public Utility Control (DPUC) released its final decision regarding the implementation of a Class III standard on June 28, 2006, in Docket No. 05-07-19. The final decision outlines requirements for accreditation of savings from C&LM projects; CHP efficiency and metering standards; environmental attribute management; qualifying demand response (DR) activities; and certificate creation, allocation, and incorporation with the NEPOOL GIS. The state had already established certain requirements for eligible CHP systems under "An Act Concerning Energy Independence," and an interim decision for Docket No. 05-07-19 released on February 16, 2006. Eligible CHP systems must be developed on or after January 1, 2006. Existing units that have been modified on or after 2006 can earn certificates only for the incremental output gains. A CHP system must meet a total efficiency level of at least 50 percent. The sum of all useful electrical energy output must comprise at least 20 percent of the technology's total usable energy output. The sum of all thermal energy products must also constitute at least 20 percent of the technology's usable energy output. In the final docket decision, DPUC determined that annual fuel-conversion efficiency and percentages of production will be assessed quarterly for the first year after initial certification. After this first year, the CHP system must demonstrate compliance with the efficiency requirements each quarter to qualify for RECs.

The final decision states that energy savings from DR activities are eligible for Class III certificates; however, the DR projects must be registered and participate in the region's wholesale electricity market administered by ISO

[7] Arizona's Renewable Energy Standard (RES) first began in 2001 and was recently revised in November of 2006 to include renewably fueled CHP while also increasing the percentage requirements. The new standard requires investor-owned utilities to generate 15 percent of their retail electric sales from renewable energy by 2025, with 30 percent (~2,000 MW) of the energy coming from distributed energy technologies. Distribution companies with more than half of their customers outside of Arizona are not subject to the requirements. For the distributed energy requirement, half of the requirement must be met from residential applications, and the remaining half must come from nonresidential, non-utility applications. CHP systems are eligible under the RES as a "renewable combined heat and power system," and defined as a distributed generation system, fueled by an eligible renewable energy resource, that produces both electricity and useful renewable process heat.

[8] Demand response (DR) resources must be registered with ISO-New England. DR resources must be on the load side, not supply side (no diesel generators).

[9] Connecticut's *An Act Concerning Energy Independence*, www.cga.ct.gov/2005/ACT/PA/2005PA-00001-R00HB-07501SS1-PA.htm. "Class III renewable energy source" means the electricity output from combined heat and power systems with an operating efficiency level of no less than 50 percent that are part of customer-side distributed resources developed at commercial and industrial facilities in this state on or after January 1, 2006, or the electricity savings created at commercial and industrial facilities in this state from conservation and load management programs begun on or after January 1, 2006."

New England, Inc. (ISO-NE). Concerning environmental attributes, the DPUC considered not allowing the title to emission allowances and certificates associated with Class III projects to be transferred with the certificate. However, after much discussion, the DPUC has decided to revisit this issue when it becomes necessary; currently the Connecticut Department of Environmental Protection does not directly award emission allowances or certificates to Class III projects.

The final decision also addresses the creation, allocation and integration of Class III certificates in the NEPOOL GIS. C&LM projects must be quantified by the C&LM fund program administrators following its monitoring and verification (M&V) plan and then must be filed in a Connecticut RPS Qualification Application. Non-C&LM project owners must use licensed professional engineers to verify savings. Before receiving approval for Class III certificates by the DPUC, DR and CHP project owners must first set up their own NEPOOL GIS accounts. Independently funded C&LM project owners must also create their own GIS account. Additionally, the final decision confirms that 100 percent of Class III certificates from non-funded C&LM, DR, and CHP projects will be granted to the customer or customer's agent. Currently, no portion of the certificates will be distributed to the C&LM fund for administrative costs, and projects that receive incentives through the C&LM will not receive Class III certificates.

As of the issuance of the final decision in 2006, the DPUC was still considering the details of inclusion of the Class III program into NEPOOL GIS. The DPUC expects a decision to be made sometime in 2007.

Maine

Maine's RPS started in 2000 and has the highest RPS requirement in the United States at 30 percent. Maine passed legislation, L.D. 2041, in June 2006 creating a renewable portfolio goal for new resources. The goal seeks to increase the share of new renewable energy capacity as a share of total capacity to 10 percent by 2017. CHP is considered an eligible resource under its "efficient resources" criterion. Maine takes a different approach to CHP than Connecticut, however, allowing only existing CHP facilities to generate RECs. In Maine, CHP units must have been installed prior to January 1, 1997; meet Federal Energy Regulatory Commission (FERC) rules as "qualifying facilities"; and meet an efficiency requirement of at least 60 percent in order to qualify for the RPS.[10]

Pennsylvania

Pennsylvania's Alternative Energy Portfolio Standard (AEPS) became effective in 2005 but requirements did not have to be fulfilled until 2007.[11] The system uses the PJM power pool's GATS to track qualifying generation for the program.

Pennsylvania has a tiered structure to its RPS, similar to Connecticut. Both new and existing renewables are eligible as Tier I resources. In 2007, 1.5 percent of electricity sold must come from Tier I sources. The standard increases to 2 percent in 2008. The standard will then increase 0.5 percent per year so that in the 15th year of the program no less than 8 percent of electricity must come from Tier I sources.

CHP is a Tier II resource and is considered eligible under Pennsylvania's definition as a distributed generation system with thermal recovery.[12] For years 1 through 4, 4.2 percent of electricity sold must come from Tier II sources, which also includes energy efficiency. This number increases to 6.2 percent for years 5 through 9; 8.2 percent for years 10 through 14; and 10 percent for year 15 and thereafter.

Hawaii

Hawaii had a voluntary RPS from 2003 until June 2, 2004, but this changed to a mandatory program with the passage of Senate Bill 2474 in 2004. This legislation set the RPS at 7 percent of net electricity sales in 2003. The state was already generating 8.2 percent of net sales from renewables in 2004, which can be counted towards the total requirements. The RPS will increase to 8 percent in 2005, 10 percent in 2010, 15 percent in 2015, and finally 20 percent in 2020. The Hawaii Public Utility Commission (PUC) has the authority to review the RPS every five years and potentially extend requirements past 2020. The regulations, in reference to CHP, state that "use of rejected heat from co-generation and combined heat and power systems excluding fossil-fueled qualifying facilities that sell electricity to electric utility companies and central power projects" are considered eligible generators.[13]

In Hawaii, an electric utility company must fulfill the RPS requirement. However, electric utilities and electric affiliates are allowed to combine their renewable portfolios to meet the requirements. Thus, Hawaii's program does not include a REC trading program as such. The utilities must document their generation directly to show compliance.

[10] Maine Public Utilities Commission, *Eligible Resource Portfolio Requirement* (November 14, 2004), www.state.me.us/mpuc/doing_business/rules/part_3/ch-311.htm.
[11] Pennsylvania Public Utility Commission, *Alternative Energy Portfolio Standards*, www.puc.state.pa.us/electric/electric_alt_energy.aspx.
[12] The General Assembly of Pennsylvania. Senate Bill No. 1030. (November 17, 2004) Tier II alternative energy sources are defined as energy derived from waste coal, distributed generation systems, and demand-side management.
[13] Renewable Portfolio Standards; PUC Study. S.B. No. 2474. *A Bill for an Act Relating to Renewable Energy* (2004), www.capitol.hawaii.gov/session2004/bills/SB2474_hd2_.htm.

Nevada

While working on the electricity restructuring process in 1997, Nevada also established an RPS. The RPS requirements began in 2005 and apply to the state's two investor-owned utilities, Nevada Power and Sierra Pacific Power. The RPS originally required a certain percentage of total electricity sales from renewables. However, in 2005, the state revised the standard to allow utilities to meet the standard through renewable energy generation (or certificates) and energy savings from efficiency measures. The RPS percentage requirements increase 3 percent every two years. For 2005 and 2006, the RPS is at 6 percent. This increases every two years to reach 20 percent in 2015 and thereafter.

CHP systems are eligible under the RPS as a "qualified energy recovery process." Eligible CHP units must be 15 MW or less, and only "the heat from exhaust stacks or pipes used for engines or manufacturing or industrial processes" used to generate electricity is considered to be an eligible CHP process. The most common type of CHP, which uses energy "from a process whose primary purpose is the generation of electricity," is excluded.[14]

Washington

Washington State passed a renewable energy standard (RES) by ballot initiative on November 7, 2006. This initiative, I-937, has two separate components—one renewable and another for energy efficiency. The initiative requires electric utilities that serve more than 25,000 customers in the state to generate 15 percent of their electricity load from new renewables by the year 2020. Electric utilities must also identify and meet separate energy conservation goals. As of 2005, 16 of Washington's 62 utilities would be regulated under the RES. The RES starts at 3 percent of a utility's load for 2012–2015, rising to 9 percent for 2016–2019; and then 20 percent from 2020 forward.

Renewably fueled DG with a capacity of not more than 5 MW is eligible under the RES. DG may also be counted as double the facility's electrical output if the utility owns the facility, has contracted for the DG and associated RECs, or has contracted to purchase only the related RECs.

CHP systems are eligible under a conservation provision in the initiative. By January 1, 2010, and every two years thereafter, each affected utility is required to identify its "achievable cost-effective conservation potential through 2019."[15] Each utility must then issue an acquisition target to be met during the next two years. Utilities can count high-efficiency cogeneration units with a useful thermal output of at least 33 percent of the total energy output towards meeting their conservation targets.

A utility's failure to meet the energy conservation or renewable energy targets will result in a $50/MWh administrative penalty (adjusted annually for inflation) paid to the state (some exemptions apply). The funds will be deposited in a special account for the purchase of RECs or for energy conservation projects at public facilities, local government facilities, community colleges, or state universities.

The Washington Department of Community, Trade and Economic Development (CTED) Energy Policy division is working on implementing Initiative 937. (A draft rule for Initiative 937 was released in May 2007[16].) The department has created two separate working groups—one to implement the renewable requirement and one for energy efficiency. The final rule adoption document must be completed by the close of December 2007. The department plans to issue a proposed rule in the fall of 2007.

Additional Resources

A number of additional resources are available for developing RPS policies.

- EPA's *Clean Energy-Environment Guide to Action* outlines 16 policies and programs states are successfully implementing to increase clean energy. Chapter 5 discusses RPS. www.epa.gov/cleanenergy/stateandlocal/guidetoaction.htm.
- EPA's Fact Sheet, *Renewable Portfolio Standards: An Effective Policy to Support Clean Energy Supply* describes the benefits of RPS for states and how RPS encourage CHP projects. www.epa.gov/chp/pdf/rps_factsheet_123006.pdf
- The Database of State Incentives for Renewable Energy (DSIRE) is a comprehensive and continually updated source of information on state, local, utility, and selected federal incentives that promote renewable energy. www.dsireusa.org.
- *Evaluating Experiences With Renewable Portfolio Standards in the United States* (2004) provides a comprehensive analysis of U.S. experience with RPS, including lessons learned. http://eetd.lbl.gov/EA/EMP/reports/54439.pdf
- *Projecting the Impact of RPS on Renewable Energy and Solar Installations* (2005) is a PowerPoint presentation that estimates and summarizes the potential impacts of existing state RPS on renewable energy capacity and supply. www.newrules.org/de/solarestimates0105.ppt

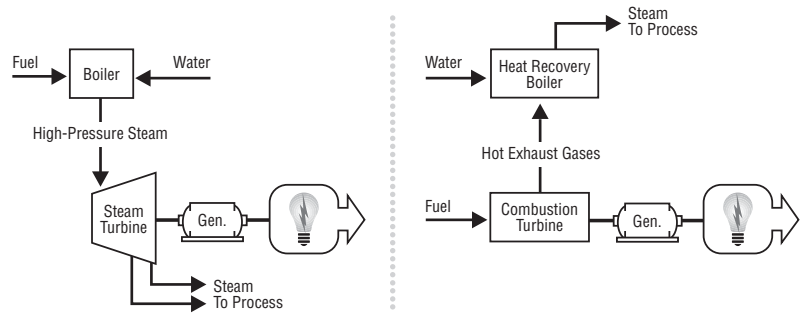
[14] Nevada Revised Statues Annotated. www.dsireusa.org/documents/Incentives/NV01R.htm.
[15] Initiative 937. www.secstate.wa.gov/elections/initiatives/text/i937.pdf.
[16] www.cted.wa.gov/site/1001/default.aspx

Addendum—Information about Combined Heat and Power (CHP)

CHP is the sequential generation of power (electricity or shaft power) and thermal energy from a common fuel combustion source. CHP captures waste heat that is ordinarily discarded from conventional power generation; typically, two-thirds of the input energy is discarded to the environment as waste heat (up exhaust stacks and through cooling towers). This captured energy is used to provide process heat, space cooling or heating for commercial buildings or industrial facilities, and cooling or heating for district energy systems. CHP facilities typically have efficiencies of 60 to 80 percent and use numerous types of technologies, including turbines, reciprocating engines, and fuel cells, as well as various fuels, including natural gas, biomass, coal, and biogas. More information about these technologies and their applications can be found in the EPA CHP Partnership's *Catalogue of CHP Technologies* (www.epa.gov/chp/project_resources/catalogue.htm). Figure 2 shows two common configurations for CHP systems.

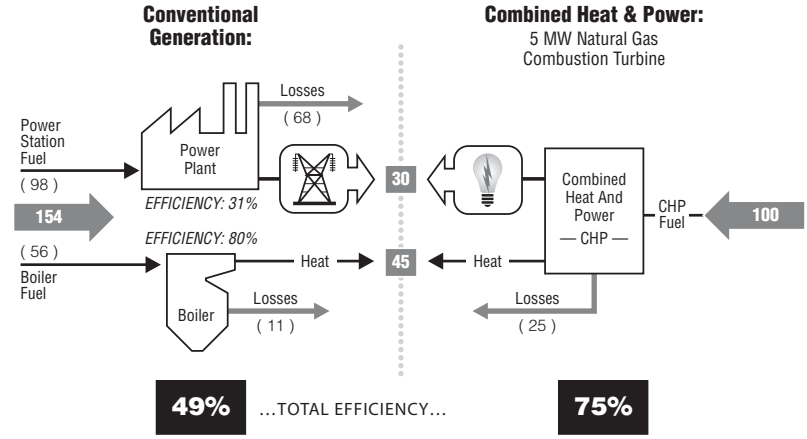
CHP's applicability to many technologies and fuels means that it can be applied in many different end uses and can use many fuels. It is a well-known and well-demonstrated technology. The United States has approximately 84 gigawatts (GW) of CHP capacity in place as of 2005, yet the potential for substantial expansion is great.[17] In 2000, the U.S. Department of Energy (DOE) and U.S. Environmental Protection Agency (EPA) set a goal to double the capacity of U.S. CHP installations by 2010.

Figure 2 - Two Typical CHP Configurations



Source: U.S. EPA *Output-based Regulations: A Handbook for Air Regulators* (2004), www.epa.gov/chp/pdf/OBR_final_9-1-05.pdf.

Figure 3 - Efficiency Benefits of CHP



Source: U.S. EPA *Output-based Regulations: A Handbook for Air Regulators* (2004), www.epa.gov/chp/pdf/OBR_final_9-1-05.pdf.

By providing electrical and thermal energy from a common fuel input, CHP significantly reduces the associated fuel use and emissions. Figure 3 illustrates the higher efficiency of a CHP facility compared to a conventional system providing the same service. In this case, both systems provide 30 units of electric energy and 45 units of thermal energy to the facility.

In the conventional system, the electricity required by the facility is purchased from the central grid. Power plants on average are about 31-percent efficient, considering both generating plant losses and the transmission and distribution losses. Thermal energy required by the facility is provided by an onsite boiler, averaging 80 percent efficiency. Combined, the two systems use 154 units of fuel to meet the combined electricity and steam demand. The combined efficiency to provide the thermal and electric service is 49 percent.

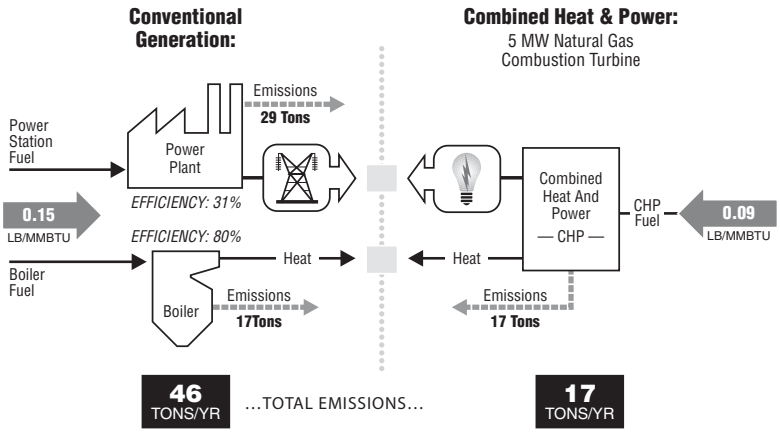
In the CHP system, an onsite system provides the same combined thermal and electric service. Electricity is generated in a combustion turbine, and the waste heat is captured for process use. The CHP system satisfies the same energy demand using only 100 units of fuel. This system is 75 percent efficient.

Due to its higher efficiency compared to conventional central-station generating systems, CHP produces lower emissions of traditional air pollutants and carbon dioxide,

[17] U.S. DOE CHP database, maintained by Energy and Environmental Analysis, www.eea-inc.com/chpdata/index.html.

the leading greenhouse gas associated with global climate change, than conventional generating systems. Figure 4 shows the NOx emissions benefits of the CHP system. The CHP system has much lower emissions because it uses 35 percent less fuel, even if the combustion process has the same input-based emission rates as the conventional equipment. In this example, as is often the case, the new CHP system displaces higher-emitting generators on the electric grid, and the emissions rate for the new system is lower than the conventional alternative, further reducing emissions. In the case shown, the CHP system emits less than half as much NOx as the conventional system due to a combination of greater efficiency and lower emissions rate.

Figure 4 - Nitrogen Oxide Emissions Benefits of CHP



Source: U.S. EPA *Output-based Regulations: A Handbook for Air Regulators* (2004), www.epa.gov/chp/pdf/OBR_final_9-1-05.pdf.

For more information, contact:

CHP
EPA COMBINED HEAT AND POWER PARTNERSHIP

Katrina Pielli
U.S. Environmental Protection Agency
Phone: (202) 343-9610
e-mail: *pielli.katrina@epa.gov*

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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