Draft White Paper

Barriers to CHP with Renewable Portfolio Standards

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The recent development of state renewable portfolio standards (RPS) has helped spur the growth of renewable energy projects, including solar, wind, and biomass power. However, there are some areas where the RPS programs have been lacking. The vast majority of new renewable energy installations produce electric power only, instead of producing both electricity and heat together in a combined heat and power (CHP) setup. Projects that utilize CHP are more energy-efficient, and they promote the conservation of resources, displacing the energy that would normally be produced in a fossil fueled boiler. Biomass fuels such as landfill gas, anaerobic digester gas, wood waste, crop residues, and other solid biomass feedstocks are included in all RPS programs, and they are all capable of harnessing CHP. But most states do not provide any incentives for combined heat and power, and as a result, most new projects do not incorporate it. This report aims to determine the barriers to CHP that exist within state RPS programs, and suggest ways to minimize or remove such barriers.

State RPS Programs

To date, 23 states and the District of Columbia have enacted a renewable portfolio standard, each operating with their own set of rules and goals. Most standards call for a given percentage of utility or electricity service provider sales to come from what is defined as a renewable resource on a yearly time schedule. In some states, such as Pennsylvania and Connecticut, energy-efficiency measures such as CHP are also included as technologies eligible for the RPS.

With all of the renewable portfolio standards, the goal is the same: to diversify utilities' energy portfolios to make them more reliable and environment-friendly, while reducing dependence on fossil fuels.

The following states (shown in Figure 1) have adopted some sort of RPS program:

- Arizona
- California
- Colorado
- Connecticut
- Delaware
- District of Columbia
- Hawaii
- Illinois
- Iowa
- Maine
- Maryland
- Massachusetts
- Minnesota
- Montana
- Nevada
- New Jersey
- New Mexico
- New York
- Pennsylvania
- Rhode Island
- Texas
- Vermont
- Washington
- Wisconsin

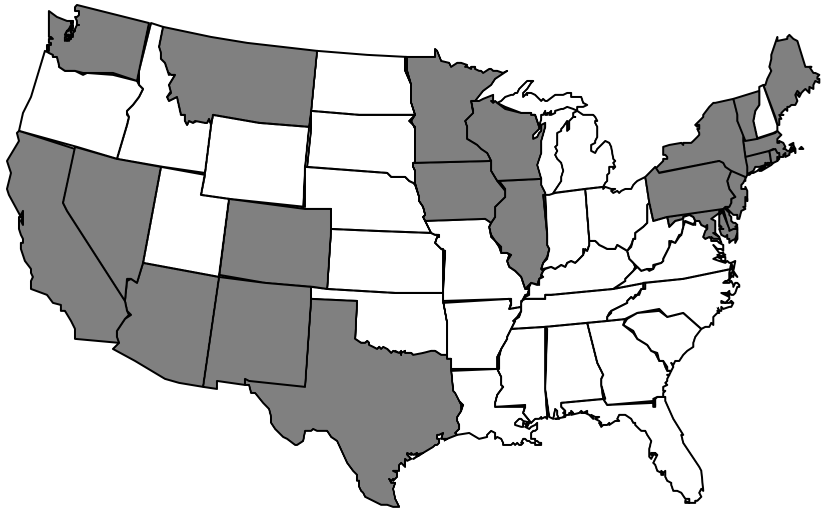

Figure 1. States with RPS Programs (Hawaii and D.C. not shown)

Incentives for Different Fuel Types

Many states with RPS programs attempt to promote or incent wind/solar projects more heavily than biomass fuel applications. States either offer more credit for the power generated, or require that a certain percentage of the RPS come from these resources. For example, in Arizona, solar power receives 150% credit, and in Illinois, it is suggested that 75% of the RPS should come from wind power. Some states have different tiers of renewable fuels or technologies, where certain types of biomass are grouped in the secondary tier, deemed not as important or beneficial as the primary tier fuels. These extra incentives for wind and solar projects have limited the amount of new biomass projects in some states. In addition, since no waste heat is produced with wind or solar power generation, there is zero potential for CHP.

Conversely, some states with minimal biomass resources may declare that a minimum amount of the RPS must come from biomass fuels, in order to ensure diversity in their portfolio. Texas, who's biomass resources are limited, has adopted such a system. To date, the state's RPS has been very heavily dominated by wind power, but their standard calls for a certain amount of capacity (500 MW) to come from biomass fuels. In order to satisfy this, an abundance of new landfill gas wholesale electricity projects have been installed, with more future LFG projects planned. However, none of these projects utilize CHP, since they were constructed solely to provide electricity for the state's RPS, and most landfills lack a sizeable thermal load.

While electricity derived from wind and solar power is generally considered to be more environment-friendly than that obtained from the combustion of biomass, the avoided emissions and regenerative cycles of biomass fuels are often neglected in this assumption. For instance, if a landfill or wastewater treatment plant were to simply let their waste methane gas escape into the atmosphere, or if the gas was flared openly, the methane and carbon dioxide emissions produced are several times greater than those produced in utilizing the gas for energy. Also, when crops or forest residues are used as biomass fuels, whatever carbon dioxide emissions are released in combustion will be absorbed by the next set of crops or trees, which will convert the CO_2 to oxygen.

Furthermore, biomass fuels have the potential to utilize combined heat and power, which greatly increases energy efficiency. When CHP is utilized, the emissions from boilers that would normally provide heat for a facility are avoided. While solar and wind projects are no doubt beneficial to the environment, biomass projects that utilize combined heat and power are arguably just as beneficial – both produce negative net emissions when compared with conventional fossil fuel alternatives. However, the majority of states with RPS programs do not promote biomass as heavily as solar and wind, and do not provide any incentives for biomass project operators to utilize combined heat and power. Most of the new biomass projects in RPS states only produce electricity. But is the lack of CHP incentives to blame, or are there other underlying factors that are causing most biomass projects to neglect CHP? Are projects being rushed to meet RPS deadlines, causing operators to forgo seeking a potential steam host for their waste heat? Is the focus on wind and solar projects causing potential biomass CHP projects to be neglected? The following sections aim to answer these questions, first by examining the current trends in biomass power installations.

Trends in Biomass Power Installations

Anaerobic Digester Gas

At wastewater treatment plants, when anaerobic digester gas (ADG) is harnessed for electricity, it is most often done behind the meter, in a CHP configuration. Treatment plants typically have high thermal and electric demands for their process operations. Normally, electricity is purchased from a utility, and heat is generated in a boiler, usually fueled by natural gas. Alternatively, plant owners can either use their ADG in the boiler, or install a CHP system to provide heat and power for the facility. Figure 2 shows a typical ADG system setup, where waste heat from the genset is used to heat the sludge and create hot water for the facility.

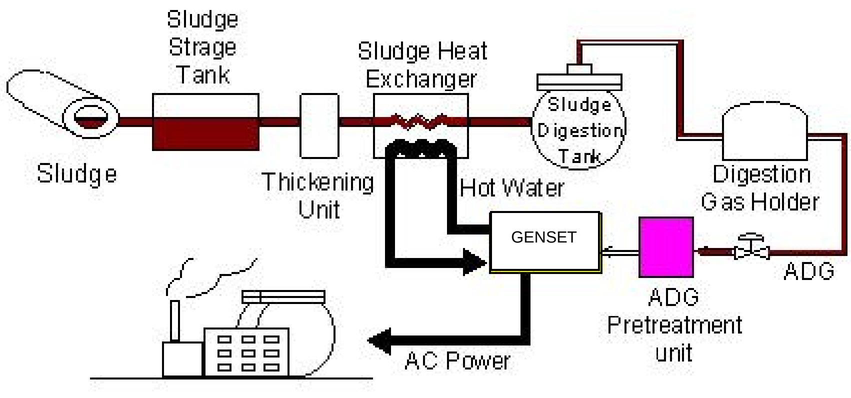

Figure 2. A Typical ADG CHP Configuration at a Wastewater Treatment Plant

The easiest option for treatment plant owners who wish to utilize their ADG is to fire the gas in their boiler in place of (or along with) natural gas, and use the steam strictly for heating purposes. This is common practice, especially among smaller plants with not quite enough ADG production to power an engine. For example, both the Walden and Cuba Sewage Treatment Plants in New York generate about 1 million gallons of ADG per day (1 MGD). This amount of gas could potentially power a small microturbine, but the operators of both of these plants claim that the current practice of using ADG in their boilers to heat the digester tank and the facility makes more sense economically and would be much less complicated than installing a CHP genset. Wastewater treatment plant operators in general site various interconnection and utility issues, as well as high capital costs and potential maintenance problems, as reasons they have not pursued an ADG-powered genset.

Larger treatment plants are more likely to install an ADG genset, and when they do, CHP is almost always utilized. Between the thermal demands of the plant and the heat required by the digester tank, there is no reason not to take advantage of the genset's waste heat. Generally, municipal wastewater treatment plants produce just enough ADG to provide heat and power for their entire facility. An example of a municipal plant utilizing CHP is the North Tanawanda Wastewater Treatment Facility, a 13 MGD plant in New York. The plant has utilized CHP for about 10 years now, with a 100 kW converted diesel engine. Most of the time, the engine runs on 100% ADG, but about 5-10% of the time, when the pressure drops too low, natural gas is used as a supplement. The chief operator of the plant is satisfied overall with the engine's performance and says that money is always saved in the long run. The engine's heat exchanger often produces enough heat for the digester tank and the entire facility, but when it doesn't, a natural gas/ADG boiler is used.

While there are a number of ADG CHP projects currently in operation, and many more treatment plants with strong project potential, the average size for municipal ADG projects is small – most fall within the 100 kW to 1 MW range. So the overall potential for CHP is not very high. Industrial wastewater treatment plants in the food and chemical processing industries tend to have much larger facilities, but the number of plants capable of ADG projects is minimal compared to the municipal sector. In a report examining the future market impacts of opportunity fuels, Resource Dynamics Corporation estimated about 600 MW of total United States potential.[1]

Animal waste from farms is another potential source of ADG energy. Numerous farms already have anaerobic digesters installed, and many others could potentially benefit from the odor control and waste reduction aspects. Another potential benefit is utilizing the digester gas for power, although the demand at most farms is typically small. Still, a genset could be used to provide electricity and heat for the farm's facilities, including heating the digester tank. In addition, leftover electricity can usually be net-metered with a local utility. In Resource Dynamics Corporation's opportunity fuels report, however, only about 80 MW of nation-wide potential for farm-based ADG CHP was estimated, even when it was assumed that all farms already had anaerobic digesters installed (or would otherwise benefit from their installation).[2]

In some cases, a company such as Microgy, Inc. will install a digester gas genset and arrange to sell the electricity produced to a local utility at wholesale price. In most cases, the waste heat is utilized to heat the digester tank, although sometimes the gas is transported to a different site, potentially combined with gas from other farms. When this is practiced, CHP is not likely to be utilized. Microgy has over 30 farm energy projects in operation throughout the United States, with several more planned.

In any case, whenever an ADG genset is installed on-site, the waste heat will likely be utilized at least for heating the digester tank, and probably for other heating applications as well. Renewable portfolio standards will have minimal impact on whether or not an ADG project proceeds with a CHP configuration.

Landfill Gas

There are well over 400 landfill gas (LFG) energy projects currently in operation throughout the country. The vast majority of these are power-only projects, selling electricity at the local wholesale rate to a utility grid. Project developers such as Waste Management, Inc. and Granger Electric/Energy Services finance the landfill gas projects. The rights to the methane gas are purchased from the landfill, and the project developer constructs a genset to produce electricity (usually with a reciprocating engine). Since

[1] *Opportunity Fuels and Combined Heat and Power: A Market Assessment.* Resource Dynamics Corporation. August 2006.

[2] Ibid.

landfills are typically found in remote locations, there is rarely a nearby site that can utilize the power and/or waste heat. For this reason, LFG CHP projects are extremely rare.

According to Waste Management, Inc., the waste heat available from a typical LFG power project is not very substantial. Even if there was a nearby industrial facility, the cost to utilize the minimal amount of waste heat would not make sense when compared to an industrial facility's typically large thermal demand. In these cases, the facility is usually more interested in using the landfill gas as a boiler fuel, in a "direct use" application. Even though industrial facilities require electric power, installing an LFG-fueled genset at such a facility is rarely attempted. Direct use projects require no significant capital investment, except for pipelines, and most project developers would rather simply sell the gas or the electricity at the landfill site, rather than installing a genset at a nearby industrial site and maintaining operation there.

Representatives at both Waste Management and Granger claim that out of all of their LFG energy projects (over 100 total), none of them utilize CHP. All projects are either wholesale electricity or direct use, with one exception. A New York LFG project in Model City, New York, being run by Waste Management, sells wholesale electricity while using its waste heat to keep a nearby greenhouse warm. The representative at Waste Management said that small heating applications such as this are practical for LFG, but finding greenhouses or other facilities with a small thermal demand located close to candidate landfill sites is not an easy task. When undergoing an electricity project at a landfill, the developers generally do not look for nearby steam hosts to utilize the waste heat. Both companies, however, do claim that renewable portfolio standards have helped to spur new LFG power projects in recent years.

Despite the difficulties involved with piping landfill gas to a nearby facility for CHP utilization, there have been several successful projects to date, and there are more in the planning processes. The EPA's Landfill Methane Outreach Program (LMOP) keeps a database of landfill gas projects, with "cogeneration" listed as the project type for these types of facilities. Resource Dynamics Corporation analyzed these projects, and the results are summarized in Table 1.

Table 1. Landfill Gas Combined Heat and Power Projects

Landfill Name	City	County	State	Project Start	Prime Mover	MW	Heat/Power used by:
Industry Hills LF	Industry Hills	Los Angeles	CA	9/1/2003	Reciprocating Engine	0.5	Pacific Palms Resort
Miramar SLF	San Diego	San Diego	CA	6/30/1997	Reciprocating Engine	6.4	Metro Biosolids Center, grid sales (elec)
Savage Canyon LF	Wittier	Los Angeles	CA	8/1/2006	Reciprocating Engine	2	Presbyterian Intercommunity Hospital
Shoreline LF	Mountain View	Santa Clara	CA	12/1/2005	Reciprocating Engine	2.9	Three ALZA (drug company) facilities
HOD Landfill	Antioch	Lake	IL	10/1/2003	Microturbine	0.4	Antioch Community High School
Adrian Landfill	Adrian	Lenawee	MI	12/1/1994	Reciprocating Engine	2.4	Consumers Power Company grid (elec)
Citizens Disposal LF	Grand Blanc	Genesee	MI	7/1/1994	Steam Turbine	3.2	General Motors facility
Burlington County SLF	Mansfield	Burlington	NJ	12/1/2002	unknown	0.1	Rutgers EcoComplex (greenhouse)
Modern LF	Model City	Niagara	NY	6/1/2001	Reciprocating Engine	12	Model City Greenhouse, grid sales (elec)
Troy SLF	Troy	Rensselaer	NY	3/1/2004	Reciprocating Engine	0.8	Hudson Valley Community College
Creswell LF	Conestoga	Lancaster	PA	10/1/2006	Reciprocating Engine	3.2	Turkey Hill Dairy, PJM grid (elec)
Frey Farm LF	Conestoga	Lancaster	PA	10/2/2006	Reciprocating Engine	3.2	Turkey Hill Dairy, PJM grid (elec)
Keystone SLF	Dunmore	Lackawanna	PA	7/28/1998	Combustion Turbine	25	PEI Power Corporation, Greenhouses
Palmetto Landfill	Wellford	Spartanburg	SC	4/1/2003	Reciprocating Engine	4.4	BMW Manufacturing Plant
Arlington Landfill	Arlington	Tarrant	TX	6/1/2001	Reciprocating Engine	5	Village Creek WWTP
Kestrel Hawk Park LF	Racine	Racine	TX	11/1/2003	Combustion Turbine	6.7	SC Johnson Company - Waxdale Facility

When examining the end uses of electricity and heat, as well as the fuels used, it is clear that not all of these are true LFG CHP projects. Many of these systems still rely on sales to local utilities' electricity grids, while utilizing only a small amount of heat and/or power. For example, in Lancaster, PA, gas from the Creswell and Frey Farm landfills is combined and used to generate electricity for the PJM power grid, but the heat produced is utilized by the nearby Turkey Hill Dairy Farm. New York's Modern LF is another example of this practice, where electricity is sold to Niagara Mohawk and waste heat is utilized by a local greenhouse. While these types of installations are utilizing waste heat, they are not a true combined heat and power setup. Additionally, not all of the LFG CHP projects use 100 percent landfill gas. Three of the prime movers in Table 1, at Industry Hills LF, Troy SLF and Keystone SLF, use a natural gas blend (i.e. they do not burn 100 percent LFG). In two cases (Miramar SLF and Arlington Landfill), LFG is piped to a wastewater treatment plant to be blended with ADG and supply the plant's heat and power needs.

Other facilities in Table 1, however, are piping landfill gas to their facilities to utilize in a full CHP configuration. The Presbyterian Intercommunity Hospital in Los Angeles county using LFG from the nearby Savage Canyon Landfill is a prime example. Currently, the gas is used to power a 1 MW reciprocating engine generator for the hospital's heat and power needs, but the operation has been successful and there is more gas to be utilized, so plans are in the works to add a second 1 MW engine. The General Motors facility in Grand Blanc, MI and the BMW manufacturing plant in Wellford, SC are two examples of industrial facilities utilizing LFG from a pipeline to provide heat and power for their plants.

Another recent successful LFG CHP project was recently completed in Mountain View, CA. ALZA Pharmaceuticals, a division of Johnson and Johnson, proposed a project that would use LFG from the nearby Shoreline Landfill to provide heat and power for three of its research and development facilities. The gas would be piped from the landfill to each of the three facilities, where it would generate heat and power with a reciprocating engine CHP system. The city of Mountain View accepted ALZA's proposal in February 2004, and construction has just recently finished. LFG from the Shoreline Landfill now powers three 970 kW generators at three separate buildings, providing each with electricity and hot water, under a 15-year contract.

Hopefully these new installations will start a trend towards more CHP utilization in LFG projects, but for the moment, the major trends are wholesale electricity for utilities, or direct thermal use for nearby industrial sites. Given the current trends, the outlook for LFG CHP projects does not appear very bright, but the recent successful CHP installations suggest that the trends may soon change. If industrial facilities located close to landfills were willing to pipe the gas and install a genset, there would be a great deal of project potential. Resource Dynamics Corporation estimated the total potential, provided that a willing industrial facility can be found within a 5 mile radius at each landfill. With this assumption, there is enough potential for nearly 1 GW of CHP capacity among landfills that have not yet engaged in energy projects.[3]

Solid Biomass Fuels

When solid biomass feedstocks are used to create electricity in boiler/steam turbine systems, the use of combined heat and power depends on the nature of the facility. If an industrial facility with significant electric and thermal demands were to utilize biomass power, it would most certainly be in a combined heat and power configuration. After all, in a boiler/steam turbine system, steam is already being produced and the heat is easily accessible. However, many new biomass projects are utility-owned, and generally built to satisfy renewable energy requirements. As such, the utility's only goal is to generate electricity for its renewable portfolio, and waste heat and steam utilization is often neglected. In California, where numerous biomass power facilities exist, the RPS program manager was unaware of any facilities that use

[3] Ibid.

CHP, although he stated that the only information the RPS officials receive is related to electrcitity generation, so they had no data on CHP practices. It is unknown whether or not these projects sought out a steam host but could not find one close enough, or if the CHP option was even explored.

When wood waste is produced by lumber processing plants or paper mills, it is often burned in a boiler for process heating. In some cases, a steam turbine electricity system may be utilized, but for the most part, the thermal demands at these facilities far outweigh the demand for electricity, so the waste is only utilized for heat. Often, the wood waste is cofired with coal. However, there is a large amount of mill wastes that are not used each year, in addition to a growing amount of urban wood waste that should be available at a relatively cheap price. If this wood waste was available as fuel in an open market, it could be purchased by industrial power producers for boiler/steam turbine CHP configurations, at a price potentially less than coal on a Btu basis. With the nation's current supply of urban wood waste, which can be obtained at a cheaper rate than coal in most locations, Resource Dynamics Corporation estimated that about 7 GW of potential could be achieved in boiler/steam turbine DG/CHP applications.[4]

In locations where solid biomass feedstocks can be obtained for a relatively cheap price, some utilities cofire with coal in massive boiler/steam turbine generators. The best markets for solid biomass DG/CHP may exist in the areas that utilities currently cofire.

Biomass Gas

Solid biomass feedstocks can be turned into a methane gas through a process called gasification. Gasifiers extract the volatile components of the fuel and generate a biomass gas, which is generally of higher quality than ADG and LFG, as well as an ash residue. Although about 20% of the fuel's heat content is lost in the process, the potential for high-efficiency CHP utilization is greater than with solid biomass combustion. Most often, biomass gas would be used in a combined cycle system, where the waste heat from a combustion turbine is used to power a heat recovery steam generator and a secondary steam turbine. Additionally, the leftover steam can be used in the gasification process, or for other process heating applications. Figure 3 illustrates this process.

However, high-quality gasifiers are a relatively new technology that is not yet commercially available. While current cost projections put advanced gasifiers at $2,000-$4,000 per kW, it is expected that in 5-10 years, an efficient, commercially available advanced gasifier will be on the market for a cost of about $1,000/kW. When this happens, Resource Dynamics Corporation estimates that there is about 30 GW of potential for biomass gas CHP projects across the nation.[5]

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[4] Ibid.
[5] Ibid.

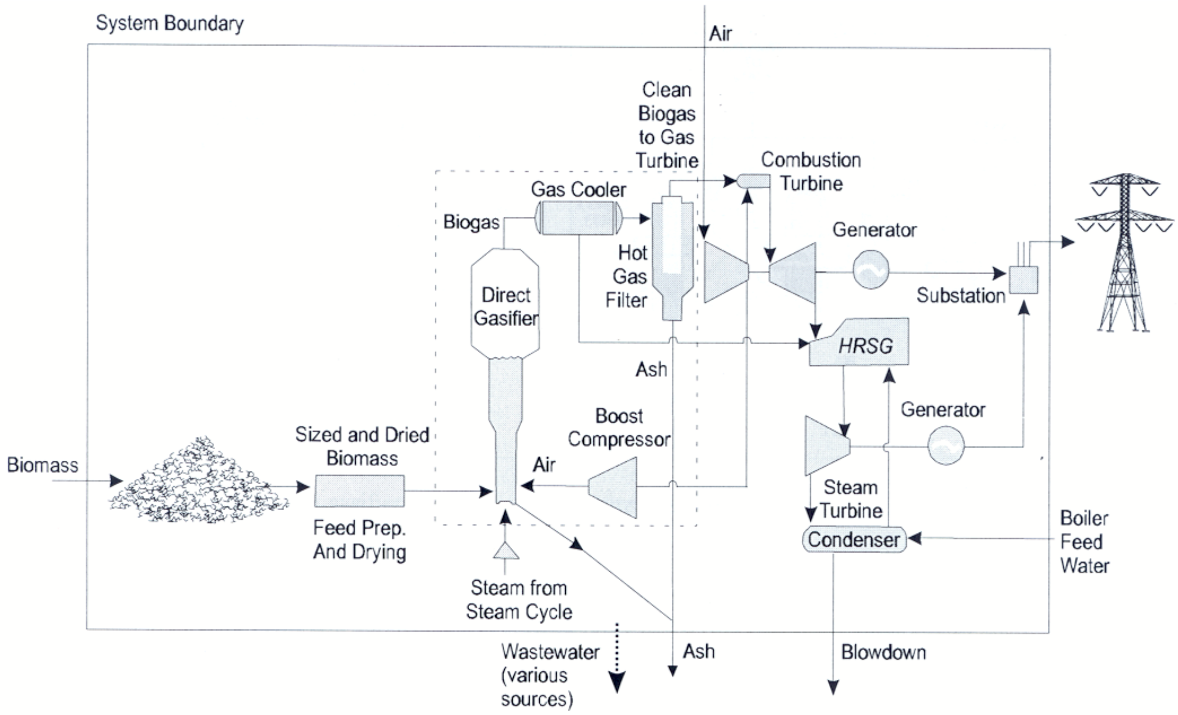

Figure 3. A Combined Cycle Biomass Gasification CHP System

Overall, the trends in recent ADG/LFG/Biomass installations show that ADG is almost always utilized for combined heat and power, while LFG most often used for wholesale electricity or direct thermal applications. Solid biomass projects using fuels such as wood waste are likely to utilize their waste heat if the electricity is also utilized on-site. When utilities construct biomass power facilities for the purpose of generating renewable electricity, CHP is sometimes neglected.

Distributed Generation versus Utility Power

One of the primary factors that determines the likelihood of CHP implementation in a biomass project is whether or not the power is utilized on site. When a biomass distributed generation (DG) unit for behind the meter, on-site power is installed, it is typically at an industrial facility that has a demand for both electricity and thermal energy, so CHP is almost always used. However, if a biomass power facility is constructed for the purpose of generating utility power, as is the case with several landfill gas and solid biomass installations, the likelihood for CHP implementation is minimal.

In the past, some RPS programs ignored distributed generation, and only focused on utility power from renewable resources. However, renewable power from DG applications should not be neglected, and market-based credit trading systems, which have become the most popular method for compliance, ensure that they are not. With these programs, the DG project operator is provided with renewable energy credits for each megawatt-hour generated, and the credits can be sold to utilities, or whoever the highest bidder may be. In states without credit trading programs, distributed generation is only included if it is explicitly mentioned in the RPS, as is the case with California, whose standard states, "we include in our definition of renewable generation…renewable distributed generation on the customer side of the meter." If a state with no credit trading program does not contain such language in their standard, distributed generation (and on-site CHP) projects will likely be neglected by their RPS.

It is important that distributed generation projects are included in the RPS programs, as they are much more likely to efficiently utilize the fuels in a CHP configuration. As mentioned previously, the reason most landfill gas projects do not utilize their waste heat is because of a lack of nearby electric and thermal demand. Third party project developers harness the LFG for electricity generation and sell the power to a nearby utility, neglecting the potential utilization of waste heat from the genset. The only way to implement more CHP projects with landfill gas is to promote the use of the gas by nearby industrial facilities for combined heat and power, rather than simply for heat. The EPA's Landfill Methane Outreach Program does a great job of promoting landfill gas projects, but they generally accept that most on-site LFG projects only utilize the gas for heating purposes, and that most power projects only generate utility electricity. If industrial CHP projects were more actively pursued by the program, more installations may be seen.

Solid biomass gas projects with wood and wood waste fuels are constructed for different purposes. When utilized on-site, biomass fuel is typically either produced by the site's operations, or purchased from a nearby facility. Either way, it is being used at a location that typically demands both heat and power. Facilities that produce wood waste historically have only utilized it for heat, but promoting biomass power and CHP, such as through renewable portfolio standards, may help spur more biomass CHP projects in the industrial sector. However, while renewable portfolio standards can help incent distributed CHP projects, utilities are also constructing their own biomass power plants to meet the standards, with CHP often being neglected. The following section details how state RPS programs have influenced biomass-fueled projects, and whether or not they utilize CHP.

State RPS Influence on Biomass-Fueled CHP

As previously mentioned, most states do not include CHP or cogeneration as part of their renewable portfolio standard, nor do they offer any real incentives for utilizing combined heat and power. Only the electricity produced from renewable resources counts towards the standard. As a result, many projects are built strictly to satisfy the electricity requirement of the state's RPS goal, leaving CHP as an afterthought. In some cases, such as with landfill gas, there are no nearby facilities that can utilize the heat or steam produced by the unit. This is also the case with many solid biomass power-generating facilities.

In Massachusetts, only "low-emissions, advanced biomass power conversion technologies" are eligible for the RPS. As a result, several abandoned biomass facilities in the region (from the early days of PURPA qualification) are being resurrected, with new fluidized bed boiler systems, to qualify them as an advanced, low-emissions technology. An example of such a project is the 8 MW Ware Cogen Facility in Massachusetts. Despite its name, leftover from its previous stint as a biomass power plant, the facility does not utilize cogeneration (CHP). It was only revived for the RPS to produce electricity – the facility no longer serves any other purpose, so there is no on-site thermal demand. Several other old biomass facilities in the region have been resurrected for the same purpose, and none of them appear to be utilizing CHP. If the state offered incentives for using combined heat and power, perhaps the waste heat would be utilized, or a nearby steam host would be sought out.

To date, five states have included CHP as part of their renewable portfolio standard: Connecticut, Hawaii, Maine, Nevada and Pennsylvania. Arizona's new proposed RPS also includes CHP from biomass or biogas fueled sources. In some states, such as Connecticut and Pennsylvania, the RPS is a tiered system, and CHP is a second or third-tier renewable, in a class with other energy-efficiency measures.

- *In June 2005 the Connecticut legislature adopted legislation that complements the existing RPS by adding new "Class III" requirements covering energy efficiency and CHP. Under the new class III requirements, electricity suppliers must purchase 1% of supply from efficiency and CHP by 2007, and 4% by 2010.*[6]
- *Under Pennsylvania's Alternative Energy Portfolio Standards Act of 2004, renewable energy must account for 8% of the power sold in the state after 15 years of implementation. In addition, "tier 2" "advanced energy resources" must account for an additional 10% of power sold in 15 years. "Tier 2" resources include energy efficiency, CHP, hydropower, and waste coal generation.*[7]

Hawaii and Nevada include all CHP projects in their RPS. In Hawaii, all of the energy produced is counted, while in Nevada, only the recycled waste heat energy is credited.

- *Hawaii's Renewable Portfolio Standard law sets a renewable resource requirement of 8% of kWh sales in 2005, rising to 20% in 2020. Energy efficiency (including CHP) qualifies as a resource with no cap or set-aside. In 2004, according to reports filed by Hawaii's utilities, renewable energy and energy efficiency resources accounted for about 11.2% of electricity sales, with renewables 68% of these resources and efficiency 32%.*[8]
- *In 2005, Nevada's RPS law was amended to increase the portfolio requirement, but also to allow the utilities to use energy efficiency programs (including CHP) to help meet the requirements. Under the new law, renewable energy and energy efficiency must meet 20% of the state's electricity needs by 2015, of which up to 25% can be met with energy efficiency.*[9]

Instead of issuing Renewable Energy Credits for energy efficiency and CHP applications, some states are planning to issue Energy Efficiency Credits (EECs) that would be traded separately. Connecticut is scheduled to start their EEC program in 2007, with Pennsylvania and Nevada soon to follow.

All of these CHP standards have recently been enacted, so their effect on potential projects remains to be seen. However, it is suspected that with the extra incentive to use CHP, many biomass projects that would have otherwise overlooked the potential of utilizing their waste heat will now seriously look in to the option.

Massachusetts proposed adding CHP to the list of renewable fuels and technologies in June 2006, but the proposal did not pass. In addition, there is an old law requiring a steam operator onsite at all times for steam generating equipment, which has discouraged CHP. There have recently been talks about having this law removed.

Other Programs that provide incentives for CHP

Aside from the renewable portfolio standards, there are several other ways that states and the federal government can offer incentives for electricity producers to utilize CHP. States with emission credit trading programs often provide incentives to CHP project operators. The utilization of waste heat offsets

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[6] American Council for an Energy-Efficient Economy. *Energy Efficiency Savings Standards Around U.S. and The World*. July 2005. http://www.aceee.org/energy/eesavings.htm.
[7] Ibid.
[8] Hawaiian Electric Co., 2005, "Renewable Portfolio Standard Status Report." Kauai Island Utility Cooperative, 2004, "Renewable Portfolio Standards (RPS) Status Report."
[9] American Council for an Energy-Efficient Economy. *Energy Efficiency Savings Standards Around U.S. and The World*. July 2005. http://www.aceee.org/energy/eesavings.htm.

boiler emissions, so some states will provide give credits in the amount of potential emissions offset by the unit. Sometimes states offer tax credits for CHP operators. For example, property tax exemptions are offered by Connecticut, Michigan and Ohio. For renewably fueled DG/CHP, the federal government offers a 1.9 cent/kWh tax credit for closed-loop (dedicated energy) biomass, and a 0.9 cents/kWh tax credit for open-loop (waste) biomass. National tax credits are also offered for fuel cells and microturbines, which can be used for CHP. Some states, such as Connecticut, California, New Jersey, New York, and Ohio, provide grants or loans for new DG/CHP projects, provided that certain energy-efficiency or clean-energy qualifications are met. Finally, states can have electricity restructuring laws, ordering utilities to utilize energy-efficiency measures. The Texas law is as follows:

- *Texas' electricity restructuring law (SB-7-1999, signed into law by then-Governor Bush) established a requirement for electric utilities to offset 10% of their demand growth through end-use energy efficiency programs. Utilities are generally exceeding this goal. For example, in 2003, utility energy efficiency programs reduced demand by 151 MW, exceeding the 135 MW goal by 11%.*[10]

There are several ways that both state and federal governments can provide incentives for CHP. However, for biomass-fueled projects, it is believed that adding CHP as part of the renewable portfolio standard would help spur the most growth.

Conclusions and Recommendations

The lack of new CHP projects in RPS states is likely due to: 1) states pushing for solar and wind power projects, which cannot utilize CHP, 2) the promotion of power-only and direct thermal LFG utilization projects, and 2) a lack of RPS incentives for new utility biomass projects to incorporate CHP. In order to remedy these problems and provide a better environment for biomass CHP project growth, three steps need to be taken: 1) even the playing field for all renewable fuels in terms of RPS and other state/federal incentives, 2) promote CHP for LFG projects more heavily, and 3) provide RPS incentives for those that utilize waste heat in a CHP configuration, or make CHP a prerequisite for new biomass RPS projects. *The means to achieve these steps are now provided. In addition, some tips for project developers to incorporate CHP with the current market conditions are given.*

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[10] Public Utility Commission of Texas, 2005, *Report to the 79th Texas Legislature, Scope of Competition in Electric Markets in Texas*.