MAINE PUBLIC UTILITIES COMISSION

DRAFT

REPORT and RECOMMENDATIONS on the PROMOTION of RENEWABLE RESOURCES

I. INTRODUCTION

During its 2003 session, the Legislature enacted Resolve, Relating to Renewable Resources.[1] This Resolve directs the Public Utilities Commission ("Commission") to examine mechanisms to ensure an adequate and reliable supply of electricity for the State and to promote the State's use of renewable and indigenous resources. In particular, the Resolve asks the Commission to examine mechanisms that would provide adequate support for biomass generation, hydroelectric facilities with a capacity less than 30 megawatts or less, and fuel cell generation. The Commission was directed to include an analysis, including cost impacts, of the most effective forms of the following mechanisms:

- Renewable Portfolio Requirement;
- System Benefit Charge; and
- Use of purchases from Maine's renewable generators to supply standard offer service.

Additionally, the Resolve directs the Commission to examine mechanisms used in other states and their adaptability for use in Maine, to consult with entities with expertise or substantial interest in the promotion of renewable resources, and to present any consensus positions or alternatives if consensus cannot be reached. The Resolve requires that the Commission submit its report and recommendations to the Joint Standing Committee on Utilities and Energy by December 31, 2003.

To provide the Legislature with the information and background necessary to fully examine its policies on electric generation resources, this report will discuss a number of resource support mechanisms in addition to the three mechanisms noted above. The scope of this report will include mechanisms and considerations related to both larger-scale generation facilities and small on-site units. As such, many of the issues associated with distributed generation (DG) that have been raised before the Legislature in recent years will be discussed in this report.

As part of its efforts to gather background information for this report and to solicit the views of interested persons, the Commission engaged in numerous meetings and discussions with entities having expertise or interest in issues regarding the promotion

[1] Resolves 2003, ch. 45.

of renewable and indigenous power,[2] and conducted research on mechanisms employed in other states to support or promote renewable power. The Commission released a draft report and sought written comment from all interested entities. The Commission subsequently hosted a meeting to further discuss the matters raised in its draft report and to assess the possibility of achieving consensus on appropriate resource support mechanisms for use in Maine.

This report is structured as follows:

- **Section II – Overview:** Discussion of past and current mechanisms used in Maine to promote renewable and indigenous resources, the impact of those mechanisms, and the various policies and goals that should be considered in adopting resource promotion legislation.

- **Section III – Resource Support Mechanisms:** General review of the attributes of a variety of mechanisms that can be used to support and promote renewable and indigenous resources, including the three mechanisms specified in the Resolve.

- **Section IV - Fuels and Technologies:** Discussion of individual renewable and indigenous fuels and technologies, current barriers to their development and use, and appropriate mechanisms to support the fuel or technology.

- **Section V – Other State Mechanisms:** Description of mechanisms used to support renewable resources in other states.

- **Section VI – Recommendations:** Discussion of viable approaches to the promotion of renewable and indigenous resources given legislatively specified policies and goals.

[2] A list of the entities with whom the Commission held discussions is included in Appendix __ of this report.

II. OVERVIEW

A Promotion of Resources Prior to Electric Restructuring

Prior to the restructuring of Maine's electric industry,[3] the State, through its Public Utilities Commission, had substantial control and influence over the resources used to supply electricity to Maine's public. This occurred through the Commission's oversight of vertically integrated electric utilities that had the obligation to provide electricity through a least cost mix of generating (as well as demand-side) resources.

Beginning in the early to middle 1980s, the Commission's oversight of utility resource acquisition was guided by several legislative directives that promoted resource diversity and the development of renewable and indigenous generating resources.[4] By the time the industry was restructured, these policies resulted in an overall resource mix serving Maine's public that consisted of almost 50% renewable power.

B. Promotion of Resources under the Restructuring Act

The State's ability to impact the mix of generating resources through the oversight of utility planning and acquisition came to an end with the implementation of the Restructuring Act. By opening the provision of generation supply to competition and requiring the State's utilities to exit the generation business, the Restructuring Act rendered the traditional mechanisms to influence the State's generation mix inapplicable.

Recognizing this result, the Legislature included a generation resource policy statement and two implementing provisions in the Restructuring Act. The Legislature stated its policy as follows:

> In order to ensure an adequate and reliable supply of electricity for Maine's residents and to encourage the use of renewable, efficient and indigenous resources, it is the policy of this State to encourage the generation of electricity from renewable and efficient sources and to diversify electricity production on which the residents of this State rely….[5]

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[3] Restructuring in Maine went into effect on March 1, 2000.

[4] These legislative directives were included in the Electric Rate Reform Act, 35-A M.R.S.A. §§ 3151-3155, the Small Power Production Act, 35-A M.R.S.A. §§ 3301-3308, and the Maine Energy Policy Act, 35-A M.R.S.A. § 3191. These legislative provisions were either repealed or substantially revised with the restructuring of the industry.

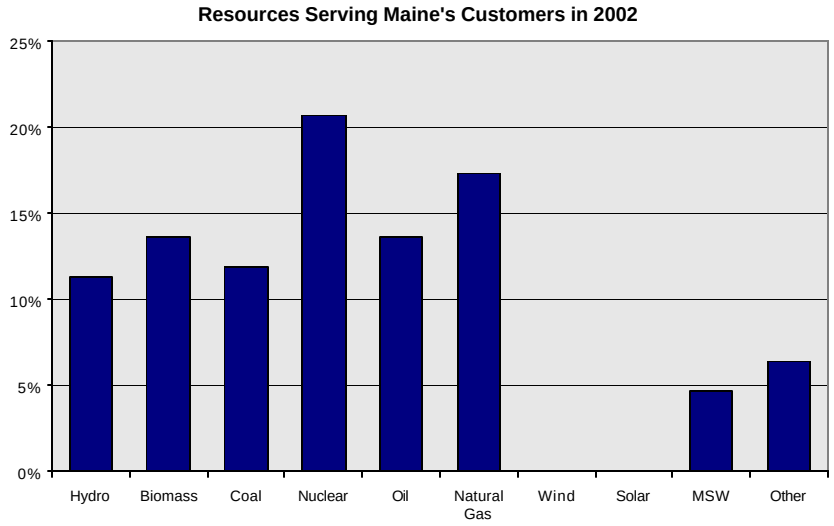
[5] 35-A M.R.S.A. § 3210(1).

The Act's primary implementing provision is the eligible resource portfolio requirement.[6] The other provision is a renewable resource research and development fund supported by voluntary ratepayer contributions.[7]

1. Current Portfolio Requirement

The current portfolio requirement requires that each competitive electricity supplier meet at least 30% of its retail load in Maine from "eligible resources." Eligible resources are defined in statute and consist of resources typically considered renewable, as well as "efficient" cogeneration resources that may be fueled by fossil fuels. An eligible resource is not required to be located in the State, but its energy must be delivered to the New England grid and designated as serving load in Maine.

The portfolio requirement has ensured that at least 30% of Maine's electric load has come from some combination of the resources designated in the Restructuring Act. The following graph displays the resource mix used to serve Maine's retail load during 2002.[8]



The experience to date, however, reveals that the current portfolio requirement is not satisfying the Restructuring Act's stated policy of encouraging the

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[6] 35-A M.R.S.A. § 3210(2)(3).

[7] 35-A M.R.S.A. § 3210(5)(6).

[8] Appendix __ contains additional information about the sources of the generation serving Maine's customers. The graphs show that almost 50% of Maine's load is served by system power, some of which is used to satisfy the portfolio requirement. The graphs also show that a portion of the portfolio requirement has been met by cogeneration fueled by natural gas and coal.

generation of electricity from renewable and efficient resources. The primary reason is that the "supply" represented by the list of eligible resources is significantly greater than the "demand" created by the 30% requirement, and retail suppliers are able to satisfy the portfolio requirement through facilities that can supply power at or near the prevailing market price. The consequence is that Maine's current portfolio requirement produces no (or very little) financial premium over market for those facilities that require it.

Because the current portfolio requirement has no significant impact on prices paid to generators, it appears to have little impact on Maine's retail rates. The requirement does, however, cause administrative burden to retail suppliers and may represent a barrier for other suppliers to enter Maine's retail market.

2. Voluntary Research and Development Fund

As required by the Restructuring Act, a program is in place whereby Maine's electricity consumers can make voluntary contributions through their electric bills to fund renewable resource research and development (R&D) and demonstration community projects using renewable energy technologies. Specifically, the Act specifies that funds for renewable resource R&D be distributed to the University of Maine System, the Maine Maritime Academy or the Maine Technical College System, and that funds for demonstration community projects using renewable energy technologies be distributed to Maine-based nonprofit organizations. The State Planning Office (SPO) has the statutory responsibility to administer the program.

To date, ratepayers throughout the State have contributed in excess of $100,000 to the R&D fund. The SPO has contracted with the Maine Technology Institute (MTI) for the distribution of the funds to take advantage of MTI's existing grant process infrastructure and to leverage additional funds that may be available to grantees. Although grant proposals have been requested, as of October 2003, MTI has not made any R&D grants.

C. Policy Goals and Considerations

1. Policy Goals and Objectives

Mechanisms used to promote particular electric generation resources or technologies involve, for the most part, public support through what are essentially ratepayer or taxpayer subsidies. Most resource support mechanisms involve increasing electricity prices to the general public to provide financial benefits to private entities whose activities are deemed to serve the public good. Accordingly, legislative policy goals and objectives need to be considered and established when determining whether to adopt mechanisms to support certain categories of generating resources. The following are potential policy goals and objectives that the Legislature may wish to consider:

- **Environmental Benefit:** Renewable resources are generally considered less environmentally harmful relative to fossil fuel resources (primarily with respect to air emissions). However, most renewable resources do have some environmental impacts and, in some cases, those impacts can be greater than other forms of generation.[9] There is currently a significant amount of debate as to the relative environmental benefit and harm of various categories of resources.

- **Resource Diversity:** Renewable resources can provide greater diversity in the region's energy mix. This tends to reduce over-reliance on dominant fuel sources (primarily gas at the current time) and may help to stabilize electricity to some degree in that the costs of renewable resources generally do not vary with oil and gas prices.[10] Renewable resources also reduce reliance on foreign sources of fuels and lessens the depletion of the earth's resources.

- **System Reliability:** Renewable resources tend to be smaller units that are distributed geographically throughout the system. As such, they can provide enhanced voltage support, reduced line losses, and aid the process of restarting the system after major disruptions. However, if located in parts of the system that were not designed for electricity transmission (as opposed to distribution), or if the grid must be upgraded to adjust harmonics, voltage fluctuations, or reactive power to maintain power quality in the vicinity, new generating facilities can increase system costs. Moreover, the intermittent nature of some renewable sources reduces their system reliability benefit.

- **Economic Development:** Maine historically has had a relatively large number of renewable resource facilities spread throughout the State. These resources have had an economic development impact in their communities through the creation of jobs and an enhanced tax base.[11] Additionally, some of these facilities have provided a societal benefit by providing a means for the disposal of wood and municipal solid waste. However, the promotion of facilities in Maine that would not otherwise run or be constructed could have a negative impact on other facilities in the State that might, as a result, be forced to operate in fewer hours or to close down.

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[9] The relative merits and impact of individual resources and technologies are discussed in section IV of this report.

[10] The addition of renewable resources to the regional mix, however, is unlikely to influence clearing prices through the foreseeable future. This is because natural gas facilities will likely remain the marginal units in the region, thus establishing the clearing prices.

[11] During the last legislative session, the Independent Energy Producers of Maine (IEPM) provided a list of its member biomass, hydroelectric, and municipal solid waste facilities with their locations, number of employees, and amount of local taxes. This list is provided in Appendix___ to this report.

2. Implementation Considerations

In addition to overall policy goals, there are a variety of considerations that should be evaluated in determining which resources or technologies receive public support and the mechanisms for providing that support. The following are the primary considerations:

- **Cost:** Resource support mechanisms, as mentioned above, are essentially public subsidies and, as such, the potential cost of support mechanisms should be carefully examined.[12] Thus, the Legislature should consider the cost to accomplish its policy goals, as well as the impact of increased electricity costs on Maine's public. The Legislature should also consider whether the subsidy is likely to be a temporary mechanism to aid in the development of a resource or permanent in that the resource is likely to always need financial assistance.

- **Commercial Viability:** The primary purpose of the resource support mechanisms that are the subject of this report is to provide assistance to resources or technologies that are not commercially viable. A resource or technology that can operate profitably through currently prevailing market prices of electricity is commercially viable and therefore not in need of public assistance. It is resources or technologies whose cost structures are greater than market prices or those that are in relative early stages of development that are proper beneficiaries of resource support mechanisms.[13]

- **Prior Contracts:** Generating facilities that have pre-existing qualifying facility contracts with utilities will continue to operate throughout the remainder of the contract term. Consequently, assistance through a resource support mechanism is not necessary to ensure their continued operation.

- **Existing/New Resources:** Resource support mechanisms can be used to maintain existing facilities within the State or to stimulate the development of new facilities.

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[12] Cost impacts to support certain resources and to implement particular support mechanisms are discussed in sections IV and VI of this report.

[13] There is also the possibility that renewable generators that need subsidies today may in the future become not just commercially viable but highly profitable as a result of significant and sustained increases in the price of fossil fuels. This raises the question of whether a financial assistance program should include a requirement that such generators share future profits with ratepayers or taxpayers in return for past support. The Commission does not address this issue as it applies to any government assistance to for-profit enterprises, and is thus not within the special expertise of utility regulators.

- **Established/Emerging Technologies:** Resource support mechanisms can be used to assist established technologies that are not yet commercially viable or to promote the development of emerging technologies through research and development with the eventual goal that the technologies will become commercially viable.

III. RESOURCE SUPPORT MECHANISMS

Funding through taxes or utility rates: There are a variety of mechanisms that can be used to support generation resources and technologies. As mentioned above, such mechanisms can be funded through taxes or electricity prices.[14] The Commission's general position, as stated to the Legislature on previous occasions, is that the promotion of basic public policies such as environmental improvement or economic development should be funded through general tax revenues rather than electricity rates. The Commission recognizes, however, that electricity rates are a common funding mechanism for the support of renewable resources and technologies and are often considered a second best alternative to the use of tax funds. This report focuses on electric consumer funding mechanisms in that the Commission's expertise lies in the regulation of utility rates and in the development of a competitive retail market for electricity.

This section of the report reviews a variety of resource support mechanisms and their respective attributes. In considering the mechanisms that might be appropriate to serve legislatively established policy goals, it is useful to distinguish among the following categories of the resources and technologies:

- **Grid-Scale:** Facilities that are designed primarily to provide power to the electric grid.
- **On-Site:** Facilities that are designed to provide electricity for on-site use.
- **Emerging Technologies:** Technologies that are in the development stage and are relatively far from economic applications.

As discussed below, appropriate mechanisms to support particular resources or technologies will depend on the categories to which they belong.

A. Renewable Portfolio Standard

A renewable portfolio standard (RPS)[15] is a commonly used mechanism to promote the use of renewable resources. The mechanism works by requiring retail electricity suppliers to meet a specified percentage of their load within a state through designated categories of resources. A RPS can be an effective resource support mechanism if designed properly to accomplish legislative policy goals. By mandating that a specified percentage of a state's resource mix come from resources that are

[14] Voluntary contributions and federal grants can provide additional sources of funding, but are generally not adequate to fund mechanisms discussed in this report.

[15] Renewable portfolio standard or RPS is the commonly used term for this type of mechanism. Maine's current eligible resource portfolio requirement is an example of a RPS.

presumably above market cost, the mechanism does result in an increase in the retail cost of electricity supply for consumers.

The following are the primary attributes of a RPS:

- **Market mechanism:** A RPS uses the competitive electricity market to accomplish legislative goals (i.e. specified percentages of designated categories of resources in a state's energy mix) in a manner that tends to minimize costs to electricity consumers. The mechanism would cause generators to compete to provide designated resources at the lowest cost. Lower cost facilities would receive the benefits of the RPS, while higher cost facilities may receive no benefit.

- **Market power:** A RPS can be impacted by market power if ownership or control over facilities within a designated category is concentrated. This would limit effective competition within the category, potentially resulting in prices rising above costs.

- **Cost unknown:** The cost to electricity consumers of a RPS cannot be known with any certainty in advance. A reasonable estimate of the cost might be obtainable after the fact; this would have a greater likelihood if the NE-GIS[16] produces a transparent market for eligible Maine certificates.

- **Cost can be capped:** The cost exposure for electricity consumers can be capped by including an alternative compliance mechanism. Such a mechanism would provide competitive suppliers with the option of paying a pre-specified amount per megawatt-hour into a fund in lieu of complying with the RPS. The fund would then be used to support the same policy goals as the RPS. Consumer cost exposure would be effectively capped at the alternative compliance amount.

- **Ensures specified quantities:** A RPS, by its design, will ensure that a legislatively specified amount of designated categories of resources will be included in a state's energy mix.

- **Flexibility:** A RPS can be structured to promote several categories of resources through the use of "tiers." For example, given policy goals of maintaining existing biomass facilities and encouraging new wind facilities, a RPS can be structured with two tiers—one requiring that x% of load be met with existing biomass and another requiring that y% of load be met with wind power.

- **Grid-scale facilities:** A RPS is effective primarily in supporting grid-scale facilities. The mechanism is not as effective in supporting resources, such as

[16] The NE-GIS is a New England regional system that allows for the trading of electricity attributes separate from the energy commodity.

photovoltaic and wind installations, that are designed to meet a customer's on-site needs.

- **Maine facilities:** Any attempt to limit RPS eligibility to facilities located in Maine would raise serious constitutional questions, because the Commerce Clause of the U.S. Constitution generally prohibits states from enacting laws that discriminate against interstate commerce or amount to economic protectionism.[17]

- **Administration:** A RPS requires relatively little public effort to administer. The Commission could continue to administer a State portfolio requirement without additionally resources. However, if a capping mechanism is included, it is possible (depending on market conditions) that a significant number of suppliers may opt for the alternative of paying into a fund. If this turns out to be the case, then there may be a substantial administrative burden related to distributing funds consistent with legislative policies that would require additional resources for whatever entity is responsible for administering the capping mechanism funds.

B. System Benefit Charge

A system benefit charge (SBC) is also a commonly used mechanism to support renewable resources. The mechanism is a surcharge on the bills of transmission and distribution (T&D) utility customers. The funds collected are then distributed to support generation resources according to previously established criteria.[18] A SBC can be an effective mechanism to support designated categories of resources to accomplish legislative policy goals. By its nature, a SBC is a surcharge that results in a direct increase in T&D utility rates for Maine's electricity consumers.

The following are the primary attributes of a SBC:

- **Cost known:** The surcharge is established in advance. Accordingly, the cost to ratepayers is known with certainty.

- **Quantities unknown:** The amount of renewable generation that will result from the mechanism cannot be known in advance, but can be known after the fact.

- **Flexibility:** A SBC can be structured to accomplish a variety of policy goals. For example, a policy goal of promoting two categories of resources can

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[17] Appendix __ to this report contains a discussion of the Commerce Clause issue. Some states have limited their RPSs to in-state facilities or have adopted reciprocity requirements (whereby out-of-state facilities are eligible only if their states have a RPS). To the Commission's knowledge, none of the RPSs with such eligibility requirements have been challenged in court. The eligibility requirements of other states are shown in Appendix__.

[18] The mechanism is essentially the same as that currently used in Maine to fund energy efficiency programs and support for low-income electricity consumers.

be accomplished by segregating the funds with specified amounts dedicated to each category. The mechanism can also be designed to maximize the amount of energy generated from a particular category (e.g. through a bidding process) or to provide support more broadly throughout the category (e.g. specifying an amount per kilowatt-hour that all generators in the category receive).

- **Fund distribution:** Under a SBC, it is difficult to determine the correct amount of funding that individual generators should receive. The correct amount of funding depends on individual generator costs and on prevailing market prices. If the funding amount is too high, the generator would receive more public assistance than necessary. If the funding amount is too low, the assistance will not result in the commercial viability of the resource as intended. In a situation of rising market prices, a generator that received public assistance in one year may obtain sizable profits in later years. It is possible to include provisions for the return of funds under such scenarios.

- **Facilities/technologies:** A SBC can be effective in supporting grid-scale facilities, on-site applications, and emerging technologies.

- **Maine facilities:** A SBC can be designed so that only Maine facilities benefit through the receipt of funds.[19]

- **Consumer contribution:** Because a SBC is a surcharge on tariff T&D rates, customers that are on discounted rates or special rate contracts would not contribute to the State's resource promotion policies, unlike customers who take service under tariff rates. In contrast, the cost of a RPS flows through to consumers' competitive supply prices and will thus tend to be paid by all electricity consumers.

- **Administration:** A SBC requires significant resources to administer. A SBC involves the distribution of funds to entities according to specified legislative policies and specific administrative rules. The required resources would depend on the size of the fund. The Commission could administer a SBC fund as it does the energy efficiency program, but this would require significant additional resources (including additional personnel).

C. Standard Offer Supply

The Resolve asks the Commission to examine the use of purchases from Maine's renewable generators to serve portions of the standard offer load as a potential support mechanism. There are three basic methods by which purchases to supply standard offer can be used as a resource support mechanism:

[19] As discussed in Appendix __, a SBC does not raise the same level of Commerce Clause questions with respect to instate location requirements as does a RPS.

- ***Portion of standard offer bid:*** Standard offer bidding would occur basically as it has over the last several years, except that a certain portion of standard offer load would be bid out separately. Only designated categories of facilities could supply this segregated portion of the standard offer load. The precise size of the segregated load would depend on the legislative policy goals. For example, if the goal were to maintain the operation of all the existing biomass facilities in the State, the segregated portion would equal the combined capacity of the biomass facilities.

- ***Wholesale contracts:*** The State or T&D utilities would enter into wholesale power contracts to buy the output of resources in designated categories and that output would be used to serve standard offer load. The remainder of the standard offer load not covered by the purchases would be served through the ordinary Commission bid process. The State or utility purchase of the output from the designated categories of resources would occur through a bid process to minimize cost. The contracts can be of shorter or longer terms.

- ***RPS applicable only to standard offer:*** A portfolio requirement would be adopted that would apply only to standard offer suppliers. Competitive (non-standard offer) suppliers would not have requirements applicable to their resource portfolios. A standard offer portfolio requirement would be designed to support resource categories designated by the Legislature in much the same way as a generally applicable RPS.

All of these methods are feasible and could be designed to effectively support renewable resources. However, it is possible that the standard offer may terminate in the future if efficient competitive retail markets develop in all sectors. If this occurs, standard offer could no longer be a vehicle to support renewable resources.

Use of the standard offer as a resource support mechanism is essentially a variation of a RPS and thus shares its basic features (discussed above). In addition, use of the standard offer has the following attributes:

- **Standard Offer Prices:** The mechanism would raise the prices of standard offer service in that it is presumed that the cost of resources in the designated categories would be above market cost.

- **Fairness:** Only standard offer customers (who tend to be residential and small business customers) would pay the cost of the State policy of supporting renewable generation. Customers that take service from competitive suppliers (who tend to be larger businesses and industrial customers) would not contribute to the cost of the policy. Such a situation raises questions of fairness.

- **Market impact:** The mechanism would artificially raise standard offer prices and tend to increase migration into the retail competitive market (assuming the existence of retail suppliers in the applicable sector). If such migration occurs, there

will be increasingly less support for the designated renewable resources as electricity consumers leave the standard offer.

- **Administration:** The first two methods would likely require some additional resources for the Commission to administer.

C. Net Billing

Net billing is a commonly used metering and billing practice applicable to consumers that use renewable generation to serve their own electricity needs. As such, it is only applicable to on-site generation applications (rather than grid-scale facilities).

Under a net billing arrangement, a customer's generation over a month is netted against the customer's usage. The customer is billed each month only for the difference between usage and generation. If generation exceeds usage, the customer receives a credit that can be used offset future usage. In effect, a net billing customer is compensated for its excess generation at the retail price of electricity. Because the retail price of electricity is substantially greater than the value of generation supply, net billing represents a subsidy in the form of lost T&D revenues. Thus, the benefit to net billing customers is funded by T&D utilities and their ratepayers.

Net billing is available in 38 states and has been available in Maine (through Commission rule) since the mid 1980s. The purpose of net billing has been to promote the use of small renewable resources for an individual customer's own use. In Maine, the generation resource must be 100 kW or less and in the proximity of the load to qualify for net billing.[20] Currently there are approximately 65 net billing customers in Maine.[21] The majority are solar installations of 4 kW or less; there are also wind generators that are typically 10 kW facilities and hydroelectric facilities between 10 kW and 100 kW. The current cost of net billing to T&D utilities and their ratepayers is relatively modest, estimated at less than $50,000 per year.[22]

Net Billing is an extremely advantageous program for customers that have renewable generation under the 100 kW breakpoint and enough load to make the net billing offset worthwhile. It is also relatively easy to administer through Commission

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[20] Appendix __ to this report contains a chart summarizing net billing programs in other states. A review of this chart shows that Maine's 100 kW limitation is significantly higher than in most other states. California has a larger capacity limit, but it has a shortage of generating capacity.

[21] Appendix __ to this report contains a list of the resource type and size of current net billing generators.

[22] For every kilowatt-hour of usage that is offset by a customer's generation, the T&D utility loses its portion of the electricity rate. Currently net billing customers generate and use approximately 600,000 kWhs annually. Assuming a $0.07 per kWh T&D rate, net billing translates into a revenue loss of less than $50,000 per year.

oversight of T&D utilities and the standard offer, and does not represent a substantial burden for T&D utilities.

Over the past legislative sessions, the issue of expanding the net billing program has been raised. There are two basic means to expand the program:

1) Increase the net billing limit (for example) to 1 MW; and

2) Expand the load that can be offset by eliminating the proximity requirement and including loads of affiliates or associates.

The expansion of the net billing program would increase the cost to utilities and ratepayers. If it were assumed that an additional 10 customers with generating facilities that averaged 500 kW began to net bill, the cost in additional lost revenues to T&D utilities would likely be no more than $600,000 per year. However, the number of additional net billing customers over time cannot be known. To address concerns over this uncertainty, the cost of expanding net billing can be effectively capped by limiting the number of customers or the total customer load that can have net billing arrangements.[23]

D. Small Generator Aggregation

Small generators, by virtue of their size, face unique difficulties in accessing the competitive wholesale market. These difficulties are faced by both renewable and non-renewable generators that are in the 5 MW or less range.[24] The difficulties arise because electricity marketers are generally unwilling to purchase the output from small generators due to the significant administrative costs associated with contracting with a number of small facilities that provide little volume. Additionally, the cost for small generators to sell directly into the ISO-NE market is economically prohibitive.

Several years ago, there appeared to be some marketers willing to contract with small renewable generators and some possibility that a viable market for small renewable generation would be sustained. Currently, however, there appears to be little, if any, sustainable market for small generators.

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[23] The Commission's current net billing rule (Chapter 313) has a capping mechanism that requires a review of the program if the amount of net billing load reaches 0.5% of a utilities peak demand or approximately 7.5 MW on a statewide level. Currently, net billing load is, at most, 900 kWs.

[24] This matter was discussed in the Commission's October 2001 final report to the Legislature on distributed generation.

There are several mechanisms that could provide reasonable market access to small generators. The mechanisms could be made applicable only to small renewable generation or to any other designated category of distributed generation. These mechanisms are designed only to allow generators to receive market prices for their output. As such, they would have only a minimal (if any) ratepayer subsidy (unlike the other mechanisms discussed in this section of the report).

Several alternative mechanisms to address this matter have been discussed before the Legislature. The alternatives are:

- Require T&D utilities to purchase the output of small generators, sell the output to ISO-NE spot market, and reimburse the generator at the clearing price the utility receives for the output;[25]

- Require standard offer providers to purchase the output of small generators;

- Seek a third-party (presumably an existing marketer) or create an entity to perform aggregation purchase and sale services for small generators; or

- Require the Commission to conduct a bid process to sell the small generator output to an open market competitor.

As a result of recent ISO-NE rule changes implementing standard market design, T&D utilities are no longer in the position to aggregate small generators and re-sell their output. However, a workable means exists whereby the standard offer provider would be required to purchase the output of small generators at the applicable clearing prices using utility administered settlement processes. The standard offer provider would be financially neutral to the transaction and would have little or no administrative burden. The utilities would have a relatively small additional administrative burden.

Use of the standard offer load in this manner is a viable aggregation method to ensure a market for small generation in the ISO-NE area. Due to differing market rules (primarily the lack of a spot market), it is unclear at this point whether a similar mechanism could work in the northern Maine market. The potential for success with the other alternatives listed above is much more in question. The burden of administering individual contracts for small volumes of generation would make it unlikely that a market participant would offer to provide aggregation services. The Commission or some other entity could bid out the output of small generators. However, this would create new administrative costs, and the intermittent nature of the output and relatively

[25] By requiring that utilities only reimburse generators the amount they actually receive, the mechanism would not create new stranded costs.

small volume would likely result in prices for the generators being below the clearing prices.

E. Customer Rebates

Customer rebates, funded by a surcharge on utility bills (i.e. a SBC) or tax credits, are a common mechanism used in other states to promote renewable resource on-site applications. [26] Customer rebates (typically referred to as "buydowns") are payments made to customers to offset the installed cost of designated renewable technologies. Buydown rebates are usually made on the basis of the installed capacity of the facility. They are typically applicable to photovoltaic and wind installations, but sometimes extend to fuel cells, biomass and other resources. Buydowns in other states commonly range from $3.00 to $5.00 per watt up to a specified percentage of total cost, or 10% to 30% of the installation and capital costs. In some programs, the installation must undergo a prior inspection and payments are made overtime to ensure that the installation produces the expected amount of energy.

Customer buydown programs in other states are often part of "clean energy fund" activities that operate similar to energy efficiency fund implementation. In addition to customer buydowns, clean energy fund programs include low interest loans for facility installations, grants for developing technologies, public education, and market development. The Commission could administer such a program in conjunction with its energy efficiency program, but additional resources (including additional personnel) would be required.

F. Green Product Demand

Several states have programs that seek to support renewable resources by stimulating retail demand for "green" electricity products. One approach is to reduce the retail cost of green electricity products by providing a credit for the purchase of green electricity. [27] The credit is funded by a surcharge on utility bills (i.e. SBC) and is generally paid to green marketers rather than retail customers for administrative reasons. A second approach is to require a "green standard offer." [28] A green standard offer is arranged for by the state or a utility and provides all customers with a readily

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[26] Appendix __contains a table displaying rebate programs in place in other states. Sixteen states offer ratepayer funded rebates for solar installations and six offer rebates for wind, while 13 states offer tax credits for solar and wind installations. Maine had sale and property tax exemptions for solar energy equipment, but the exemptions were repealed in the mid 1980s.

[27] California, Rhode Island and New York have implemented such programs. The California program ended with the termination of retail access.

[28] New York and Massachusetts have green standard offer programs.

accessible option to purchase a green electricity product. Finally, some states require or encourage green purchases by state government.[29]

Both approaches are an indirect means to promote the development of grid-scale renewable generation resources and it is difficult to determine the effectiveness of these approaches compared to other resource mechanism. A green product credit program would involve significant resources to implement, while a green standard offer would create some additional administrative burden. Both could be implemented by the Commission with some additional resources.

[29] As shown in Appendix___ to this report, six states have implemented government purchase programs, and Maine has recently added to this number.

IV. FUELS AND TECHNOLOGIES

This section of the report discusses individual generating fuels and technologies, current barriers to their development and use, and possible promotional mechanisms or activities. The section examines the three resources specified in the Resolve, the fuels and technologies that are currently eligible for Maine's RPS and other potential candidates for public support. The following table summarizes key issues associated with each fuel. The sections following the table discuss the issues in more depth.

Fuel	Barriers	Effective Support Mechanisms	Potential Goals	Current Capacity in ME
Biomass	• Unpredictable fuel availability and cost • Falling electricity prices • Uniform disclosure label rule • Non-PTF charges	• Redesigned RPS or SBC that exclude lower-cost resources • Small generator aggregation • Elimination of non-PTF charges	• In-state jobs, economy (including support for wood products industry) • Geographic diversity • Fuel diversity • Environmental benefits • Renewable	250 MWs 13 facilities
Municipal Solid Waste	• Competition for MSW • Falling electricity prices • Limits to RPS value	• Redesigned RPS or SBC that exclude lower-cost resources	• Environmental benefits (of waste disposal) • In-state jobs, economy • Renewable	60 MWs 4 facilities
Efficient Cogeneration	• Falling electricity prices • Competition for plant output	• Redesigned RPS so percentage is closer to supply • SBC	• In-state jobs, economy • Environmental benefits	300 MWs 8 facilities
Grid-scale Hydro (>5 MW)	• Upstream passageway requirements • Non-PTF charges • Low-impact demands	• Redesign RPS so percentage is closer to supply • SBC • Upstream passage reconsideration • Elimination of non-PTF charges	• Environmental benefits • Renewable • Maintain ecosystem • Recreational benefits, flood control • Fuel diversity • Geographic diversity • Price stability	540 MWs 29 facilities
Small-scale Hydro (< 5 MW)	• Access to market • Falling electricity prices • Non-PTF charge	• Small generator aggregation • "Other renewables" RPS or SBC • Increase net billing breakpoint • Allow multiple accounts to net bill • Eliminate non-PTF charges	• Environmental benefits • Renewable • Maintain ecosystem • Fuel diversity • Geographic diversity	17 MWs 47 facilities (<1 MW) 48 MWs 20 facilities (1-5MW)
Grid-scale Wind	• Public reaction (visual) • Siting • High capital costs • Long-term contracts needed	• "New and other renewables" RPS or SBC • Siting requirements reconsideration	• Environmental benefits • Renewable • Long-term price stability • Geographic diversity • Fuel diversity	100 MWs 2 facilities (planning stage)

On-site Wind	• Costly at small-scale • Access to market • Lack of public awareness	• Customer rebates • Small generator aggregation • Increase net billing breakpoint • Educate institutions	• Support overall State renewables policy	On grid: 300 kW 18 facilities Off grid: Far more
Grid-scale Solar	• High capital cost and limited hours of sun	• "New and other renewables" RPS or SBC	• Environmental benefits • Renewable • Long-term price stability • Fuel diversity	None
On-site Solar	• Costly • Lack of public awareness	• Customer rebates • Educate institutions • State sponsored demonstrations and licensing	• Support overall State renewables policy	700 kW 270 facilities
Peat	• Has been costly • Concern over sludge, if used	• Redesign RPS to include peat • SBC		1 facility currently not operating
Landfill Gas (methane)	• Existence of natural gas • Access to market	• "New or other renewables" RPS or SBC	• Environmental benefits (of methane removal)	None
Geothermal	• Lack of public awareness • Lack of qualified installers	• State sponsored demonstrations and licensing	• Support overall State renewables policy	2 commercial 20 residential per yr
Tidal	• Not yet viable			None
Fuel Cells	• High capital & operating cost • Need improved efficiency and lower costs	• Customer rebates • R&D support	• Environmental benefits • High power quality	None

A. Biomass

Biomass is an eligible resource under Maine's current RPS law. The law does not define "biomass." In Maine, the term has generally referred to facilities that burn wood chips or sawmill waste to generate electricity.[30] Some biomass facilities are stand-alone electric generators and some are cogenerators that use the electricity to serve their own load as well as for export to the electrical grid. There are nine stand-alone biomass plants ranging in size from 15 to 45 MW and four small wood products companies with capacities less than 1 MW (four cogenerators - three also using coal, oil, or hydro - range in size from 40 to over 100 MW; in this report, we consider those

[30] The Commission has interpreted landfill gas to be biomass for purposes of Maine's current RPS. Other plant crops and plant byproducts, as well as animal byproducts such as manure and sludge, are generally considered biomass. A revised RPS might clarify the products that comprise biomass.

plants to be efficient cogenerators).[31] The 13 biomass plants have a combined capacity of over 250 MWs. In addition, a significant number of non-Maine biomass plants participate in New England's market.[32]

Maine's existing biomass plants were built when utilities were paying a relatively high price for electricity produced by qualifying facilities (QF). The majority of the stand-alone biomass QF contracts have expired, causing the facilities to sell their electricity at substantially lower market prices. Biomass plants have relatively long ramp-up procedures, which limits their ability to respond quickly to hourly changes in market prices. In addition, the availability and cost of fuel is currently unpredictable, increasing operational costs. Because of rising costs and falling revenues, as many as six plants are reported to have been idled for various periods of time over recent years and at least three are currently idle. However, at least three stand-alone plants whose contracts have expired are operating.

Biomass plants provide benefits that extend beyond electricity generation. First, biomass plants allow for local disposal of wood byproducts. The economic impact to the sawmill industry has been cited in both Maine and New Hampshire as perhaps the most compelling reason to support the biomass industry.[33] In the absence of biomass facilities, the 200-plus sawmills in Maine would be required to establish landfills to dispose of as much as 875,000 tons of waste produced annually or to dispose of the waste in municipal landfills.[34] Under either of these options, sawmills would lose the revenue they currently receive from the sale of their waste and would incur costs estimated in the tens of millions of dollars. In addition, Maine's biomass facilities directly employ more than 200 people and pay over $2.6 million in local taxes.

Biomass facilities are scattered around the State in remote locations, adding geographic diversity to Maine's generating mix, and they reduce Maine's reliance on fossil fuels.

In many states, biomass is eligible for support through a RPS or SBC, but eligibility is generally limited to facilities that are smaller than 30 MW, that meet certain emissions standards, or that are fueled by sustainable biomass. Only two of Maine's biomass plants qualify for the Massachusetts RPS and there is no reason to believe that any qualify for other states' RPSs. A federal inflation-adjusted $0.015 per kWh

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[31] Appendix __ lists Maine's biomass plants.

[32] The Commission estimates that 13 biomass plants operate outside of Maine in New England: ten in New Hampshire, two in Vermont, and one in Connecticut.

[33] "Report of the Committee on Sawmill Biomass," December 31, 1999, Committee on Sawmill Biomass and "Markets for Low-Grade and Underutilized Wood in New Hampshire," New Hampshire Department of Resources and Economic Development, January 2002.

[34] Data regarding waste are taken from material produced in 1999 by Maine's Committee on Sawmill Biomass created by Joint Order, HP 1583.

Production Tax Credit is available to biomass plants that use closed-loop technology, but no plant in Maine qualifies for that credit.

A study by the biomass industry in New Hampshire indicates that biomass plants in that State cost $0.054 per kWh on average to operate, resulting in the need for approximately $0.014 per kWh of public support to be competitive with market generation that averages $0.04 per kWh.[35] Partial data on Maine's biomass facilities indicate a possible need for a subsidy ranging from $0.00 to $0.03 per kWh if the market price is $0.04 per kWh, with plant requirements varying significantly. The 1999 report from Maine's biomass committee hypothesized the need for a subsidy in the $0.01 per kWh range. Neither the Commission nor the 1999 Biomass Committee has had access to individual facility costs and operation data that would allow verification of the validity of these estimates.[36] However, based on the available, unverified estimates, it appears that some subsidy – probably in the range of $ 0.01 per kWh – is necessary to maintain some or all of Maine's biomass industry. Because costs vary among plants, a fixed cent-per-kWh subsidy would be more than is necessary for some facilities and not enough for others. In addition, changing market prices would change the needed subsidy level.

To put potential subsidies in perspective, if all biomass plants operated at an 85% capacity factor and received a $0.01/kWh subsidy, the subsidy would cost ratepayers approximately $19 million.

Environmental Issues: Biomass generators emit CO_2, a greenhouse gas. However, waste wood that fuels some facilities would ultimately emit CO_2 as it degraded. A biomass plant that generates in conjunction with sustainable forest practices can be considered to be a neutral emitter of CO_2, in that new growth absorbs the CO_2 in equal or greater amounts than that emitted.[37] Biomass generation emits lower levels of NOX and SO_2 than do fossil fuels.

Barriers

- **Unpredictable fuel availability and cost:** Under utility contracts, facilities could enter into long-term fuel contracts, while under current, less-certain operating conditions, fuel is generally purchased on a short-term basis. This situation has proven

[35] Currently, the forward market values generation at about $0.044 per kWh, which lowers the estimated subsidy by 4 mills. The value differs over future time periods.

[36] The Commission requested cost and operation data from the biomass facilities. Only aggregated data in the form of group averages and ranges were provided.

[37] Representatives of the biomass industry have requested that the Commission allow CO_2 offsets for all biomass facilities under its rule governing uniform disclosure labels for competitive suppliers. The matter is pending.

problematic to both the biomass plants and the wood products industry that depends on the plants to dispose of its waste stream, and has resulted in price volatility of fuel costs. In addition, wood waste is not always located in close proximity to a plant, resulting in significant transportation costs.[38]

- **Falling electricity prices*:*** The price that facilities can receive from the competitive market for electricity has dropped significantly below the price utilities paid under earlier utility QF contracts.

- **Uniform disclosure label rules:** Because biomass generators are not automatically assumed to be neutral emitters of CO_2 for purposes of Maine's uniform disclosure label, "green" marketers are hesitant to include biomass in their portfolios. When biomass has been used in green products, some customer dissatisfaction has occurred.

- **Non-PTF charges:** In BHE's service territory, generating plants located on non-PTF facilities must pay non-PTF charges to transport energy to the wider grid.

Support Mechanisms

- **Redesigned RPS or SBC:** A redesigned RPS or SBC that excludes lower-cost resources would provide financial benefits to Maine's biomass facilities. The existence of relatively low-cost hydroelectric and efficient cogeneration facilities limits the effectiveness of the current RPS for biomass facilities. Massachusetts's RPS, which is limited to higher-cost renewables, would be advantageous for Maine biomass plants that qualify.

- **Small generator aggregation:** A mechanism whereby a single entity aggregates generation from all small generators and sells or disburses the aggregated generation into the market would benefit the four biomass plants with capacities below 1 MW. Such mechanisms are discussed in section III of this report.

- **Eliminate non-PTF charges*:*** Although CMP has eliminated non-PTF charges by socializing its non-PTF costs among all ratepayers, socializing the charge would be relatively more costly to BHE's ratepayers. However, socializing the charge would lower costs and make generation more competitive for biomass facilities in BHE's territory.

[38] A 1999 State law allowed for a tax credit to sawmills to offset some of the cost of transporting sawmill waste to biomass plants. If passed through to biomass facilities, the credit would have lowered the price of fuel for biomass plants. Biomass plants apparently were able to continue paying prices for fuel that allowed sawmills to transport without triggering the credit mechanism. The credit was never used, and has expired.

B. Municipal Solid Waste

"Municipal solid waste (MSW) in conjunction with recycling" is an eligible resource under Maine's current RPS law. Four eligible MSW plants, with combined capacity of 60 MWs, operate in Maine. Three of the four in-state facilities still obtain relatively attractive electricity revenues under utility QF contracts. These contracts will end between 2007 and 2018. A significant number of MSW plants located outside Maine participate in New England's market and are eligible for Maine's RPS.[39]

Revenue for MSW facilities is produced through two means – tipping fees and electricity sales. MSW plants typically operate 24 hours a day throughout the year, thus providing a steady source of generation. Some burn all solid waste (i.e., "garbage") brought to their facilities and some remove metals and glass before burning. The material burned to produce electricity thus includes such things as household refuse, tires, and wood scraps.

Three conditions made MSW plants attractive when they were constructed: 1) a State prohibition on new commercial landfills appeared to make alternative disposal methods a necessity; 2) a municipality could require trash haulers to deposit all waste from the municipality's residents in the MSW facility; and 3) utilities paid a relatively high price for generated electricity. The effect of all these conditions has diminished significantly.

Evaluating the current economic viability of MSW facilities is complicated by the fact that MSW facilities have two sources of revenue: electricity sales and tipping fees. Thus, if electricity prices fall, a MSW plant can attempt to make up the losses through higher tipping fees. However, the ability to raise tipping fees for commercial MSW is constrained by the existence of a healthy competitive market for MSW; attempts to increase tipping fees could result in haulers bringing their MSW to other locations. In addition, municipalities own or have an interest in three of the four facilities,[40] so residents, not private investors, must absorb financial losses. Similarly, increased tipping fees increase waste removal costs for local residents.

To the extent that a MSW facility obtains higher electricity revenues because of a RPS or other ratepayer funded mechanism, Maine's electricity ratepayers are subsidizing trash disposal in municipalities other than their own. On the other hand, all Maine citizens may be benefiting from lower mercury emissions than would be created by disposal through landfills.

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[39] The Commission estimates that 20 MSW plants operate outside of Maine in New England – 11 in Connecticut, seven in Massachusetts, one in New Hampshire, and one in Vermont.

[40] IEPM reports that 40% of Maine's municipalities have an ownership stake in a MSW generating facility.

The Commission has been provided with very limited information regarding the costs required to operate Maine's MSW facilities.[41] It appears that, if MSW were evaluated solely as a source of electricity, it would be extremely costly when compared with other forms of electricity generation and would require subsidies far exceeding those required by biomass or wind generation. However, if tipping fees cover a significant percentage of a facility's cost, MSW facilities might be economically viable. The Commission cannot judge a reasonable or likely subsidy level.

To put potential subsidies in perspective, if all MSW plants operated at an 85% capacity factor and received a $0.01/kWh subsidy, the subsidy would cost ratepayers approximately $4.6 million.

Environmental Issues: While MSW facilities appear to burn material that can be environmentally harmful, they are, in fact, more environmentally benign than alternative MSW disposal methods. The State has developed air emission control requirements as a condition for licensing MSW facilities. In the absence of the facility, waste would reside in landfills, and methane produced by flaring at landfills is considered more harmful than mercury emissions from MSW generating facilities. However, many residents living in the vicinity of some MSW facilities complain of ash particles produced by the plant.

Barriers

- **Competition for MSW:** Competition (from other in-state and out-of-state MSW facilities and landfills) now exists for municipal solid waste, effectively capping commercial tipping fees.

- **Falling electricity prices:** The price that the facilities can receive from the competitive market for electricity has dropped significantly below the price paid by utilities under QF contracts. This becomes a barrier when utility contracts expire.

- **RPS value:** RPS programs in Maine and in other New England states have created no discernible economic value for Maine's MSW facility selling power in the competitive market. Out-of-state MSW facilities have been used to satisfy suppliers' RPS requirements in Maine, but the Commission is unaware of whether a premium was paid for this power. RPSs in some states have emissions requirements for MSW plants, limiting the eligibility of Maine's facilities.

Support Mechanisms

- **Redesigned RPS or SBC:** A redesigned RPS or SBC that excludes lower-cost resources would provide financial benefits to Maine's MSW facilities, assuming that MSW facilities need public support to remain profitable after their contracts expire (a

[41] The Commission requested cost and operation data from the MSW facilities. One facility provided such information subject to confidentiality protection.

likelihood that the Commission cannot judge without more knowledge of facilities' operating costs).

C. Efficient Cogeneration

An "efficient resource" is defined in Maine's RPS statute as a facility that qualifies as a cogeneration facility under PURPA rules and that meets a specified efficiency standard.[42] As a practical matter, this definition encompasses most, if not all, of Maine's cogenerating facilities constructed before 1997. Four large cogeneration facilities, with combined capacity of over 300 MWs, generate power in Maine.[43] These facilities burn biomass for all or a portion of their generation and use coal, oil or hydro as well. Only two of the facilities have declared themselves, under the region's Generation Information System (NE-GIS), to be eligible under Maine's RPS, even though all are presumed to qualify as "efficient resources."

In addition, four smaller cogeneration facilities generate at less than 1 MW capacity, burn biomass (and are included in the biomass discussion in this report) and have not declared themselves to be efficient cogenerators. At one time, all these facilities sold generation to utilities under QF contracts at prices that significantly exceed today's market price of electricity. Two of the larger facilities still obtain electricity revenues under utility contracts that will expire between 2008 and 2012. It is presumed that no out-of-state facilities satisfy Maine's efficiency criteria, and none have been used to satisfy Maine's RPS.

Cogeneration is concentrated in wood products businesses such as paper mills and sawmills. These businesses account for a significant level of employment and industrial output in Maine. The merits of biomass-fueled generation are discussed in the biomass portion of this section.

Cogeneration is generally an efficient, low-cost way to produce electricity. Cogeneration facilities either use the heat from a thermal process that is inherent in its business operation or produce heat that fuels both electricity generation and industrial processes**.** Thus, the process is relatively less costly than stand-alone generation. Cogenerators usually use a portion of their generation to serve their own load, selling the remainder to the market. As a general matter, cogeneration is commercially viable without any type of ratepayer subsidy.

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[42] Maine statute specifies the efficiency standard as: During any calendar year, the sum of the useful power output and the useful thermal energy output of the facility must be no less than 60% of the total energy input to the facility.

[43] All or a portion of these plants might also qualify for a RPS that contains biomass as an eligible resource, if the RPS allowed consideration of a portion of a dual-fuel facility.

The Commission has no data on the amount of electricity that is generated but not sold through the grid, but it is a significant amount. Thus, the impact caused by encouraging cogeneration cannot be estimated.

Environmental Issues: As mentioned elsewhere, the predominant fuel used in Maine cogeneration facilities is wood-based biomass. Because some facilities additionally use coal or oil, they have environmental impacts associated with those fuels. However, because these facilities are relatively efficient and must observe strict environmental standards, their environmental impact is reduced compared with stand-alone facilities.

Barriers

- **Falling electricity prices:** The price that facilities can receive from the competitive market for electricity has dropped significantly below the price paid under prior utility contracts. While this fact does not generally make cogeneration uneconomic, it has significantly reduced the value of cogeneration to the industrial plant.

- **Competition for plant output:** Industrial plants that cogenerate in Maine have faced increasingly stiff competition, creating significant pressure to reduce costs. Electricity is a significant portion of many plants' operating costs.

Support Mechanisms

- **Redesigned RPS or SBC:** A RPS redesigned so that the required percentage is closer to the eligible supply or a SBC could provide financial benefits to cogeneration facilities. Because cogeneration is less costly than most other forms of generation that typically meet RPS requirements, suppliers would likely make significant purchases of cogeneration to meet their RPS requirement.

D. Grid-Scale Hydroelectric[44] (above 5 MW)

Hydroelectric facilities with capacity less than 100 MW are eligible resources under Maine's current RPS statute. Four hydro facilities with capacity between 30 and 90 MWs, with combined capacity of 240 MWs, exist in Maine. Twenty-five facilities with capacity between 5 and 30 MWs have combined capacity of over 300 MWs. Approximately 20 facilities of this size (and over 20 smaller facilities) were sold by Maine's utilities at the time of restructuring, and are now owned by FPL Energy, PPL, and WPS-ESI. Six of the facilities retain utility QF contracts and are therefore receiving

[44] The Resolve directs the Commission to examine mechanisms to support hydroelectric facilities of 30 MW or less. However, there is no clear-cut breakpoint among facilities that governs barriers or issues associated with hydroelectric facilities. Environmental impacts, average generating cost, geographic benefits, and value for recreation and flood control are not uniquely determined by size. For the purposes of describing barriers and opportunities, this report uses a 5 MW breakpoint.

attractive prices for their generation. The owners of hydroelectric facilities sell generation at both the wholesale and retail level.

Most of Maine's hydroelectric facilities were constructed during the 1980s or much earlier, and no new facilities are likely to be built. Thus, a resource support mechanism would act to provide assistance to existing facilities, not encourage new ones. Hydroelectric facilities have created ecosystems and recreational opportunities along waterways that depend upon the flow of water, and they provide flood control. They offer a reliable alternative to natural gas and are not subject to price volatility associated with fossil fuel facilities.

Because there are a number of these smaller facilities scattered throughout the State, they provide geographic diversity that offers voltage support to the utility grid. Geographic diversity, however, is only an advantage if the grid is structured to transport the generation and to accommodate the voltage support. Because these hydroelectric facilities have existed for many years, the grid is structured to benefit from their diversity. In addition, these facilities form the basis for black-start capability of Maine's grid. Because they are of medium size and are widely disbursed, they are brought on line early in the sequence, creating a valuable contingency service.

Grid-scale hydroelectric facilities have been among the least costly forms of electric generation for decades. While costs differ among plants, grid-scale hydroelectric power traditionally has cost less than $0.03 per kWh to generate, which is comfortably competitive in the open market. During months when water flows, hydroelectric facilities run 24 hours per day and thus provide an inexpensive source of base load electricity. While the initial capital costs of most hydroelectric facilities are fully depreciated, recent federal and state[45] rules have required the installation of environmental improvements, primarily to allow upstream passage (i.e., fishways) where they are determined to be needed.[46] The additional cost of fishway accommodations has added millions of dollars to some facilities' costs. At least four facilities are currently slated for possible removal, in part because of the potential cost of fishways. It has been suggested that, because the additional cost supports a societal benefit, it should be supported by societal sources and not through utility rates.

Maine's current RPS limits eligibility to facilities that generate at lower than 100 MWs of capacity. Hydro-Quebec (HQ) owns significant amounts of hydroelectric facilities that exceed 100 MWs in capacity. When electric restructuring began, HQ expressed considerable interest in selling its generation in Maine's retail market. However, despite the significant amounts of hydroelectric power it owns, HQ must

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[45] The FERC has established federal fishway requirements as a condition of licensing and Maine's Title 12 § 7701-A *et. seq.* establish state requirements.

[46] Approximately half of FPL's dams have upstream passage facilities. Almost all PP&L facilities have fishways. Both have been required to build additional fishways and improve some that exist.

purchase 30% of its portfolio to meet Maine's RPS, a factor that discouraged HQ from entering Maine's market. In recent years, HQ has shown no further inclination to participate in the Maine market.

Environmental issues: Hydroelectric generation does not create harmful air emissions, but impacts fish and the surrounding ecosystem. There is substantial debate within the environmental community as to the relative impact of hydroelectric generation, and the term "low-impact" facility has been coined to differentiate between facilities that are relatively benign and those that are not.[47] The size of the facility is not the determining factor with regard to environmental impacts; rather each facility's environmental impact must be considered based on its characteristics.

Barriers

- **Upstream passage:** State and federal requirements to provide fish passage have added significant capital expenses for hydroelectric facilities of all sizes.

- **Non-PTF charges:** In BHE's service territory, generating plants located on non-PTF facilities must pay non-PTF charges to transport energy to the wider grid.

- **Low-impact features:** Some environmental supporters are hesitant to support hydroelectric facilities without further refinement based on case-by-case impacts.

Support Mechanisms

- **Redesigned RPS or SBC:** A redesigned RPS so that the required percentage is closer to the eligible supply or a SBC could provide financial benefits to grid-scale hydroelectric facilities. Because some hydroelectric facilities are less costly than most other forms of generation that typically meet RPS requirements, suppliers would likely make significant purchases of hydroelectricity to meet their RPS requirement.

- **Upstream passage:** The State might increase its efforts to review fishway requirements to find ways to remove or mitigate financial impacts.

- **Eliminate non-PTF charges*:*** Although CMP has eliminated non-PTF charges by socializing its non-PTF costs among all ratepayers, socializing the charge would be relatively more costly to BHE's ratepayers. However, socializing the charge

[47] For example, some hydroelectric facilities create significant amounts of mercury above the impoundment or negatively impact surrounding ecosystems. The Low Impact Hydropower Institute has developed criteria that would qualify a facility as low impact. While some criteria are easily measured (e.g., compliance with certain State and federal laws), it is unclear who would determine compliance with other criteria.

would lower costs and make generation more competitive for hydroelectric facilities in BHE's territory.

E. Small-scale Hydroelectric (below 5MW)

Hydroelectric facilities that generate very small levels of power are scattered across Maine. There are 47 facilities, totaling 17 MWs, that generate below 1 MW and there are 20 facilities, totaling 48 MWs, that generate between 1 and 5 MWs. Some provide electricity for a local residence or business, and many control the water level of small lakes. All were constructed long ago, and no new facilities are likely to be built. Thus, a resource support mechanism would provide assistance to existing plants, not encourage new ones.

A small (100 kW) hydroelectric facility might generate 22,000 kWhs per month on average. If sold at $0.04 per kWh on the open market, the facilities would receive less than $900 per month in revenue. Even a 1 MW facility generating 10% of the time would produce 72,000 kWhs and receive about $2,900 per month in revenue. Thus, any significant cost quickly erodes these facilities' profitability.

The restructuring of the electric industry (both on the federal and State levels) has resulted in increased financial burdens for small facilities. For example, insurance and metering for these customers costs as much as $500 per month. Lack of economies of scale makes many costs almost as high for small facilities as for large. In recent years, the Commission has worked with CMP to eliminate some of these insurance and metering costs.

Small hydroelectric generators also face problems associated with the sale of generation on the open market. Most had utility QF contracts that paid attractive prices for their generation. These contracts have gradually expired and some facilities continue to find it impossible to operate profitably at market prices. In addition, generators find it difficult or impossible to contract with wholesale buyers because competitive marketers are generally unwilling to purchase from small facilities.[48]

Even with reduced insurance and metering costs, many small hydroelectric facilities find it difficult to operate profitably, and some have ceased operation.

Environmental Issues: Hydroelectric generation does not create harmful air emissions, but does impact fish and the surrounding ecosystem.

[48] As mentioned in section III of this report, when the Commission first investigated the problems faced by small hydroelectric facilities, a handful of competitive suppliers were willing to purchase generation from these facilities and a market thus appeared to be developing. At this time, it appears that a sustainable market for small renewable generators has not developed.

Barriers

- **Access to market.** Joining NEPOOL and following the procedures for selling into the wholesale market are costly – annual dues are $10,000 and daily reporting and metering are necessary. Moreover, wholesale and retail electricity suppliers are unwilling to expend the administrative costs for such a small amount of power, leaving the small generator with no ready access to the market.

- **Falling electricity prices.** As utility contracts expire, lower market power prices cause generators' revenue to drop significantly. Lack of economies of scale make generation relatively costly.

- **Non-PTF charges:** In BHE's service territory, generating plants located on non-PTF facilities must pay non-PTF charges to transport energy to the wider grid.

Support Mechanisms

- **Small generator aggregation:** A mechanism whereby a single entity aggregates generation from all small generators and sells or disburses the aggregated generation into the market would benefit small-scale hydroelectric facilities. Such mechanisms are discussed in section III of this report.

- **"Other renewables" RPS or SBC:** A RPS or SBC that includes resources such as wind, solar, and fuel cells (called "other renewables" in many states) but that excludes larger, low-cost hydroelectric and cogeneration facilities would add financial value to small-scale hydroelectric generation by increasing the demand and therefore the price the generator would receive for its power.

- **Raise net billing breakpoint:** Raising the net billing breakpoint from 100 kW to 1 MW could benefit some small hydroelectric facilities, but only if the customer's load is large enough to absorb the increased amount of generation. Typically, a residential customer could not benefit from an increase in the breakpoint.

- **Allow multiple accounts to net bill:** Allowing small hydroelectric facilities who net bill to use their generation to offset the load of affiliates and associates located elsewhere in the state, or the load of neighbors, could significantly benefit small hydroelectric facilities. This is especially true if the breakpoint is increased from 100 kW to 1 MW.

- **Eliminate non-PTF charges:** Although CMP has eliminated non-PTF charges by socializing its non-PTF costs among all ratepayers, socializing the charge would be relatively more costly to BHE's ratepayers. However, socializing the charge would lower costs and make generation more competitive for small scale hydroelectric facilities in BHE's territory.

F. Grid-Scale Wind

Wind is an eligible resource under Maine's current RPS statute. Two grid-scale wind projects, with combined capacity of 100 MWs, are in the permitting stage in Maine, and national studies indicate that there are a number of sites in Maine where wind conditions are favorable for grid-scale wind facilities. Because of its intermittent nature, a grid-scale wind facility is likely to sell its generation to a wholesale or retail electricity supplier rather than become a retail supplier of electricity. This gives a facility the potential to obtain a long-term sales contract, which is extremely desirable for a developer to receive financing for capital investment. A wind facility will likely be built only if it can operate at a 30% capacity factor or better. While wind is sporadic, many believe that wind patterns in portions of Maine generally coincide with peak electric load needs, making wind a useful supplement to base load generation.

Grid-scale wind technology has advanced to the point that, with the current federal Production Tax Credit, it can compete with other sources of generation. A reasonable estimate of generation costs is about $0.06-$0.07 per kWh over the long-term. At this cost, wind is close to being competitive in the current short-term generation market and offers long-term price stability. The federal government provides an inflation-adjusted $0.015-per-kWh tax credit (currently $0.018 per kWh) to for-profit wind generation. This credit lowers the cost of wind generation to about $0.04-$0.05 per kWh, which is in the range of prevailing market prices.

Those who support wind generation point to the long-term economic benefits. The price of fuel is not volatile, the fuel will not be depleted, and operating costs are relatively low because of the lack of thermal processes and complex mechanics.

The RPS program in Massachusetts (discussed in section V of this report), which is limited to new renewable generation, has created discernible economic value for wind generation in Maine. In addition, the $0.018 federal Production Tax Credit is critical to the economic viability of wind generation. The credit will soon expire, but it appears likely that it will be renewed.

Proliferation of wind facilities is likely to increase the geographic diversity of generation in Maine. As discussed in section II of this report, this feature provides both benefits and risks to the utility grid. Depending on the configuration of the grid in the vicinity of the facility, the generator could provide voltage support; however, the sporadic nature of wind generation limits this benefit. Alternatively, in some locations the grid must be upgraded significantly to allow for generation into (as opposed to out of) the area.

Environmental Issues: Wind is generally viewed as an environmentally benign source of electrical generation in that it produces no air emissions. Objections focus on visual and migratory bird impacts.

Barriers

- **Public reaction:** Visual impacts often cause significant negative public reaction.

- **Siting:** State siting requirements may require costly studies. For example, generators may be required to study wetland, bird migration, and visual impacts.

- **High capital costs:** Facilities have proportionately higher capital costs than most types of generation. However, fuel is essentially free.

- **Long-term contracts:** Because wind facilities have higher capital costs, long-term contracts (10 years or more) for electricity sales are often necessary to attract capital investment. The generation market generally does not offer contracts of this length.

Support Mechanisms

- **"New or other renewables" RPS or SBC:** A RPS or SBC that includes new renewable resources or renewables such as wind, solar, geothermal, and fuel cells but that excludes larger, low-cost hydroelectric and cogeneration facilities, would add financial value to wind generation by increasing demand and thus the price the generator would receive for its power. In addition, an RPS or SBC reassures investors that the State is likely to continue long-term support for wind generation and that the facility therefore will continue to be financially viable.

- **Siting requirements:** The State might review siting requirements to find areas that could be removed or streamlined, and might confer with environmental and local groups to examine ways to mitigate public concern over visual impact.

G. On-Site Wind

Small 10 kW wind turbines that generate power for use by residential and small business consumers are well established, and newer 1 kW and 50 kW turbines are beginning to appear. For larger applications, 660 kW turbines are well established and are far more efficient. Pursuant to Commission rule, customers have the option to net bill generation against their load over time. The procedure is explained in section III of this report. Approximately 15 small on-site wind facilities, most generating with a 10 kW turbine and with a total capacity of approximately 300 kW, net bill in Maine and a higher number exist off-grid. The amount of generation exported to the grid is insignificant. Consumers that are not connected to the utility grid typically maintain propane or diesel backup to the wind generator.

Small-scale wind is not an economic alternative if the customer is connected to the grid. A 10 kW turbine might cost $3,500 to $7,000 to install, and might generate 13,000 kWhs per year, translating to a $0.15-$0.30 per kWh installation cost if

recovered over 20 years. Borrowing costs and operating costs add to the ongoing expense of the facility. Economies of scale make larger wind turbines significantly more efficient (and therefore less costly) than smaller turbines. For example, a 660 kW turbine might cost $700,000 to install and produce 1,500 MWhs of electricity per year, translating to as low as a $0.03 per kWh installation cost (ignoring borrowing and operating costs) if recovered over 20 years. With the addition of operating costs, these turbines still remain economically uncompetitive without some form of public support.

Eleven states offer personal and/or corporate tax credits for the installation of wind generators, with credits ranging from 10% to 35% of equipment and installation costs. Six states offer direct rebates in the form of a buydown of installation costs. Buydowns are commonly part of Clean Energy Funds that are used to support a variety of renewable initiatives. The $0.018 federal Production Tax Credit is not available to wind generators that are not built for profit. Small-scale wind is, however, sometimes an economic alternative to a lengthy line extension. While these rebates make some wind generation economically viable, consumers who own small-scale generation generally do so for environmental reasons or to avoid costly line extensions in remote locations.

In most cases, owners of on-site wind seek only to cover their own load at a reasonable price, and are not looking to sell their generation into the market. However, adopting a mechanism that facilitates smaller wind generators selling into the market would reduce the need to expand net billing (with its inherent subsidy) and thus would be a superior long-term means of encouraging small-scale generation from wind and other sources. In the near term, fewer than a handful of customers are likely to sell into the market.

Finally, some advocates believe that small wind turbines engender favorable public reaction, and that visible State support would offer an impetus for other environmentally benign forms of power.

Environmental Issues*:* Although wind is considered environmentally benign relative to other sources of electricity, small-scale on-site generation produces such an insignificant amount of power that it cannot be considered a replacement for generation produced by fossil fuel.

Barriers

- **Costly at small scale:** A small turbine – especially one smaller than about 660 kW – is an extremely costly form of generation.

- **Access to market.** For customers who wish to sell excess generation, joining NEPOOL and following the procedures for selling into the wholesale market are costly – annual dues are $10,000 and daily reporting and metering are necessary. Moreover, wholesale and retail electricity suppliers are unwilling to expend the administrative costs for such a small amount of power, leaving the small generator with no ready access to the market.

- **Lack of public awareness:** Wind generation might well be attractive to many homeowners for non-economic reasons or as a long-term generation alternative, but some view the public as not generally aware that the technology is available.

Support Mechanisms

- **Customer rebates:** Customer rebates in the form of a buydown or tax credit applied against the capital investment would facilitate the initial installation of on-site wind generators. A rebate would reduce the costs, potentially speed the development of economic small-scale generation, and signal the State's support of renewables.

- **Small generator aggregation:** A mechanism whereby a single entity aggregates generation from all small generators and sells or disburses the aggregated generation into the market would benefit on-site commercial wind sales. Such mechanisms are discussed in section III of this report.

- **Increase net billing breakpoint:** Increasing the net billing breakpoint from 100 kW to 1 MW might make 660 kW turbines a marginally economic form of on-site generation for some larger businesses whose load could absorb this level of generation. Raising the net billing breakpoint would not be advantageous to residential consumers, whose use is already far below the current 100 kW breakpoint. Raising the breakpoint would also be advantageous if customers were allowed to aggregate the loads of affiliates and associates or if the proximity requirement (discussed in section III of this report) were removed. The amount of excess generation exported to the grid would likely remain insignificant.

- **Educate institutions:** State sponsorship of seminars or other mechanisms to inform financial institutions of facts surrounding wind generation could facilitate installation procedures.

H. Grid-Scale Solar

Solar generation is an eligible resource under Maine's RPS statute. Grid-scale solar generation exists in mid-western and southern states, but will not be economically viable in Maine or New England in the foreseeable future.

Barriers

- **High capital costs and limited hours of sun:** Limited sunlight in the Northeast makes grid-scale solar power uneconomic in New England.

- **Other:** Until grid-scale solar generation becomes less costly, it is not possible to judge what other barriers might exist.

Support Mechanisms

- **"New and other resources" RPS or SBC:** If solar generation should become less costly, a RPS that is limited to new resources or resources such as wind, solar, and fuel cells would add financial value to solar generation by increasing demand and thus the price the generator would receive for its power.

I. On-site Solar

Small, well-established photovoltaic (PV) panels produce energy primarily in the homes of residential consumers. PV panels replace on-grid power in three ways, each widely used: to produce electricity for use in the home, to actively heat hot water, or to actively provide space heat. Residential PV installations are commonly 1 kW to 5 kW in size. When not connected to the utility grid, customers maintain battery storage and/or propane or diesel backup generation.

Solar generation shares many of the characteristics of on-site wind generation. If the consumer is connected to the utility grid, he or she purchases generation when the on-site facility is insufficient to meet the consumer's load and provides generation to the grid that exceeds load. Pursuant to Commission rule, customers have the option to net bill generation[49] against load over time, as discussed in section III of this report. Approximately 40 consumers with solar panels, for a total capacity of 90 kW, net bill in Maine. An additional 175 off-grid installations are recorded through the Million Solar Roofs program[50] and installers have found that the vast majority of installations are off-grid.

On-site photovoltaics are not an economic alternative to electricity supplied from the grid. A typical home PV installation costs $20,000 or more to install, and might generate 5000 kWhs per year if connected to the grid,[51] making a capital cost payback of 20 years unlikely. A federal Business Investment Tax Credit of 10% of investment and installation cost is available for all PV installations. Thirteen states offer personal and/or corporate tax credits, with credits ranging from 10% to 35% of equipment and installation costs. Sixteen states offer buydowns ranging from $2 to $5 per Watt. Buydowns are commonly part of Clean Energy Funds that are used to support a variety of renewable initiatives. Most states require compliance with installation standards and some require post-installation inspection.[52] Incentives do not make PV technology

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[49] PVs used for hot water or space heat only would not qualify for net billing.

[50] A DOE grant to fund the Million Solar Roofs program in Maine has helped develop a data base of solar installations. So far, approximately 175 installations have been recognized.

[51] The approximately 40 solar customers who net bill in CMP's territory generate, on average, 500 kWhs per year. A customer that is not connected to the grid might generate far more.

[52] Appendix ___ summarizes the incentives offered by other states.

economically competitive, but are intended to provide assistance to those who desire the technology.

Unlike wind generation, solar technology does not yield significant economies of scale through larger solar panels. Like wind, small-scale solar can be an economic alternative to a lengthy line extension, there is no fuel price volatility, and operating costs are relatively low because of the lack of thermal processes and complex mechanics. Consumers who install small-scale generation generally do so for environmental reasons or to avoid costly line extensions in remote locations, and have no interest in selling the generation. However, interest is developing in aggregating renewable credits for credit trading.

Many states, including Maine, participate in the Department of Energy's (DOE) Million Solar Roofs program, a program that offers a forum for state assistance, education, and data gathering. Maine's Department of Economic and Community Development (and more recently the Public Utilities Commission) oversees solar installation licensing exams[53].

Some believe that small solar-powered homes engender favorable public reaction, and that visible State support would offer an impetus for other environmentally benign forms of power.

Environmental issues: While PVs are an environmentally benign source of electricity, small-scale on-site generation produces such an insignificant amount of power that it cannot be considered a replacement for generation produced by fossil fuel.

Barriers

- **Costly:** Producing electricity with solar panels is extremely costly.

- **Lack of public awareness:** Solar generation might well be attractive for non-economic reasons to many homeowners, but some believe that the public is not generally aware that the technology is available.

Support Mechanisms

- **Customer rebates:** Customer rebates in the form of a buydown or tax credit applied against the capital investment would facilitate the initial installation of PVs. A rebate would reduce the costs, potentially speed the development of economic small-scale generation, and signal the State's support of renewables.

- **Educate institutions:** State sponsorship of seminars or other mechanisms to inform financial institutions of facts surrounding solar generation would facilitate installation procedures.

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[53] Some states require that solar installers pass a certification exam.

- **State sponsored demonstrations and licensing:** State support of programs that emphasize public outreach and solar home demonstrations, such as DOE's Million Solar Roofs and annual Solar Home Tours might increase the market for solar installations by making the public more aware of the benefits of PVs. State sponsorship of PV installer certification[54] would assist the public in obtaining efficient PV installations.

J. Peat

One peat-burning facility, with a capacity of 23 MW, exists in Maine. The facility was constructed in 1988 and the cost of generation has generally not been economic. However, consideration is being given to reconfiguring operating processes and supplementing peat with sludge, as a means of making the plant economically viable. It is reported that the plant would employ approximately 50 people in an economically depressed location. No other peat facilities operate in New England.

Neither peat nor sludge are explicitly included as eligible resources in Maine's RPS. Peat is created in a wetlands environment over thousands of years and is not generally considered renewable. Whether peat should be considered renewable, whether peat and sludge should be considered biomass, and whether sludge is municipal solid waste have not been addressed in the context of Maine's RPS.

Environmental Issues: Sludge exhibits some characteristics of MSW. It emits heavy metals and requires emissions controls as part of its permitting requirements. However, it would emit heavy metals as it decomposed, so burning in a controlled generating facility might be a more environmentally benign way to dispose of the sludge. Peat emissions resemble those of biomass, and are therefore more benign than burning fossil fuels. However, peat, unlike sustainable biomass, cannot be considered CO_2 neutral as a result of sustainable growth practices. In addition, elimination of a peat bog and the transport of sludge can cause public concern.

Barriers

- **Unknown:** Until Maine's peat facility pursues re-activation, the barriers are unknown.

Support Mechanisms

- **Redesigned RPS or SBC:** A redesigned RPS that includes peat or a SBC could provide financial benefits to peat-burning facilities.

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[54] The North American Board of Certified Energy Practitioners (NABCEP) has developed a national certification program that Maine could consider for adoption.

K. Landfill Methane Gas

The technology to use methane gas produced by landfills to generate electricity is well established.[55] Because generation from methane requires natural gas, its technical potential has been limited in Maine until the recent expansion of gas in the State. However, approximately 17 landfill methane facilities, with typical capacities of 1 MW to 5 MWs, exist elsewhere in New England. These facilities sell their generation to local utilities, which is not possible in Maine. The Commission has ruled that landfill gas can be considered as biomass and thus is an eligible resource under Maine's RPS statute.

The Commission has not investigated the costs and competitive economic viability of methane gas generation.

Environmental Issues: Methane generation facilities are less environmentally harmful than the alternative method of flaring the methane gas produced by landfills. The generation of electricity from landfill gas does emit CO_2. However, CO_2 is considered a less harmful greenhouse gas than the methane that would otherwise be released. Thus, these facilities create a positive environmental impact.

Barriers

- **Existence of natural gas:** Natural gas distribution facilities currently exist primarily in the Portland and Lewiston areas, in portions of southern Maine, and in the Bangor area. Thus, landfill gas facilities could only be constructed in those areas or in proximity to gas pipelines.

- **Access to market.** Joining NEPOOL and following the procedures for selling into the wholesale market are costly – annual dues are $10,000 and daily reporting and metering are necessary. Moreover, wholesale and retail electricity suppliers are unwilling to expend the administrative costs for such a small amount of power, leaving the small generator with no ready access to the market.

Support Mechanisms

- **"New or other renewables" RPS or SBC:** A RPS or SBC that includes new renewable resources or renewables such as wind, solar, geothermal, and fuel cells but that excludes larger, low-cost hydroelectric and cogeneration facilities, would add financial value to landfill gas generation by increasing demand and thus the price the generator would receive for its power.

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[55] Agricultural methane (i.e., from dairy farms) can also be used to produce electricity, but that technology remains experimental.

- **Small generator aggregation:** A mechanism whereby a single entity aggregates generation from all small generators and sells or disburses the aggregated generation to the market would benefit landfill gas facilities. Such mechanisms are discussed in section III of this report.

L. Geothermal

Geothermal energy may be used to produce grid-scale electricity, but only in a few western states[56] where volcanic activity creates extremely high temperatures below the earth's surface. Grid-scale geothermal facilities create no air emissions and are a relatively economic source of reliable baseload generation.

Geothermal energy is also used throughout the country to actively heat space and water, replacing electricity, oil, or gas for that purpose. In Maine, the most common and most economic technology - the ground source coupled heat pump - extracts heat from well water to heat and cool the owner's space and water. Particularly in cases where the customer already owns a well and cooling is required in addition to heating, this method is reported to realize a payback of 5 years or less when compared to electricity or oil used for the same purpose.[57] In a recent year, at least 20 residences in Maine installed new geothermal systems. A few states offer tax credits or rebates for geothermal installations.

A contractor must receive training to become qualified to install geothermal technology. Such training does not generally exist within Maine. However New Hampshire provides government support for geothermal energy, and training can be obtained there.

Like wind and solar energy, geothermal energy creates no air emissions, does not deplete resources, increases fuel diversity, and tends to lower price volatility. Customers use geothermal energy to serve their own heating needs, not to export to the grid.[58] While the technology is economically viable for some people, but not generally familiar, ratepayer support would encourage new installations by educating the public about the technology.

Environmental Issues: Geothermal energy is one of the most environmentally benign sources of space and water heat.

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[56] California far exceeds other states (Hawaii, Nevada, and Utah) in grid-scale geothermal capacity.

[57] This payback period is reported by a company that installs geothermal technology throughout the Northeast.

[58] Indeed, like PVs, geothermal does not generate electricity for export to the grid.

Barriers

- **Lack of public awareness:** Geothermal energy is economically attractive for some homeowners, but the public is not generally aware that the technology is available.

- **Lack of qualified installers:** Electrical and space conditioning contractors must become qualified to install geothermal technologies; many have not yet done so.

Support Mechanisms

- **State sponsored demonstrations and licensing:** State support that emphasizes public outreach and demonstrations might increase the market for geothermal installations by making the public more aware of its benefits. Requiring State building activity to consider geothermal options would add visibility and might result in additional installations.

M. Tidal or Wave

Electricity may be generated by the ocean in two ways: through tidal movement and through wave movement. Both sources are appealing because they would not produce air emissions and are non-depleting resources. However, neither is economically feasible because of high construction costs. In addition, tidal and wave facilities may affect surrounding ocean ecosystems. Nevertheless, these sources of electricity interest organizations such as the U.S. Department of Environmental Protection as an eventual means of producing electricity with low environmental impacts for a large proportion of the population.

Barriers

- **High capital costs:** The technology is immature and capital costs are high.

- **Other:** Until grid-scale tidal or wave generation becomes less costly, it is not possible to judge what other barriers might exist.

Support Mechanisms

- **"New or other renewables" RPS or SBC:** If wave or tidal generation becomes less costly, an RPS that includes new resources or "other resources" such as wind, solar, and fuel cells would add financial value to ocean generation by increasing demand and thus the price the generator would receive for its power.

N. Fuel Cells

Fuel cell technology has existed since the 1800s, and government agencies such as the Departments of Energy and Defense as well as other advocates believe that fuel cells will eventually be among the most efficient and environmentally benign forms of power production. However, improvements in cost and implementation practicality must be made before fuel cells will be viable without significant subsidization. Currently, virtually all fuel cell installations are demonstration or research projects supported by state, federal, or private funds.

Existing fuel cell facilities that deliver power to the electric grid typically have a capacity of approximately 250 kW. In Maine, such facilities would encounter market barriers similar to those encountered by wind and hydro facilities of this size. On-site fuel cells with capacities of 5-10 kW also exist to serve customers' loads. On-site fuel cells tend to follow a customer's load, and applications in which a customer generates to serve load and sell excess to the grid appear to be rare.[59] On-site generators would encounter barriers similar to those encountered by on-site solar installations. On-site fuel cells commonly use a proton exchange membrane technology (PEM), while 250-kW facilities commonly use phosphoric acid technologies (PAFC). Other technologies exist.

All fuel cells require hydrogen for operation and all produce water and heat. Most commonly, hydrogen is extracted from natural gas or propane. Using pure hydrogen requires hydrogen production, storage, and infrastructure systems that are less available and far more costly than are systems that use natural gas. This is important when establishing qualifications for fuel cell eligibility in a RPS or SBC program. Some states require that fuel cells use a "renewable resource" to be eligible for a RPS. This requirement appears to limit eligibility to the higher-cost fuel cell technologies that do not extract hydrogen from fossil fuels. While encouraging more environmentally benign fuel cell development, this constraint might inhibit development of the fuel cell models that show some likelihood of becoming commercially available within a reasonable amount of time.

Environmental Issues: Fuel cells produce power through electrochemical means rather than combustion, and therefore emit very low levels of NOX and CO2.

Barriers:

- **Costly:** Fuel cells of all sizes remain extremely costly.

[59] This characteristic of fuel cells applies to microturbines as well.

- **No customer rebates:** Many states offer rebates, in the form of buydowns or tax credits, to fuel cell installations and many states and utilities provide research grants or operate demonstration projects. Maine does not offer any of these benefits.[60]

- **Access to market:** The barriers a 250-kW fuel cell facility would face in selling its power are similar to those described for small wind and hydro electric generators.

Support Mechanisms

- **Customer rebates:** Customer rebates in the form of a buydown or tax credit applied against the capital investment would facilitate the initial installation of both on-site generation and generation for grid sale. Because significant improvements must be made in fuel cell technology, rebates would be most effective when used for demonstration or research installations.

- **Small generator aggregation:** A mechanism whereby a single entity aggregates generation from all small generators and sells or disburses the aggregated generation to the market would benefit fuel cell facilities that sell to the market. Such mechanisms are discussed in section III of this report.

[60] Maine's voluntary R&D fund could support a fuel cell application, but no projects have yet been funded through that program.

V. OTHER STATE MECHANISMS

In this section of the report, the Commission presents a description of resource support mechanisms used in other states. The section focuses on Massachusetts and Connecticut in that they are New England states with comprehensive renewable programs that include both a RPS and a SBC. The Massachusetts and Connecticut programs illustrate a variety of typical approaches. A summary of the mechanisms used in other states throughout the country is provided in Appendix___ to this report.

A. Massachusetts

1. Massachusetts RPS

As part of its 1997 electric utility restructuring legislation, Massachusetts required the adoption of a RPS. The final regulations were adopted in 2002 and are applicable to service beginning in 2003.

The Massachusetts RPS applies only to new resources, defined as systems installed after December 31, 1997. New resources that are eligible under the Massachusetts RPS are:

- solar photovoltaic or solar thermal energy;
- wind energy;
- ocean thermal, wave, or tidal energy;
- fuel cells using renewable fuels;
- landfill gas; and
- low-emission, advanced biomass power conversion technologies[61]

The percentage requirements in Massachusetts begin at 1.0% and increase annually as follows:

- 2003-1.0%
- 2004-1.5%
- 2005-2.0%
- 2006-2.5%
- 2007-3.0%
- 2008-3.5%
- 2009-4.0%
- additional 1% each year thereafter (until terminated)

[61] Such technologies include gasification using such biomass fuels as wood, agricultural, or food wastes, energy crops, biogas, biodiesel, or organic refuse-derived fuel. Biomass facilities that have been retrofitted with advance conversion technologies may also be eligible. Two of Maine's biomass facilities are considered eligible for the Massachusetts RPS.

The Massachusetts program has an alternative compliance mechanism that allows electricity suppliers the option paying into the State's Renewable Energy Trust (discussed below). The alternative compliance amount is $0.05 per kWh. The alternative compliance amount was established to be higher than the assumed incremental cost of new renewable resources.

2. Massachusetts SBC

The Massachusetts restructuring law also created a "public benefit fund" to promote renewable fuels and technologies. The fund is referred to as the "Renewable Energy Trust Fund" and it is supported through a SBC. Beginning in 2003, the SBC is set at 0.5 mills ($0.0005) per kWh, which is expected to result in funding of approximately $25 million per year.

The fund is administered by the Massachusetts Technology Collaborative (a quasi-public research and development entity) with oversight and planning assistance from the State's Division of Energy Resources. The following fuels and technology are eligible for assistance:

- solar photovoltaic and solar thermal electric energy;
- wind energy;
- ocean thermal, wave or tidal energy;
- fuel cells;
- landfill gas;
- waste-to-energy;
- naturally flowing water and hydroelectric; and
- low emission, advance biomass technologies.

The Massachusetts fund has established the following six areas of focus:

1. Green Power: Identify and remove barriers to the development of renewable technologies and facilitate their development.

2. Green Policy Development: Facilitate policy debate on renewable energy development on the state and federal levels.

3. Renewable Energy Industry Support: Develop industry support programs for renewable energy companies.

4. Education and Public Awareness: Educate through school curricula, museum resources, and universities.

5. Community Outreach and Siting: Work with communities and regions to create tools and resources for the understanding of the renewable energy environment.

6. Green Buildings and Schools: Develop guidelines and standards to facilitate market transformation through demonstrations on new and renovated buildings.

B. Connecticut

1. Connecticut RPS

Connecticut's 1998 electric restructuring law included a requirement for the establishment of a RPS. Initially, the requirement did not apply to the standard offer. This exemption was removed in 2003.

The Connecticut RPS has two tiers, referred to as "classes." Class I renewable sources are:

- solar power;
- wind power;
- new sustainable biomass;[62]
- landfill gas;
- fuel cells;
- ocean thermal power;
- wave or tidal power;
- low emission advanced conversion technologies; and
- new run-of-the-river hydropower of 5 MW or less.

Class II renewables are:

- trash-to-energy;
- biomass that meets specified emissions criteria; and
- run-of-the-river hydropower of 5 MW or less.

The percentage requirements in Connecticut increase annually as follows:

	Class I	Class I or II	Total
• 2004	1.0%	3.0%	4.0%
• 2005	1.5%	3.0%	4.5%
• 2006	2.0%	3.0%	5.0%
• 2007	3.5%	3.0%	6.5%
• 2008	5.0%	3.0%	8.0%
• 2009	6.0%	3.0%	9.0%
• 2010	7.0%	3.0%	10.0%

[62] Existing sustainable biomass that meets certain emission criteria may also qualify as a Class I resource.

The Connecticut statute specifies that the eligible resources may be located within the ISO-NE control area or in neighboring states that have comparable renewable portfolio standards.

2. Connecticut SBC

Connecticut also has a "public benefit program" to promote renewable energy technologies. The program is referred to as "The Connecticut Clean Energy Fund" and it is supported by a SBC. The SBC in 2003 is 0.75 mills ($0.00075) per kWh and increases to 1.0 mill ($0.001) per kWh beginning in 2004. The SBC is expected to result in funding of approximately $30 million per year.

The fund is administered by Connecticut Innovations, Inc. (a quasi-governmental investment organization) with guidance from a Renewable Energy Investments Advisory Committee whose members are appointed by the Connecticut Legislature and Governor. By statute, funds may be used for grants, equity investments, contracts or other actions to support research, development, manufacture, commercialization, deployment and installation of renewable energy technologies and actions which expand renewable technology expertise within the State. All investments from the fund must have a direct economic benefit for Connecticut. Existing investments from the Connecticut fund include:

- development of a green marketing program;
- seed funding to develop portable solar power systems;
- wind energy study;
- promotion of retail demand for renewable electricity; and
- demonstration fuel cell and photovoltaic projects.

VI. RECOMMENDATIONS

At the outset of this section, the Commission emphasizes that this report makes no recommendations as to fundamental public policies regarding the promotion or subsidization of particular categories of generation resources. Rather, this section of the report provides the Commission's recommendations as to the effective design of various resource support mechanisms given specified policy goals or objectives.

A. Maine's Current Portfolio Requirement

As discussed in section II(B) of this report, Maine's current eligible resource portfolio requirement is not accomplishing the policy goal stated in the Restructuring Act of encouraging the use of renewable, efficient and indigenous resources. The current mechanism is not providing financial assistance to the designated resources and technologies. It does add some administrative burden for retail suppliers and may be a barrier to entry into Maine's retail market.

The Commission recommends that the Legislature repeal Maine's portfolio requirement in its current form.

B. Policy Goals and Objectives

In determining whether to adopt one or more of the resource support mechanisms discussed in this report, the Legislature should consider and establish its policy goals and objectives regarding electricity generation resources. Potential policy goals and objectives are discussed in section II(C) of this report. It is the Legislature's role to establish fundamental public policy and to set policy goals involving the use of public or ratepayer funds to support particular objectives. In doing so, the Legislature should determine which, if any, resources or technologies should receive public assistance consistent with State policy.

Accordingly, the Commission does not offer in this report recommendations as to fundamental public policy goals, whether any resource support mechanism should be established using public or ratepayer funding, or which particular resources should be favored over others.[63]

The Commission recommends that the Legislature assess and establish electric generating resource policy goals and objectives, whether resource support mechanisms should be established, the generating resources that should be promoted to serve public policy goals, and the amount of public funding that should be devoted to support generating resources.

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[63] Generation resources, regardless of whether they are renewable, have a variety of environmental impacts. The Legislature may wish to consult with the State's Department of Environmental Protection in determining which resources should be promoted for environmental reasons.

C. Resource Support Mechanisms

The Commission's expertise is in determining the most effective means to accomplish legislatively stated goals and the impact of various implementation approaches on the State's electricity consumers. Thus, this portion of the report will provide the Commission's recommendations as to the design of the most effective mechanisms to support electricity resources given particular policy goals.[64] The recommendations provided will be presented in the following three categories:

1) grid-scale resources (larger resources);
2) on-site applications (smaller units primarily under 1 MW);
3) emerging technologies (research and development).

1. Grid-Scale Resources

This section of the report focuses on the three mechanisms listed in the Resolve to support grid-scale resources:

- renewable portfolio standard
- system benefit charge
- purchases to supply standard offer

The three mechanisms, if properly designed, can be effective in promoting the use of designated categories of resources. For the reasons discussed below:

The Commission recommends either a RPS or a SBC if the Legislature decides to adopt a mechanism funded by electricity consumers to support grid-scale facilities.

The Commission recommends against the use of purchases to supply standard offer service as a mechanism to support generating resources.

Renewable Portfolio Standard

- **Cost capping mechanism:** A major defect in the use of a RPS is that the cost to consumers cannot be determined with any certainty in advance. This defect can be remedied to a large extent by the inclusion of an "alternative compliance mechanism" that acts to cap consumer cost exposure. An alternative compliance mechanism would provide retail suppliers with the alternative of paying a specified

[64] This report presents the general design of recommended mechanisms, as well as implementing draft legislation in Appendix __. Much of the detail of particular mechanisms will need to be determined in subsequent rulemakings or other implementation proceedings after the Legislature makes its basic policy determinations.

amount per megawatt-hour into a resources support fund rather than having specified percentages of resources in their portfolios. Thus, if the premium above market prices for the required resources is greater than the alternative compliance amount, suppliers would be expected to pay into the fund thereby capping cost exposure at the alternative compliance amount.

An alternative compliance mechanism would also reduce to some degree market power concerns that might result if there is a concentration of ownership or control in categories of designated resources within the RPS. The mechanism would limit consumer exposure to price impacts resulting from any market power consequences that might derive from the adoption of a RPS.

The Commission recommends that a RPS be adopted only if it includes an alternative compliance mechanism as a cap on consumer cost exposure.

- **Regional deliverability:** There are serious questions as to whether a RPS can be limited to facilities located within Maine due to Commerce Clause restrictions. However, a deliverability requirement (similar to that included in the current RPS) can be adopted that would restrict applicability of a RPS to those facilities that actually deliver power to the New England or Maritimes control areas. This would ensure that facilities that are located in remote areas and do not serve Maine customers will not receive financial assistance from Maine's consumers through a RPS.

The Commission recommends that electricity used to satisfy a Maine RPS be delivered to the New England or Maritimes control areas.

- **Credit trading:** A system that allows for the trading of the renewable attributes of generation separate from the energy commodity generally reduces the cost of compliance for suppliers, allows for more transparency in the price of renewable power, and provides for superior verification of compliance. Such a system, referred to as the New England Generation Information System or NE-GIS, is currently in operation in New England. Due to the size of the market, there is no similar system in northern Maine.

The Commission recommends that a Maine RPS allow for renewable credit trading if a reliable system is in existence.

- **Exclusion of certain resources:** The purpose of a RPS is to provide financial assistance (in the form of increased market prices) to particular resources that would not be developed or operated without assistance. As discussed in section IV of this report, cogeneration and hydroelectric facilities above 5 MW[65] are generally commercially viable and not in need of public assistance to maintain their operation. Moreover, resources that have long-term qualifying facility (QF)contracts

[65] A size breakpoint is never perfect. However, 5 MW is a reasonable dividing point for this purpose.

that predate industry restructuring are paid substantially above market prices and must operate pursuant to their contractual terms.[66] The inclusion of commercially viable resources or those with QF contracts in a newly designed RPS would divert funds away from other resources that are in need of assistance and diminish the resource promotion objective of a RPS.[67]

The Commission recommends that cogeneration, hydroelectric facilities above 5 MW, and facilities with qualifying facility contracts be excluded from any newly designed RPS because public assistance is not necessary to support their development and operation.

- **Resource tiers:** Resource tiers with separate portfolio percentages within a RPS can be used to accomplish specified policy goals by ensuring that stated percentages of designated categories of resources are in the State's resource mix.

The Commission recommends that resource tiers be included in a RPS if the policy goals include promotion of particular categories of resources.

Biomass facilities: The difficulties of Maine's biomass facilities after industry restructuring and the corresponding impact on Maine's wood product industry have been discussed before the Legislature for several years. In the event that the Legislature determines Maine's existing biomass facilities should receive public support, the adoption of a RPS separate tier for biomass facilities would be an effective means of providing that support.[68] Assuming that a separate tier could not constitutionally exclude out of state facilities, some public support would go to facilities outside of Maine. This result would be mitigated to some degree because many of the facilities outside of Maine have QF contracts that would be excluded if the Commission's recommendation regarding such contracts were adopted.

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[66] Qualifying facilities that are paid current market prices pursuant to their utility contracts should not be excluded from the RPS.

[67] Excluding resources with QF contracts would diminish the value of the utilities' entitlements that are periodically sold to offset stranded cost. The Commission's view, however, is that increases in electricity supply prices to electricity consumers that result from a RPS should directly benefit those resources designated by the Legislature as needing assistance and not indirectly reimburse those same consumers through lower stranded costs.

[68] Although the primary purpose of the biomass tier would be to support existing facilities, the Commission does not recommend that the tier exclude new biomass facilities. Moreover, there is a debate as to the environmental impacts of different type of biomass facilities. If the Legislature decides to support biomass facilities for environmental reasons, it should consider eligibility restrictions used in other states, such as sustainability of fuel supply or advance emission technology.

Based on the approximate potential output of Maine's biomass facilities compared to Maine's total electricity usage, a portfolio percentage for a RPS biomass tier would be in the range of 17%. Assuming an average subsidy of $0.01 per kWh (as discussed section IV of this report), the expected cost to consumers would be in the range of $19 million.[69] A $0.03 per kWh alternative compliance mechanism should be high enough to allow the more costly facilities to benefit from the RPS. This would cap consumer cost exposure at approximately $60 million per year.

However, the design of an RPS is an imprecise exercise, based on incomplete data, complex supply and demand relationships, and unknown future market prices. Thus, a more cautious approach using a lower portfolio percentage and alternative compliance cap would be advisable. The impact of the mechanism and its cost to consumers could then be evaluated after a few years to determine whether it is adequately serving its public policy goals. A 10% biomass tier would have an expected cost to consumers in the range of $11 million assuming a $0.01 per kWh average subsidy. A $0.015 per kWh alternative compliance mechanism would cap consumer cost exposure at approximately $17 million per year.

The Commission recommends that a separate biomass tier be included in an RPS if the Legislature determines that electricity consumer funded support should be directed to Maine's biomass industry. A reasonable portfolio percentage for this purpose would 10% with an alternative compliance mechanism set at $0.015 per kWh. The mechanism should be reviewed after two years to determine whether it is satisfying its public policy goals at an acceptable cost to consumers.

Municipal solid waste: As discussed in section IV of this report, municipal solid waste (MSW) facilities present unique considerations in determining whether support from electricity consumers is warranted. Currently, three of the four facilities in Maine have QF contracts and would be excluded from a RPS pursuant to the Commission's recommendation regarding facilities with such contracts. However, there are a number of MSW facilities in other states that could receive support from Maine consumers if MSW is included in a Maine RPS that is not restricted to instate facilities. If the Legislature determines that MSW facilities should be supported by the State's electricity consumers, it would be sensible to include MSW in the biomass tier. This would, however, have the potential effect of diluting the benefit to the biomass industry.

The Commission recommends that municipal solid waste facilities be included in the biomass tier if the Legislature determines that electricity consumer funded support should be directed to these facilities.

Other resources: Resources (other than biomass and MSW) typically included in RPSs in other states are: wind, solar, tidal, wave, geothermal, small hydroelectric, landfill gas, and fuel cells. These resources make up an extremely low

[69] This assumes an average capacity factor for the Maine biomass facilities of 85%.

percentage of the resource mix in New England and (except for hydroelectric resources) can be considered as developmental. In the event the Legislature determines that developing renewable resources should receive public assistance, it would be reasonable to establish a separate tier for such resources. It is likely that such an approach would primarily benefit wind, small hydroelectric, and landfill gas facilities, in that the other resources are far from economic viability or not designed to provide significant amounts of power to the grid.[70] Including the other mentioned resources, however, would not do any particular harm and may have some promotional benefit. Because these resources are currently extremely limited in the region, the other renewables tier would primarily promote new facilities. For this reason, the approach adopted in Massachusetts where the percentage amount is initially relatively small and increases gradually over time is sensible. Additionally, the adoption of a similar approach in Maine would promote regional consistency.[71]

The Massachusetts RPS has an alternative capping mechanism of $0.05 per kWh. If this cap were adopted in Maine, electric consumers cost exposure would initially be capped in the range of $11 million growing to approximately $22 million in 2009 (assuming the RPS percentages are the same as in Massachusetts). The Massachusetts cap was designed to be higher than the subsidy needed by the applicable resources, but no data is yet available on the cost of the program. To be cautious, a lower cap would be advisable at this time. A $0.025 per kWh alternative compliance mechanism would cap consumer exposure to approximately $5.5 million initially growing to approximately $11 million in 2009.

The Commission recommends that an "other renewables" tier be adopted if the Legislature determines that electricity consumer funded support should be provided to developing resources and smaller hydroelectric facilities. The tier would include wind, solar, tidal, wave, geothermal, small hydroelectric, landfill gas, and fuel cells. A reasonable portfolio percentage for this purpose would start at 2.0% in 2005 and grow at a half percent a year until it reaches 4.0% in 2009 with an alternative compliance mechanism set at $0.025 per kWh.

System Benefit Charge

- **Resource categories:** Resource categories within a SBC can be used to accomplish specified policy goals in a similar manner as resource tiers with respect to a RPS. Thus, for reasons discussed above, the Legislature should consider a separate biomass category (that may or may not include MSW) and an "other

[70] The approach may also aid to some degree the aggregation of resources such as photovoltaics.

[71] A detailed description of the Massachusetts RPS is included in section V of this report.

renewables" category to support less developed resources and smaller hydroelectric facilities.[72]

The Commission recommends that a separate biomass category be included as part of a SBC if the Legislature determines that electricity ratepayer funded support should be directed to Maine's biomass industry.

The Commission recommends that municipal solid waste facilities be included in the biomass category if the Legislature determines that electricity ratepayer funded support should be directed to these facilities.

The Commission recommends that an "other renewables" category be included as part of a SBC if the Legislature determines that electricity ratepayer funded support should be directed to developing resources and small hydroelectric facilities. The category would include wind, solar, tidal, wave, geothermal, small hydroelectric, landfill gas, and fuel cells.

- **Maine facilities:** The distribution of funds collected from Maine's T&D ratepayers through a SBC can be lawfully restricted to generating facilities located within Maine. This allows for a more targeted approach if the primary goal is local economic impacts.

The Commission recommends that the distribution of funds collected through a SBC be restricted to electric generating facilities located within Maine.

- **Funding levels:** A funding level needs to be established for each resource category within the SBC mechanism. The considerations in determining the funding levels are essentially the same as those in establishing the resource percentages and capping amounts for a RPS.

Biomass (and MSW): As discussed in section IV of this report, the biomass facilities in Maine appear to require a subsidy that ranges from $0.00 to $0.025 per kWh. If an average subsidy of $0.01 per kWh is assumed, the total amount of ratepayer support would be approximately $19 million per year. This would translate into a SBC surcharge on all kilowatt-hour sales in the State of $0.0017 (1.7 mills) per kWh. However, the determination of a SBC funding amount is an imprecise exercise and, for the same reasons as discussed above with respect to a RPS, a cautious approach would be advisable. A total funding level comparable to the expected consumer cost associated with the recommended RPS would be in the range of $11

[72] As mention in section IV of this report, there is a federal Production Tax Credit applicable to wind facilities. Pursuant to federal regulations, the tax credit can be reduced by other federal or state financial assistance provided to the facility. Accordingly, any program to assist wind projects in Maine through a SBC should be carefully structured to avoid any federal Production Tax Credit offsets.

million. This would translate into a SBC surcharge on all kilowatt-hour sales in the State of $0.001 (1.0 mill) per kWh. [73]

Other renewables: As mentioned, the maximum cost exposure for consumers if the recommended "other renewables" RPS tier is adopted would range from approximately $5.5 million to $11 million over time. Thus, a total funding level of $7.5 million for an "other renewables" SBC category would be comparable to the overall funding of the recommended "other renewables" RPS tier. This would translate into a SBC surcharge on all kilowatt-hour sales in the State of $0.0007 (0.7 mills) per kWh.

The Commission recommends as a reasonable SBC surcharge for the biomass (and MSW) category $0.001 (1.0 mill) per kWh on all kilowatt-hour sales in the State to produce an annual funding level in the range of $11 million and for the "other renewables" category $0.0007 (0.7 mills) per kWh on all kilowatt-hour sales in the State to produce an annual funding level in the range of $7.5 million if the Legislature determines that electricity ratepayer funding should be directed at these categories of resources.

- **Distribution of funds:** Funds should be distributed to facilities only if they actually operate. There are two primary methods to distribute funds collected through a system benefit charge to support grid-scale resources:

  1) competitive bidding by facilities for available funding within a category; and

  2) providing a pre-establish amount per kilowatt-hour to all facilities in the category.

Competitive bidding for available funds, in concept, has the advantage of maximizing the amount of kilowatt-hours from a specified resource category given a set amount of funding. The more efficient facilities within the category would receive funding, while the less efficient might not receive assistance (depending on the amount in the fund). However, the competitive bidding approach is problematic if there is a concentration of ownership or control among facilities in a designated category. In addition, the winning facilities would be those that need assistance the least or perhaps not at all. Pre-establishing a funding amount per kilowatt-hour of generation has the effect of spreading available assistance among facilities within a category. Under that approach,

[73] As mentioned in section III of this report, a SBC is a surcharge on tariff rates and, as such, customers with discounted rates or special contracts would not pay the surcharge. Thus, a specified SBC applied to all kilowatt-hour sales in the State would represent a higher per kilowatt-hour charge for individual customers that pay tariff rates. For example, a 1 mill surcharge applied to all the kilowatt-hour sales in the CMP territory would result in an actual increase for those customers that pay the tariff rates of 1.2mills.

however, some facilities receive more assistance than they need, while others do not receive enough assistance to operate profitably.

Biomass facilities: The pre-establishing of a per kilowatt-hour amount (rather than competitive bidding) would be appropriate for a biomass category assuming that the policy goal is to maintain as many of the existing biomass facilities in the State as possible. Additionally, competitive bidding would be problematic since there are relatively few facilities and some concentration in ownership. The pre-established amount would be set periodically (presumably by the Commission) based on actual cost data of the biomass facilities[74] and a mechanism would be included to vary the amount actually distributed to facilities depending on market prices.[75]

The Commission recommends that funds to facilities in the biomass category (as well as MSW if included in the category) be distributed based on a pre-established amount per kilowatt-hour that varies with actual market prices as determined through periodic Commission proceedings if the Legislative goal is to spread available assistance among facilities.

Other resources: For the broader category of other resources, a competitive bidding approach would be preferable assuming the policy goal was to obtain as many kilowatt-hours of energy from resources within the category given the limited funding amounts. Essentially, facilities would bid for the amount of subsidy that they need. The lowest bids would receive subsidies first until the amount of funding is exhausted. Because the "other resources" category would include both existing and new facilities, bids for both shorter terms (e.g. one year) and longer terms (e.g. ten years) would be allowed.

The Commission recommends that funds to facilities in the "other resources" category be distributed on the basis of competitive bids in which the lower bids are funded up to the total funding amount if the legislative goal is to maximize energy from the qualifying resources.

Standard Offer Supply

- **Fairness:** Any resource support mechanism that uses only standard offer load to support designated resources raises questions of fairness in that only standard offer customers (who tend to be residential and small business

[74] The Commission believes the provision of actual cost data (pursuant to appropriate confidentiality protection) should be a condition for obtaining assistance under the SBC program.

[75] In essence, the Commission would set a "target price" necessary to keep the biomass facilities in operation. If market prices were at or higher than the target prices, the facilities would receive no assistance. If market prices were below the target price, the facilities would receive assistance amounting to the difference between target price and the market price up to a pre-specified cap.

customers) would pay the cost of the State's policy of supporting renewable generation. Customers that take service from competitive suppliers (who tend to be larger businesses and industrial customers) would not contribute to the cost of the State's policy.[76]

The Commission recommends that the Legislature not adopt any resource support mechanism that uses only standard offer load to support renewable resources as it would be unfair to standard offer customers and other mechanisms exist to more fairly apportion the burden among the States electricity consumers.

- **Preferred design:** In the event the Legislature decides to use the supply to standard offer load as a resource support mechanism, the most efficient approach would be to adopt a portfolio requirement applicable only to standard offer providers. The choice of eligible categories of resources (including the designation of tiers) would involve the same considerations as those in designing a more broad-based RPS,[77] but the applicable percentages would have to be increased to reflect the smaller amount of standard offer load relative to the State's total electric load. This approach maintains the existing method for procuring standard offer supply and avoids the need for the State or T&D utilities to enter the business of purchasing and selling electricity.

- **Cost capping mechanism:** The use of standard offer load to support particular resource categories should include a mechanism to cap the cost exposure to standard offer customers. An appropriate mechanism to cap cost exposure under the preferred design would be to include an alternative compliance mechanism that would allow standard offer providers to pay into a fund if the market prices of eligible resources rise above a pre-established amount.

In the event that the Legislature decides to use standard offer load as a resource support mechanism, the Commission recommends that a RPS applicable only to standard offer providers be adopted and that cost exposure be capped through an alternative compliance mechanism.

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[76] Even among large customers, imposing support for renewable energy only on standard offer service may result in an undesirable allocation of this burden. Commission steps to make the standard offer price for large customers correlate more closely with market prices may induce large customers to leave the standard offer to obtain longer-term price certainty, leaving on the standard offer only those customers who are unattractive to competitive suppliers. To the extent these customers are rejected by the competitive market because of undesirable financial circumstances, they are probably the group who could least afford the burden of supporting renewable generation.

[77] Any attempt to limit a standard offer RPS to only Maine facilities would raise the same Commerce Clause questions that exist for a more broad-based RPS.

Green Product Demand

- **Green standard offer:** A "green" standard offer sanctioned by the State would likely impede and perhaps prevent the development of a retail market for green products. Accordingly, such an approach would only be warranted if there were indications that a green market would not develop on its own. In Maine, green retail products have recently appeared through the competitive market. Because these products are relatively new, their long-term viability is unknown. Thus, a green retail market should be given a chance to develop before the introduction of a state-sponsored green product is considered.[78]

The Commission recommends that a green standard offer not be adopted at this time.

- **Green retail credits:** In the event the Legislature adopts a SBC, a mechanism that exempts customers that buy a green product[79] from the SBC could be a cost effective means to support renewable resources through stimulating retail demand. This is because generators have to be provided enough money to be commercially viable, while buyers might require less due to individual desires to support environmentally benign power. Additionally, a T&D bill credit for customers that buy green could be of substantial marketing value. The approach could, however, result in providing credits to customers that would have purchased green without any inducement and the amount devoted to this purpose would need to be capped to avoid exhausting funds for other promotional purposes.

The Commission recommends that the entity administering a SBC be authorized to adopt a program in which customers that buy a green product are exempted from the SBC up to a specified cap.

2. On-Site Applications

On site-applications generally refer to the use of solar, wind, small hydroelectric facilities, geothermal heat pumps, and fuel cells to primarily provide customers' own electrical needs. This section of the report examines the following three mechanisms to support on-site generating resource applications:

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[78] If the Legislature adopts a SBC to support renewable resources, it should consider exempting customers that buy a 100% green product from the T&D utility surcharge. Such customers would already be contributing to the development of renewable generation and a SBC exemption should induce more customers to consider buying a green electricity product.

[79] A green product would have to be specifically defined. The criteria for defining a green product for this purpose would be the same as those discussed in this report for determining which resources should receive ratepayer funding.

- net billing
- small generator aggregation
- customer rebates

The Commission recommends against the expansion of net billing as a means to provide public support for on-site renewable resources.

The Commission recommends the adoption of a small generator aggregation mechanism to provide wholesale market access to small generators.

The Commission recommends that a Clean Energy Fund program including customer rebates, grants and other initiatives, be established if the Legislature decides that certain on-site applications should be supported through a surcharge on utility rates.

Net Metering

- **Arbitrary subsidy:** As discussed in sections III and IV of this report, increasing the net billing limit to 1 MW, removing the proximity restriction, and allowing the generation resource to offset the load of the customer's affiliates and associates could provide a significant benefit primarily to small wind and some hydroelectric installations. However, net billing represents a subsidy in the amount of the difference between total retail electricity costs (supply and T&D) and the value of the customer's generation. This subsidy would approximate $0.07 and $0.08 per kWh for residential net billing customers. There has been no indication that this is the amount of subsidy necessary to assist smaller renewable resources. Thus, the net billing subsidy is arbitrarily determined. In addition, the current 100 kW limit is high relative to other states. Because there are means to facilitate small generators to aggregate and sell into the market (discussed below) that do not involve a subsidy, as well as other initiatives that can better target any necessary subsidy, the Commission does not recommend the expansion of net billing at this time. The matter should be reconsidered in the future if other small generator support mechanisms prove ineffective.

The Commission recommends against the expansion of net billing at this time either through an increase to the net billing kW limit or an expansion of the applicable load in that net billing represents an arbitrarily determined subsidy and other mechanisms exist that do not involve subsidies or that can better target subsidies. The Commission recommends that the expansion of net billing be reconsidered if other support mechanisms are shown to be ineffective.

- **Net billing expansion:** In the event that the Legislature determines that net billing should be expanded to support on-site renewable applications, raising the current 100 kW to 1MW would be reasonable. However, removing the proximity restriction and allowing the generation resource to offset the load of the customer's associates would be contrary to the traditional purpose of net

billing which was to promote on-site applications of renewable resources.[80] Because the expansion of net billing would have a cost impact in terms of lost utility revenues and there is uncertainty as to the number of customers that might take advantage of net billing in the future, net billing should be capped to limit utility and ratepayer exposure. The cap could be used as a trigger for an investigation to determine if further net billing should be allowed. The Commission's current net billing rule has a mechanism whereby an investigation is triggered if the cumulative capacity of net billing generating facilities reaches 0.5% of a utilities' peak load.[81] A similar mechanism can be used as a statutory net billing cap.

If the Legislature determines that net billing should be expanded to support specified on-site resources, the Commission recommends that the kW limit be increased to 1 MW, that applicable load for net billing not be expanded by removing the proximity requirement or by allowing the load of associates to be netted against generation, and that a cap on net billing generation of 0.5% of each utilities' peak load be instituted.

Small Generator Aggregation

- **Standard offer provider purchasers:** A sustainable market for the output from small generators (5 MW or less) has not developed and the Commission does not foresee the future development of such a market. A requirement that standard offer providers in the ISO-NE portions of Maine purchase the output of small generators at the applicable clearing prices with T&D utilities administering the transactions would be an advisable method to remove this market barrier. The mechanism would not constitute a subsidy in that the generator is compensated at the market value for its power, and it would be revenue neutral to standard offer providers. Due to differences in market design (primarily the lack of a spot market), it is unclear whether a similar mechanism could work in northern Maine. The feasibility of developing such a mechanism would require additional investigation.

- **Qualifying resources:** Because the mechanism does not involve a subsidy and acts only to remove a market barrier, the mechanism need not be restricted to particular categories of resources that the Legislature determines should receive public or ratepayer funding.

- **Administration:** T&D utilities can administer the mechanism through the settlement process similar to net billing contracts.[82] This would amount to a

[80] An increase of the breakpoint to 1 MW without an expansion of the applicable load would tend to benefit only larger businesses with enough load that could be offset by the higher level of generation.

[81] This cap is likely to limit the number of larger net billing customers to 10 or fewer.

[82] Currently, excess generation from net billing customers is credited to standard offer load through the settlement process.

relatively small burden on utilities and would create no additional burden on competitive suppliers who desire to participate in the standard offer bidding process. In the event that utilities discover that there are significant administrative costs, they would be allowed to petition the Commission for recovery of those costs consistent with the terms of applicable rate plans. The absence of a requirement for participating generators to pay the costs of administration is a form of subsidy, but the cost is expected to be relatively small.

The Commission recommends that a mechanism be adopted that requires standard offer providers in the ISO-NE portions of Maine to purchase the output of 5 MW or less generators at applicable clearing prices with utilities administering the process through settlement procedures.

Customer Rebates and Other Initiatives

- **Clean Energy Fund:** As discussed in section III and IV of this report, customer rebates (typically referred to as "buydowns"), as well as other initiatives, are common in other states to promote photovoltaics[83] and wind power, as well as fuel cells to some degree. These activities typically occur through a "Clean Energy Fund" that is funded by utility rates (i.e. SBC) and administered much like an energy efficiency/conservation fund. Other initiatives that occur through Clean Energy Funds include loans and grants, public education, infrastructure development, and "green building" promotion.

- **Qualifying resources:** Buydown programs and other initiatives used in other states could be an effective means to promote photovoltaic installations, small wind systems, and fuel cell applications. A 1 MW or less restriction would target the program to smaller on-site applications.

- **Funding amount:** Other State's surcharges range from 0.1 mills ($0.0001) per kWh to 1.0 mill ($0.001) per kWh.[84] A surcharge of 0.1 mills on all kilowatt-hour sales in the State would produce approximately $1.1 million to fund clean energy programs in Maine. This would appear to be a reasonable initial level of funding that could be increased if the programs were viewed as successful in meeting legislative goals.

- **Administration:** The administration of a clean energy fund program is similar to administering the State's energy efficiency programs. Thus, it would be appropriate for the Commission to have the administration responsibilities. Administration could include determining the best uses for the fund under broad legislative guidelines or the legislative directive could be specific as to funding for

[83] As shown in Appendix ___ to this report, many states promote photovoltaics through tax credits or other tax break mechanisms.

[84] As noted in section V of this report, the Massachusetts Clean Energy Fund is funded through a 0.5 mills ($0.0005) per kilowatt-hour surcharge.

particular purposes. The responsibility of administering a clean energy fund would require a significant amount of additional Commission resources (including additional personnel).

The Commission recommends that a Clean Energy Fund be established if the Legislature determines that small (1 MW or less) on-site applications of photovoltaics, wind power and fuel cells should be promoted through public assistance. The fund would initially be funded by a 0.1 mills per kWh surcharge on T&D rates and administered as part of the Commission's energy efficiency program. The funding level would be reviewed after two years.

3. Emerging Technologies

- **Mandatory funding:** As discussed in section II of this report, currently Maine provides support for renewable resource research and development (R&D) through voluntary ratepayer contributions. This program has resulted in the collection of over $100,000 for R&D funding. A mandatory program funded through a surcharge on utility rates (i.e. SBC) would represent an enhanced commitment by the State to the development of new renewable resource technologies.

- **Clean Energy Fund:** The funding for renewable resource R&D can be efficiently administered as part of a Clean Energy Fund that provides support for the development of renewable resources more broadly.

The Commission recommends that the funding for renewable resource research and development occur through mandatory surcharges on utility rates and administered as part of a Clean Energy Fund if the Legislature determines that public assistance should be directed at emerging renewable technologies.

D. Legislation

Draft legislation to implement the Commission's recommendations as discussed in this section is contained in Appendix __ to this report. The Commission again emphasizes that its recommendations as to the effective structures of resource support mechanisms assume that the Legislature has made certain fundamental public policy decisions. The Commission makes no recommendation in this report as to whether public support in the form of ratepayer subsidies should be provided to categories of generation resources or whether any category of resources should be favored over any other for purposes of public support.

Appendix ___
Resources Serving Maine's Customers in 2002

The following graphs provide information about the source of resources that served Maine's customers' loads during 2002.