DRAFT

Appendix II
Eligibility Issues and Options
Connecticut Class I RPS
A White Paper

The Connecticut Department of Energy and Environmental Protection

MARCH 18, 2013

PREPARED BY:

Sustainable Energy Advantage, LLC
10 Speen Street
Framingham, MA 01701
508.665.5850
www.seadvantage.com

Contents

1 Introduction 1
2 Goals, Objectives and RPS Best Practices 2
2.1 RPS Objectives 2
2.2 Design Principles and Best Practices Relating to RPS Eligibility Changes 3
3 Comparison of Regional RPS Eligibility 4
4 Opportunities for Eligibility Expansion 8
4.1 Hydroelectric 8
4.2 Anaerobic Digesters and Biogas 9
5 Opportunities for Eligibility Contraction 11
5.1 Vintage 11
5.1.1 Contribution of Legacy Generation 11
5.1.2 Establishing a Vintage Threshold for Non-Hydro Technologies 14
5.1.3 Impact of Vintage Changes on Legacy Biomass 14
5.1.4 Impact of Vintage Changes on Legacy Landfill Gas 20
5.1.5 Impact of Vintage Changes on Legacy Wind 22
5.1.6 Other Possible Changes 23
5.2 Changes to Biomass Eligibility Requirements 24
5.2.1 PM Standards 25
5.2.2 Greenhouse Gas Standards 25
5.2.3 Impacted supply 26
5.3 Conversions of Legacy Storage Hydroelectric to Run-of-River 27
5.4 Eliminating Potential Supply Counted in Other State Policies 28
6 Implementation Options: Grandfathering and Transitional Options 30
7 Bibliography 33

1 Introduction

Since the Renewable Portfolio Standard (RPS) statute was first enacted, Connecticut policy makers have considered and implemented numerous changes to the design, targets and eligibility for the Class I. Whether implemented or simply proposed, the changes considered during this timeframe have demonstrated the direct link between policy and markets, driving changes in Class I renewable energy credit (REC) prices. Examples of factors that result in this linkage include the vintage, fuel type and location of generators that participate in Connecticut's RPS market compared to other states, and the significant price variability of Renewable Energy Certificates (RECs) used to demonstrate RPS compliance.

Most recently, Section 129 of Public Act 11-80 required the Connecticut Department of Energy and Environmental Protection (DEEP) to analyze (1) options to minimize the cost to ratepayers of procuring renewable resources pursuant to section 16-245(a) of the Connecticut General Statutes, and (2) the feasibility of increasing the renewable targets. The ultimate cost to ratepayers and the feasibility of increasing the RPS targets will be determined by whether the RPS is managed in a way that balances both policy stability and adaptability to changing market conditions, as well as best practices exhibited by other RPS programs across the region and nation.

As part of their RPS Study, DEEP is considering potential changes to Class I RPS eligibility in the context of a broader range of contemplated changes. The purpose of this white paper is to examine:

- Opportunities for expanding Class I RPS eligibility[1] where doing so will be in the State's interest without significantly destabilizing the State and regional RPS markets. Examples of expansion in the State's interest may include movement towards regional consistency by including generation eligible for other New England states' Class I RPS whose inclusion is consistent with Connecticut's RPS objectives, and where inclusion would remove a competitive disadvantage relative to other states.
- Opportunities for limiting or contracting Class I eligibility by implementing potential exclusions or restrictions on supply that might not sufficiently fulfill objectives to merit perpetual qualification. Concerns in this category pertain to historic heavy reliance on out-of-state existing generation to meet the target[2], achieving desired environmental improvement and fuel diversity benefits, and minimizing ratepayer compliance costs.[3] Options explored include changes to resource vintage, biomass, emissions, hydroelectric operation changes, and the double counting of benefits.

[1] This white paper does not explore expansion to include 'large' hydroelectric resources, a topic considered in-depth in a separate white paper, entitled "Incorporating Large-Scale Hydro into a Connecticut Class I RPS Sub-tier".
[2] This primarily includes biomass generators (largely from New Hampshire and Maine) and landfill gas (from throughout New England and New York), the details of which are provided later in this paper. As shown in Section 5, in 2010 most of Class I RPS compliance was from out of state generation, much of which falls into the category of 'legacy' (pre-restructuring) generation.
[3] One option to help minimize ratepayer cost would be to couple any contraction of eligibility with a correspondingly-sized increase in a Contracted Class I tier supplied by generation better aligned with Connecticut's RPS objectives.

DEEP engaged Sustainable Energy Advantage to consider and analyze a range of possible changes to eligibility that would reduce CT's disproportionate support of the legacy (pre-restructuring) renewable energy fleet (relative to other states); better align Class I eligibility with RPS policy objectives; improve regional consistency; or reduce ratepayer costs. This paper considers Connecticut's RPS policy objectives, as well as the principles and best practices relevant to implementing RPS eligibility changes. It compares CT Class I RPS eligibility to other states' RPS eligibility for Class I "growth" tiers as well as other "maintenance" tiers aimed at supporting legacy (pre-restructuring) generation. It identifies potential issues and options for eligibility changes, quantifying the impacted supply into various buckets that may be impacted differentially. The implications of potential changes are quantified and analyzed with respect to alignment with RPS objectives and principles, and their impact on affected generators and the Class I RPS market. Finally, the paper also discusses mechanisms for implementing potential changes and their alignment with RPS best practices.

While there are some renewable energy resources whose RECs are currently used for Connecticut Class I compliance whose operation would be unaffected by eligibility changes, the majority of such resources would face repercussions of losing CT lass I RPS eligibility. Some of these repercussions may be counter to some RPS objectives or best practices, suggesting the presence of tradeoffs for Connecticut policymakers to consider. This paper is intended to be used as a tool – in conjunction with other analyses and stakeholder discussions – to help Connecticut make informed decisions about generator eligibility that reflect the State's energy policy objectives. Through this paper, Connecticut policy makers can assess whether changes to eligibility thresholds would better align the RPS design with state energy policy objectives as well as with regional approaches to renewable energy markets while at the same time minimizing cost to ratepayers.

2 Goals, Objectives and RPS Best Practices

When considering adopting or changing any policy-driven program, it is useful to first identify objectives applicable to the existing program and of any program modifications. It is also instructive to define explicitly the principles by which program changes will be evaluated, and consider what constraints exist for making and implementing changes.

2.1 RPS Objectives

Neither Connecticut's enabling legislation nor regulations includes explicit delineation of RPS objectives. However, the DEEP has developed the following articulation of three categories of policy objectives applying to their RPS Study:

> 1) increasing fuel diversity, reducing dependence on fossil fuels, reducing dependence on foreign energy supplies, and providing a hedge against increases in oil and natural gas prices;
> 2) capturing the environmental benefits associated with reduced greenhouse gas emissions; and
> 3) realizing local economic development achieved by creating in-state employment, supporting Connecticut industries, and keeping revenue from flowing out of the state economy.

In addition, central to the RPS study, and rooted in Public Act 11-80, is the objective of minimizing the cost impact to Connecticut ratepayers of accomplishing these objectives.

Because the underlying policy drivers are intended to alter the supply mix and reduce greenhouse gases, the concept of additionality is central to the credibility of the contemplated policy action.[4] Going forward, the increased use of renewable power will need to play a significant role in achieving the State's GHG emissions reductions as well as providing a hedge against future natural gas-driven electricity price volatility.

As is typically the case, key RPS objectives are often in conflict. For example, maximizing local economic benefits generally conflicts with securing the most renewable energy per ratepayer dollar expended. (Grace, Donovan, & Melnick, 2011)

2.2 Design Principles and Best Practices Relating to RPS Eligibility Changes

Several fundamental principles should be incorporated into RPS design in order to increase the likelihood of the policy's success. RPS principles and best practices (Wiser, Porter, & Grace, 2004) encourage investment in the development and construction of new renewable generation, reducing financing costs that come with increased competition and long-term policy certainty, and include:

Fairness to Market Participants:

- Provide a stable policy environment to both existing and potential new participants.
- Attract new investment and market entry without the risk of abrupt change (e.g. a bait and switch that causes loss of investment).
- Explicitly recognize and not undermine those who have made substantial investments in response to current policy.

Market participants have made and continue to make investments and other financial commitments in accordance with the existing RPS regulations. In addition to investments in project development and direct operating activities (e.g. emissions reductions), these commitments include, for example, future participation in ISO-NE's forward capacity market (FCM). These obligations have substantial financial consequences if not fulfilled. Investments are based, in part, on the expected stability and viability of the Connecticut Class I REC market, and any proposed modifications to the existing RPS should incorporate elements of fairness that reflect the forward-looking nature of electricity markets. The evaluation of potential changes should include an assessment of the impact of those changes on recent and ongoing investments and commitments by market participants. Major changes that take immediate effect send the signal to investors that fairness is not a consideration.

Predictable: A well-designed RPS will provide market stability for all participants, reduce regulatory risk for generators and electricity suppliers, and improve the ability of renewable developers to obtain long-

[4] Additionality is the measurement of impact or net positive result of a policy intervention that would not have occurred in the absence of this action. (Scottish Enterprise, 2008) More generally, it takes into account changes in economic activity (i.e. scale, quality, pace, location) compared to a baseline scenario in which no action is taken. In the greenhouse gas policy context, additionality is a key concept under the Kyoto Protocol, which provides that emission reductions shall be: *"... (b) Real, measurable and long-term benefits related to the mitigation of climate change; and (c)Reductions in emissions that are additional to any that would occur in the absence of the certified project activity."* (United Nations, 1998) The Clean Development Mechanism Rulebook notes that *"additionality is the requirement that the greenhouse gas emissions after implementation of a CDM project activity are lower than those that would have occurred in the most plausible alternative scenario to the implementation of the CDM project activity."* (Baker & McKenzie)

term contracts to support financing for project development. Best practices for implementing this principle ensure that:

- Eligibility rules (including technology, fuel, vintage, and location) are well defined and stable, not subject to sudden or frequent change.
- Rules for the RPS are clearly defined, any material changes to the policy come with ample notice and lead-time, and changes occur only within narrowly defined parameters.

Minimize Perception of Political Uncertainty: The presence of political risk and policy uncertainty is a destabilizing force for investors. Changes in policies that originally attracted investors will devalue their investments. In order for the State to achieve its RPS policy goals, it must be seen as an attractive place to invest. Frequent program modifications would undermine this image and objective. Therefore, changes should be implemented with caution and ample notice, with consideration for fair treatment of those who have put capital at risk in response to current RPS rules.

3 Comparison of Regional RPS Eligibility

RPS programs can be designed to support new renewable generators, pre-existing (i.e. pre-restructuring, what we will refer to here as "legacy") facilities, or both. Program requirements intended to drive increasing quantities of new facilities are generally referred to as Class I or New RPS targets throughout New England. We refer to them as "growth" tiers. Most programs have increasing targets, and eligibility which is generally limited to a specified vintage (operation date) – often more recent than the applicable state's RPS legislation. Together, these criteria create demand tension and a dynamic market. In addition to new generation, some growth tier RPS programs may also encourage repowering or incremental capacity additions at existing facilities.

By comparison, we refer categorically to program requirements intended to preserve the legacy generating fleet (already in operation when the enabling RPS legislation was passed) as "maintenance" tiers. In New England, these may be designated as Class II, III, or IV, or Existing RPS targets – noting, however, that neither the number of classes nor the non-Class I taxonomy is uniform between the New England markets[5]. A maintenance tier's purpose is designed to prevent attrition among pre-existing generators using stable RPS targets which do not increase or decrease year to year. If market conditions were to jeopardize the viability of the existing fleet, maintenance tier REC prices would increase to levels sufficient to stem substantial attrition. Otherwise, existing generators are often not expected to require REC premiums because their prior investments have been fully paid for by utility ratepayers. Table 1 below summarizes the range of new and existing RPS classes in place across New England.

[5] For example, in New Hampshire the term Class II is used to refer to the targets for new solar.

Table 1: Comparison of Growth and Maintenance Tier RPS Requirements across New England

	New/Growth Tier				Other/Maintenance Tiers		
CT	Class I	All (old and new) except sm. hydro Post July 1, 2003 only			Class II	Class III	
MA	Class I: New	Post 1997 only			Class II: Existing, 3.6% target		APS: 5% by 2020
	Solar Carve-Out	Post 2010			Class II: Waste Energy; 3.5% target		
ME	Class I: New	Post 9/2005 only +			Class II: Existing. 30% target		
		Refurbished or "operating beyond useful life"					
NH	Class I: New	Post 2005 only +	New in 2012:Useful Thermal Energy Carve-out (post-2012)	Class II: New Solar Target 2011: 0.08% Target 2025: 0.3%	Class III: Existing, 6.5% target		Class IV: small hydro, 1% target
		Incremental production > historic baseline +					
		Repowered					
RI	New	Post 1997 only +			Existing, 2% target		
		Incremental production > historic baseline					
		Repowered					
Key							
	Quasi-Growth Tier (target grows as % of load over time, but most existing renewable resources are eligible)						
	Growth Tier (target grows as % of load over time)						
	Target growth of incremental supply but without increasing targets over time.						

The Connecticut Class I RPS is unique among New England states in that it is the only growth tier with an increasing target that allows generation of pre-RPS[6] vintage (except for the requirement that hydroelectric facilities must have begun operation after July 1, 2003) to participate in the market and contribute the same amount of credit towards RPS compliance as new renewable energy generation built after the RPS program came into effect. This approach impacts the extent to which the Connecticut RPS creates demand for new renewable energy generation, and the extent to which the Connecticut Class I demand draws in legacy supply from across New England and New York.

Unique features of Connecticut's Class I RPS program include:

- Eligibility of legacy generation not eligible under any other state's Class I RPS policies;
- Encourages older biomass plants to continue operating while reducing NO_x emissions;
- Encourages legacy small hydroelectric facilities to change operation to run-of-river (reducing the ability to use hydro during peak demand hours, thereby reducing energy value, capacity value

[6] Generally, pre-1998 generation is ineligible in any other New England Class I or new RPS policies.

and reliability benefits, without displacing fossil fuel use or emissions materially compared to new generation, in exchange for potential modest benefits to fisheries);

- Eligibility of natural gas fuel cells (not a renewable resource, but enables the RPS to support a specialized, local, energy-related industry); and
- Eligibility of landfill methane gas delivered to a Connecticut facility through the common carrier natural gas pipeline.

The unique features of Connecticut's Class I designations, particularly with respect to biomass (along with REC market price and ACP differentials) create a "sink" market for much of the region's existing generation that does not have opportunity to participate in Class I markets in other states. Without modifications, this generation will continue to supply Connecticut's Class I. These facilities - so long as they would continue operating without Class I RPS eligibility - do not provide the same 'additionality' benefits as the new renewables driven by Class I growth tiers throughout the region, which include increasing diversity, or displacing fossil fuel use and greenhouse gas emissions. However, if these facilities ceased operation without CT Class I eligibility, then fossil fuel use and emissions would increase. Therefore, a careful and nuanced examination of the impact of possible eligibility changes is required to inform decisions regarding recommended changes. In addition, disqualification of these resources would likely increase the cost of RPS compliance by altering the supply-demand balance, unless corresponding changes are made to targets or supply from sources better aligned with Connecticut's objectives. Table 2 and Table 3 summarize regional Class I RPS eligibility:[7]

Table 2: High Level Comparison of New England RPS Eligibility Requirements: Common Elements & Major Differences

	Common (Wind, Solar, Ocean, Tidal, LFG)	**Biomass**		**Hydro**		**Specials** (Other state specific)
CT	All	Emissions limits	●	Post 2002	◖	•Natural gas fuel cells •Landfill gas by pipe
		Sustainable Biomass (excludes CD&D waste with exceptions)	◖	Size (<5 MW)	◖	
				Run-of-river	◖	
MA	All	Emissions limits	●	New and incremental	◖	
		Efficiency & net GHG std.	○			
		Fuel standard*	◖	<30 MW	◖	
ME	All	<100 MW	●	<100 MW	●	
NH	All	Emissions	●	Incremental	◖	Useful Thermal Energy Carveout
				fish passage requirements	◖	
		fuel standard	◖	FERC-licensed	◖	
RI	All	Emissions	●	<30 MW	◖	
		Fuel Standard	◖			

●	Majority
◖	Some
○	Very few

[7] Updated from (Synapse Energy Economics, 2011).

DRAFT

Table 3: Detailed Comparison of New England RPS Eligibility Requirements

	Connecticut			Maine		Massachusetts[1]				New Hampshire				Rhode Island	
	I	II	III	I	II	I	I-Solar	II	II - WTE	I	II	III	IV	New	Existing
First Compliance Year	2004	2004	2007	2008	2000	2003	2010	2009	2009	2009	2009	2009	2009	2007	2007
Vintage	See hydro; otherwise none.		post-1/06	post-9/05	none	post-12/97	post 12/09	pre-1/98	pre-1/98	post-12/05	post-12/05	pre-1/06	pre-1/06	post-12/97	pre-1/98
Fuel Type / Technology															
Biomass	NOx limit = 0.075 lbs/MMBtu	NOx limit = 0.2 lbs/MMBtu		< 100 MW	< 100 MW	50%+ efficiency; fuel standard; emissions per DEP		emissions per DEP		NOx limit = 0.075 lbs/MMBtu. PM limit = 0.02 lbs/MMBtu.		<= 25 MW w/ same emissions limits at Class I		High st'd for clean wood fuel.	High st'd for clean wood fuel.
Biomass Thermal										✓					
Fuel Cells	✓	✓				✓ if run on RE fuel		✓ if run on RE fuel		✓ if run on RE fuel				✓ if run on RE fuel	✓ if run on RE fuel
Geothermal				< 100 MW	< 100 MW	✓		✓		✓				✓	✓
Hydro	<= 5 MW, ROR, post-7/1/03	<= 5 MW ROR		< 100 MW	< 100 MW	New + incremental hydro < 30 MW; LIHI or equiv. certification		<= 7.5 MW; LIHI or equiv. certification		incremental MWh over historic baseline			<= 5 MW	< 30 MW	< 30 MW
Methane: includes landfill gas, anerobic digestion, sewage plant wastes	Yes + LFG by NG pipeline from outside ISO-NE also eligible.	Yes + LFG by NG pipeline from outside ISO-NE also eligible.		< 100 MW	< 100 MW	✓		✓		✓		✓		✓	✓
MSW & WTE	1 facility (PRE)	✓			✓ w/ recycling				✓						
Ocean Thermal	✓	✓				✓		✓		✓				✓	✓
Solar Photovoltaic	✓	✓		< 100 MW	< 100 MW	✓	✓	✓		✓	✓			✓	✓
Solar Thermal Electric	✓	✓		< 100 MW	< 100 MW	✓	✓	✓		✓	✓			✓	✓
Tidal	✓	✓		< 100 MW	< 100 MW	✓		✓		✓				✓	✓
Wave	✓	✓		< 100 MW	< 100 MW	✓		✓		✓				✓	✓
Wind	✓	✓		✓	< 100 MW	✓		✓		✓				✓	✓
Combined Heat & Power			w/ 50% min operating efficiency		< 100 MW										
Waste Heat or Pressure			✓ post 4/07												
Conservation & Load Management			✓												
Obligated Entities	Includes investor-owned utilities and competitive LSEs, but excludes municipal and cooperative utilities.									Includes IOUs, Cooperatives and competitive LSEs.				Narragansett Electric & competitive LSEs	
Geographic Eligibility	Within ISO-NE; or imported from adjacent control areas if the energy is delivered and settleed in the market settlement system.														
Verification Mechanism	NEPOOL Generation Information System														
Compliance Period	Annual. January 1 to December 31.														
Alternative Compliance Payment	Penalty Payment is fixed at $55/MWh	Penalty Payment is fixed at $55/MWh	Penalty Payment is fixed at $55/MWh	$65.27/MWh in 2013; adj. annually by CPI.	N/A	$65.27/MWh in 2013; adj. annually by CPI.	$550/MWh in 2013	$26.79/MWh in 2013; adj. annually by CPI.	$10.72/MWh in 2013; adj. annually by CPI.	$55/MWh in 2013; adj. annually by 1/2 CPI.	$55/MWh in 2013; adj. annually by 1/2 CPI.	$31.50/MWh in 2013; adj. annually by 1/2 CPI.	$26.50/MWh in 2013; adj. annually by 1/2 CPI.	$65.27/MWh in 2013; adj. annually by CPI.	$65.27/MWh in 2013; adj. annually by CPI.
Banking	Compliance with Class I/New RPS requirements is bankable for 2 years; in most markets, annual bankable quantity capped at 30% of current year's obligation.														
	(1) Massachusetts' RPS also includes an Alternate Energy Portfolio Standard (APS), which governs the utilization of certain non-renewable resources, and is therefore not included in this analysis.														

4 Opportunities for Eligibility Expansion

There are a number of alterations Connecticut could make to Class I eligibility which may be in the State's (and ratepayers') interest, which could be implemented without materially destabilizing the regional new renewables marketplace. Such expansion in the State's interest would involve allowing generation eligible for other New England states' Class I RPS to the degree it's benefits and impacts are consistent with Connecticut's RPS objectives. The reason that such changes would not have a destabilizing effect (compared to changes like introducing large and/or unbounded new sources not eligible elsewhere in the region) is that the additional supply is already eligible in other states. Connecticut may benefit where such inclusion would expand supply available to Connecticut and thereby remove a competitive disadvantage relative to other states that would occur when supply is tight and states compete at the margin for supply. The regional market may also benefit from greater harmonization and liquidity (which tends to favor lower prices). Here we consider changes to the definition of eligible hydro, anaerobic digestions and biogas.

4.1 Hydroelectric

Connecticut's neighbors within New England have defined hydroelectric supply eligible for their RPS growth tiers, specifically Massachusetts Class I and Rhode Island New, have done so in a manner intended to limit eligibility to project applications that do not cause degradation of water quality, river flow, fisheries and watershed, but in a different and more inclusive manner than Connecticut Class I which only uses a date, size and limit to a run-of-the-river project. Each of these states requires new or incremental generation.

Relevant Eligibility Language from Massachusetts Class I RPS.[8]

> "Hydroelectric Energy. Electrical energy from a Generation Unit that uses flowing freshwater as the primary energy resource, with or without a dam structure or other means of regulating water flow, and that is not located at a facility that uses mechanical or electrical energy to pump water into a storage facility (i.e., a so-called "pumped-storage facility")." (225 CMR 14.02)
>
> "The Unit has a nameplate capacity up to 30 megawatts, or increased capacity installed or efficiency improvements implemented after December 31, 1997, the aggregate of which increased capacity or efficiency improvements does not exceed 30 megawatts." (225 CMR 14.05(1)6a, with 25 MW changed to reflect 2012 statutory change to 30 MW not yet implemented in regulations)
>
> "Unit does not involve any dam or water diversion structure constructed after December 31, 1997, or pumped storage of water." (225 CMR 14.05(1)6.b)
>
> "The Unit meets appropriate and site-specific standards that address adequate and healthy river flows, water quality standards, fish passage and protection measures and mitigation and enhancement opportunities in the impacted watershed, as determined by the Department in consultation with relevant Hydroelectric Agencies", demonstrated

[8] http://www.mass.gov/eea/docs/doer/renewables/biomass/225-cmr-14-00-final-reg-doer-081712-clean-copy.pdf

by LIHI Certification of the Unit, or if either rejected or are outside of LIHI jurisdiction, by petition to the Department. (225 CMR 14.05(1)6.d)

Relevant Eligibility Language from Rhode Island "New" Renewable Energy Standard.[9]

3.32. Small Hydro Facility: means a facility employing one or more hydroelectric turbine generators and with an aggregate capacity not exceeding thirty (30) megawatts. For purposes of this definition, "facility" shall be defined in a manner consistent with Title 18 of the Code of Federal Regulations Section 292.204(a)(2)(i) and (ii) as of the date of enactment of the Renewable Energy Act (June 29th , 2004); provided, however, that the size of the facility is limited to no greater than thirty (30) megawatts, rather than eighty (80) megawatts. For a Small Hydro Facility to be eligible as a New Renewable Energy Resource it must in no case involve any new impoundment or diversion of water with an average salinity of twenty (20) parts per thousand or less.

Options for expanding hydroelectric eligibility consistent with the criteria above are summarized below in Table 4. Each option could be interpreted as expanding the eligible pool of resources available to Connecticut without expanding the quantity eligible throughout the region, in a manner *comparable* to Connecticut's screening threshold.

Table 4: Potential Hydroelectric Eligibility Expansions and Their Implications

Potential eligibility change	Benchmark
Increase MW cutoff to 30 MW.	MA, RI
No New Impoundments replacing run-of-river.	MA, RI
Allow incremental generation above an historical baseline at an existing facility resulting from efficiency improvements and/or capacity additions, so long as there is no new impoundment. → more energy output without additional degradation, harm to fisheries, etc. → would allow for capturing upgrades and efficiency improvements.	MA, RI, NH
Low Impact Hydroelectric Institute (LIHI) certification instead of "run-of-river"	MA

Initially, about 70 MW of hydro currently operating would become Connecticut Class I-eligible. However, a modest quantity of additional supply will be qualified in other these other states over time, and in times of modest regional shortage, such changes would exert downward pressure on Class I REC prices.

4.2 Anaerobic Digesters and Biogas

Connecticut allows "methane from landfill gas" as a Class I resource, as does each of the other New England states. Other states are more explicit in allowing a broader range of biogas to electricity sources, including anaerobic digestion, or the more inclusive term "biogas" which encompasses both of these subsets.

Relevant Eligibility Language from Massachusetts Class I RPS.[10]

Eligible Biomass Fuel. Fuel sources consisting of Eligible Biomass Woody Fuel, Co-Mingled Biomass Woody Fuel, Manufactured Biomass Fuel; by-products or waste from

[9] http://www.ripuc.ri.gov/utilityinfo/RESRules(7-25-07).pdf

[10] http://www.mass.gov/eea/docs/doer/renewables/biomass/225-cmr-14-00-final-reg-doer-081712-clean-copy.pdf

animals or agricultural crops; food or vegetative material; algae; organic refuse derived fuel; anaerobic digester gas and other biogases that are derived from such resources; and neat Eligible Liquid Biofuel that is derived from such fuel sources; but shall not include Construction and Demolition Waste as defined in 310 CMR 19.006. (225 CMR 14.02)

Relevant Eligibility Language from Rhode Island "New" Renewable Energy Standard.[11]

3.7 Eligible Biomass Fuel: means fuel sources including brush, stumps, lumber ends and trimmings, wood pallets, bark, wood chips, shavings, slash, yard trimmings, site clearing waste, wood packaging, and other clean wood that is not mixed with other unsorted solid wastes; agricultural waste, food and vegetative material; energy crops; ***landfill methane or biogas, provided that such gas is collected and conveyed directly to the Generation Unit without use of facilities used as common carriers of natural gas***; or neat bio-diesel and other neat liquid fuels that are derived from such fuel sources.

Relevant Eligibility Language from New Hampshire Class I RPS.[12]

Puc 2502.04 "Biomass fuels" means "biomass fuels" as defined in RSA 362-F:2, II, namely "plant derived fuel including clean and untreated wood such as brush, stumps, lumber ends and trimmings, wood pallets, bark, wood chips or pellets, shavings, sawdust and slash, agricultural crops, ***biogas***, or liquid biofuels, but [not] any materials derived in whole or in part from construction and demolition debris."

We note that Connecticut's Public Utility Regulatory Authority (PURA) has implicitly considered this category as eligible even if the current rules are not explicit, by certifying some anaerobic digestion in the past, listed under the landfill gas category on the PURA web site. To implement such a change, the Class I resource definition should be modified to allow biogas, defined as all biologically derived methane from sources such as yard and plant matter, food waste, animal waste and sewage sludge, as eligible resources.

The impact initially would be modest initially – there are a very limited number of small biogas projects online at present. But, as states in the region struggle with limited space for landfilling refuse, they are aggressively moving towards encouraging and incentivizing biogas applications. For example, in 2012, Massachusetts added anaerobic digestion to eligibility for virtual net metering and a number of other programs, and created a long-term contracting program open to biogas generation. Rhode Island just established a standard offer price for anaerobic digestion under its distributed generation standard offer program. As a result of the push to get organic materials out of the waste stream, we expect to see interest in rapid expansion of this segment. Connecticut would benefit from this trend by clarifying RPS eligibility.

[11] http://www.ripuc.ri.gov/utilityinfo/RESRules(7-25-07).pdf
[12] http://www.puc.state.nh.us/Regulatory/Rules/Puc2500.pdf

5 Opportunities for Eligibility Contraction

If DEEP wishes to redirect ratepayer support for RPS compliance to supply that is well-aligned with Connecticut's stated objectives while reducing total costs, DEEP could limit contract eligibility for supply deemed less effective at meeting these objectives and replace them with lower cost supply that better meets the RPS goals.

Simply limiting supply to in-state sources only, is neither legal (violating the interstate commerce clause of the U.S. constitution (Elefant & Holt, 2011)), nor advisable (compared to other states and provinces in the region, Connecticut has limited cost-effective new renewable supply in-state).

There are several options for limiting supply and each would contribute to desired outcomes differently. A careful and nuanced examination of the impact of potential eligibility changes is required to inform final policy recommendations..

5.1 Vintage

5.1.1 Contribution of Legacy Generation

Legacy generation, which is uniquely eligible under Connecticut Class I (compared to other regional Class I markets), presents an opportunity to narrow eligible supply and increase the State's consistency with regional RPS markets. Table 3 demonstrates a significant degree of commonality and overlap across New England RPS programs, with several notable differences in eligibility for Connecticut Class I. Table 5 quantifies Connecticut's uniquely-eligible legacy supply.

Table 5: Legacy Generation Contribution to CT Class I RPS

Fuel Type	Vintage	Est. GWh in 2012	Est. % of 2012 CT Class I RPS	Eligible in Class I other than CT?
Biomass	Pre-1998	1,031	37%	No
Landfill Gas	Pre-1998	225	8%	No
Legacy Hydro converted to run-of-river	Pre-1998	80	3%	No
Wind (Searsburg)	Pre-1998	14	0.5%	No
TOTAL		**1,225**	**43.5%**	

Supply from legacy biomass and landfill gas, legacy hydro converted to run-of-river, and one small legacy wind project comprised an estimated 43.5% of Connecticut Class I supply in 2012, and none of these resources are eligible in any other Class I market. Taken together, this means that slightly more than half of the 2012 Connecticut Class I target is encouraging the development and construction of new regional supply, while nearly half is supporting the continued operation of facilities that were built in advance of the RPS's adoption.

Historically, the contribution of legacy generators to Class I compliance has been even larger, on a percentage basis. Figure 1 and Figure 2 demonstrate the impact of this supply on the composition of CT Class I RPS compliance in 2010. These figures reveal that the pre-1998 biomass which supplied

approximately 76% of CT Class I demand in 2010 (and 37% in 2012, see Table 3) are located not in Connecticut but in Maine and New Hampshire. In addition, much of the third largest supply category – pre-1998 landfill gas – is from New York.

Figure 1: Composition of 2010 CT Class I Supply, by Location

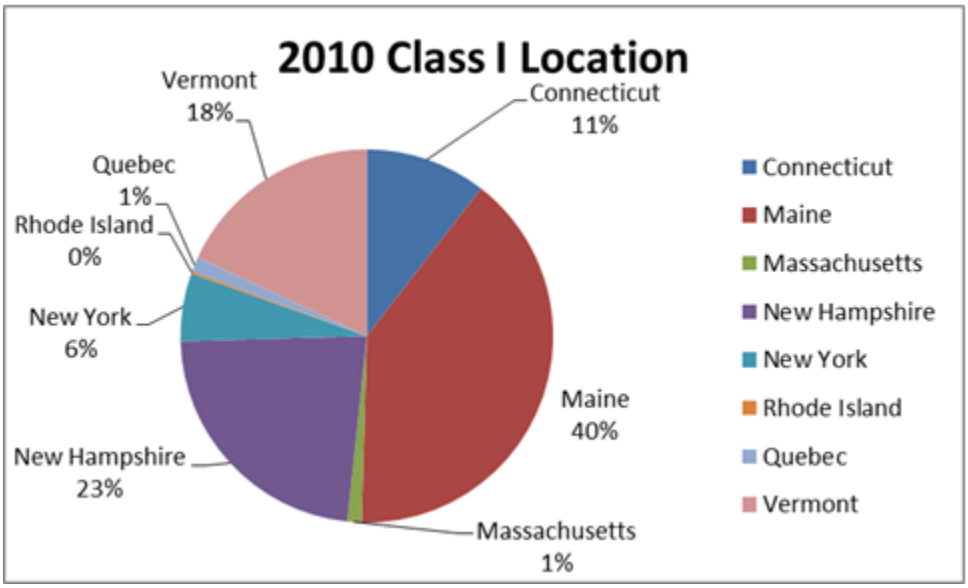
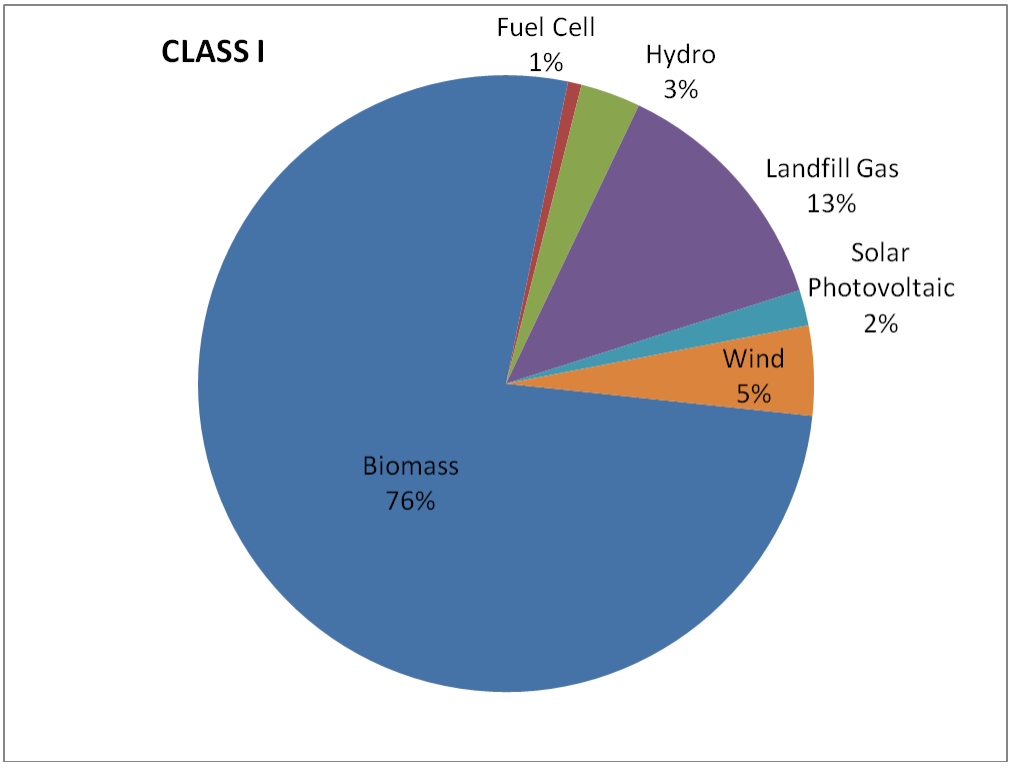


Figure 2: Composition of 2010 CT Class I Supply, by Fuel Source[13]



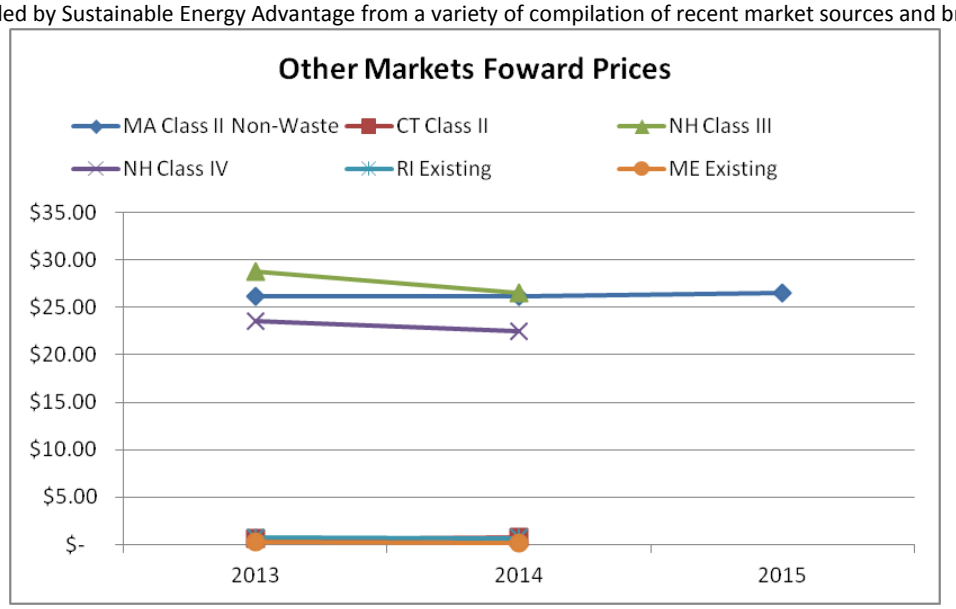
[13] DEEP RPS Database.

Since the legacy fleet is not expanding, as targets increase in the coming years, it will fulfill a smaller percentage of Connecticut Class I. However, there are other factors at work which impact the fluctuating contribution of this legacy supply, as described below.

Connecticut Class I acts a sink for the above-described supply, much of which otherwise would have few, if any, options for monetizing RECs associated with annual production. Where RPS tiers from different states have overlapping eligibility, REC supply, unless it is contractually obligated to a specific state, will freely migrate among the states in order to receive the highest revenue (price) available. The legacy biomass and landfill gas supply that qualifies in Connecticut overlaps with New Hampshire Class III and the hydro overlaps with New Hampshire Class IV, (both maintenance tiers). Much of the supply in Table 5 is eligible to differing degrees for the Massachusetts Class II, Maine Class II, and Rhode Island 'Existing' demands (also maintenance tiers). Due to these eligibility differences, however, only some of these maintenance tiers provide any material REC revenue, as Figure 3 shows, and all of these maintenance tier markets have prices that are typically well below the Connecticut Class I RPS market except in times of substantial supply surplus.

Figure 3: Recent Market Prices for New England RPS Maintenance Tiers

(Source: Compiled by Sustainable Energy Advantage from a variety of compilation of recent market sources and broker quotes)



Supply not captured in these overlaps has nowhere to go other than Connecticut. Two important dynamics are at play for those legacy plants with material variable operating costs (e.g. biomass plants with material fuel costs) and other generation with very small variable operating costs (hydro, landfill gas and wind). When REC prices are sufficiently high in the Connecticut Class I market, production from these facilities targets Connecticut Class I. The converse is also true: If Connecticut Class I REC prices fall below New Hampshire Class III and IV, and Massachusetts Class II, eligible supply will migrate to these markets to the degree possible. For legacy biomass plants not otherwise insulated from market forces by PPAs, however, when the price of energy and RECs combined do not support marginal operating costs at these facilities, production decreases (and plants may close temporarily), less energy is produced, and fewer RECs flow into market.

If some or all of this supply were no longer eligible for Connecticut Class I, it would have no other market. Depending on the circumstances, such supply would either continue to operate but garner less revenue, or potentially be unable to continue operation. With respect to Connecticut's Class I RPS and regional Class I RPS markets, the demand tension supporting new development would increase, unless targets were altered proportionately, or such supply was replaced by a contracted incremental tier for which large hydro would be eligible.

5.1.2 Establishing a Vintage Threshold for Non-Hydro Technologies

If Connecticut were to expand the application of a vintage threshold beyond hydroelectric facilities, the threshold date could be the same as presently used for hydro (post-July 2003), or could be aligned with the Massachusetts Class I and Rhode Island New RPS tiers, thereby allowing projects that commenced commercial operation after December 31, 1997.

This approach is currently used in all other New England states and is coupled with a policy that also allows incremental increases in production beyond a specified historic baseline to be eligible at facilities that originally commenced operations prior to the applicable vintage threshold date (e.g. for Massachusetts, December 31, 1997).

The method of calculating the historic baseline should be precise, and should account for the potential that certain projects may not have been operating for some or all of this period. Some RPS programs (RI & NH) also allow repowered facilities to be eligible for the Class I RPS if they demonstrate that a substantial (80% in some cases) portion of the facility's cost basis – including the prime mover – has been replaced.

In other cases (ME) facilities can become eligible through proof that they have been refurbished and operating beyond their useful life. This policy has proven difficult to implement. The Maine PUC has received several proposals under this provision, each of which it has needed to study at great length and some of which have resulted in lengthy disputes and need for reconsideration. The associated uncertainty over whether Maine's RPS compliance market will be balanced or in surplus has contributed to REC price volatility.

5.1.3 Impact of Vintage Changes on Legacy Biomass

This section explores the contribution of legacy biomass to Connecticut Class I RPS compliance and the potential impact of eliminating, phasing out this generation source, or reducing the credit awarded to such generators.[14] The objective of such a change would be to limit the extent to which Connecticut ratepayer funds are spent for production from out-of-state legacy facilities which were in operation when the RPS was enacted, thereby allowing that support to be redirected to resources that are better aligned with RPS objectives, including 'additionality' and economic benefit.

Issues motivating any potential contraction of eligibility criteria include:

[14] For instance, by conveying credit towards compliance for less than 1 REC per MWh produced, any approach recently adopted by Massachusetts for biomass plants whose conversion efficiency falls below a set percentage. 225 CMR 14.05(8(c)(3).

- Recognizing that since these plants are typically older than 20 years, their initial investment cost has already been fully paid;
- Recognizing that support of the legacy fleet by Connecticut ratepayers disproportionately exceeds support provided by any other state;
- Distinguishing the degree to which owners of any facilities that might be deemed ineligible going forward relied upon the CT Class I definitions in stimulating investment. For legacy plants, the initial investments were clearly not made in response to the CT Class I policy; and
- Recognizing the fact that conveying RECs to this category of generators may not lead to the displacement of fossil fuels and their resulting emissions if these projects are economic without Class I revenues.

Factors tempering the above points include consideration of the following factors and their alignment with the objectives discussed in Sections 2.1and 2.2:

- Do facilities need the support to continue operation? In some cases, withdrawal of support may cause curtailment of production and shutdown, increasing the region's fossil fuel use and GHG emissions
- Should investors have the opportunity to recoup newer investments made in reliance on the CT RPS policy? Subsequent to adoption of the CT RPS, some of these facilities have made investments, some modest and some substantial - relying on RPS eligibility. Such investments include expenditures on emission controls, repowering, or purchases by new owners of eligible operating assets. The impact on those making such investments should be considered and respected in evaluating any changes.

Of the biomass generation that is currently supplying the CT Class I RPS, or is expected to in the near future (i.e. projects eligible and under construction), none of the output of the legacy plants are currently under long-term contract, while some of the newer supply is currently under long-term contract. The uncontracted supply is effectively exposed to the repercussions of Connecticut Class I eligibility changes. Figure 4 allocates uncontracted Connecticut Class I eligible biomass according to vintage. The majority of this supply was in operation before 1998 when the RPS legislation was enacted. No additional supply in this category has come on-line between 1998 and July 1, 2003 – the vintage criteria date used by Connecticut to determine the eligibility of small hydroelectric generators. As a result, the same quantity of supply would be affected regardless of whether Connecticut established a vintage eligibility date of 1998 or July 1, 2003. The uncontracted biomass supply added after July 1, 2003 represents Public Service of New Hampshire's Schiller Station's conversion of one of its units to biomass (approximately 45 MW net), along with portions of the Plainfield Renewable Energy (7.5 MW) and Burgess Biomass (approximately 9.5 MW) plants which are not currently under long-term contract[15], as well as two small biomass CHP facilities in northern New England. This latter category of supply would not be impacted by changes to the vintage eligibility criteria, and would continue to be eligible for multiple Class I RPS markets.

[15] Plainfield Renewable Energy and Burgess Biomass are large biomass plants under construction and due to reach commercial operation before the end of 2013. Plainfield Renewable Energy has contracted to sell the RECs and energy from 30 out of 37.5 MW under a Project 150 Electricity Purchase Agreement with Connecticut's investor-owned utilities, while the RECs associated with approximately 58 out of 67.5 MW capacity from Burgess Biomass are under long-term contract to Public Service of New Hampshire. The remainder of the RECs from these plants are largely dependent on the Connecticut Class I market.

Figure 4: New and Legacy Uncontracted Biomass, by Vintage

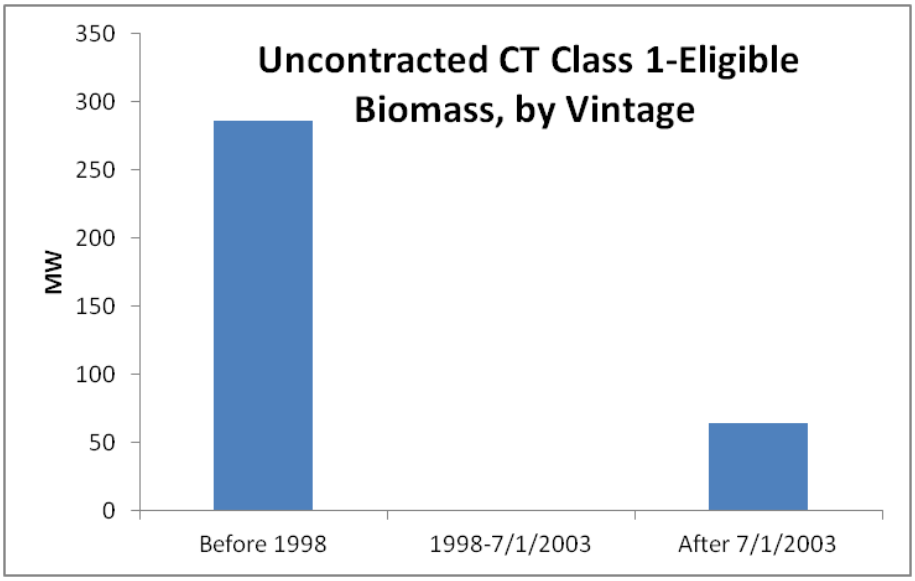


Figure 5 shows the physical distribution of this same supply across the New England states.

Figure 5: New and Legacy Uncontracted Biomass, by State

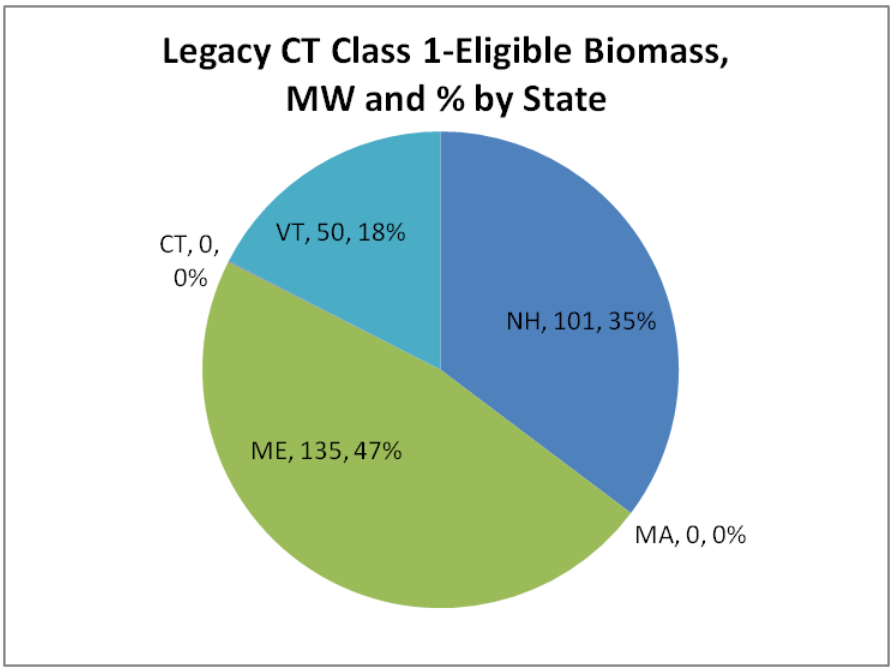


Table 6 divides existing (legacy) biomass into four categories, providing detail on the distribution of associated MW between Connecticut and other states, an estimate of the annual production from these facilities, and – for reference – an estimate of the percentage of 2012 Connecticut Class I demand that could have been served by these facilities. Production certified only for Connecticut Class I would have no other Class I market opportunities if it's eligibility in Connecticut were to sunset. This is the largest

component of currently eligible legacy biomass, and the single largest contributor to Connecticut Class I compliance – capable of meeting nearly 40% of demand[16] in 2012. If production from these facilities were not eligible, Connecticut Class I RECs would then be obtained from new, regional RPS generators eligible in multiple Class I markets, to the extent they are available. However, contracting eligibility would reduce available REC supply and may lead to higher REC prices. If a contracted large hydro tier were to be established, however, a portion of the void left by legacy biomass would likely be replaced by a contracted incremental tier for which incremental (e.g. post-2003) large hydro would be eligible . With respect to the individual facilities themselves, the loss of Connecticut Class I eligibility would result in uniform treatment across the region; all legacy biomass would be eligible only for maintenance tier markets, where REC premiums are expected to be remain at little more than the cost of the transaction unless or until such time as attrition in the operating fleet prompts a price increase. Because these plants have fuel and other variable operating costs of 7 – 8¢ per kWh or higher, the combination of energy and capacity market revenues in today's low energy price environment, combined with far lower REC revenues if no longer CT Class I eligible, would threaten the continued operation of these plants, making it likely that many would curtail production or shut down in response. This would likely result in a significant increase in fossil fuel use and commensurate emissions, unless replaced by a contracted incremental tier for which large hydro would be eligible.

Generation which is already certified for New Hampshire Class III, or which is assumed to be certifiable with modest investments in emissions controls, represents a combined 70 MW (17% of Class I demand) and would have the ability to market its RECs into NH-III if Connecticut phased-out their eligibility.[17] As the REC prices in the NH-III marketplace provide modest material (although often lower) revenue compared to CT Class I RECs, plants in this category would stand a greater chance of continued production than those in the first category, although the change would definitely put pressure on their economic viability and continued production.

The remaining 31 MW would be less affected by removal of Class I eligibility, as they are already eligible in more than one Class I market.[18] However, their long-term eligibility for other Class I tiers would ultimately be limited to the smaller states, putting downward pressure on the REC revenues they may be able to garner.

[16] Although we note that some of these plants produced at reduced levels during 2012 due to low energy prices.
[17] It is unclear whether eligibility only for NH-III would be sufficient to justify additional investments in particulate matter reduction for those plants not currently qualifying.
[18] We note that as of the end of 2015, over half of this category is expected to lose Massachusetts Class I eligibility and therefore might migrate to the first category if unable to secure certification elsewhere.

Table 6: Breakdown of Existing (Legacy) and Other Operating Biomass Supply

Biomass Eligibility Sub-Categories	Total MW	MW in CT	% in CT	Est. Annual GWh	% of 2012 CT-1 Demand
Certified Only in CT-1	170	0.15	0.1%	993	35%
Certified in CT-1 and NH-3	36	0	0%	261	9%
Certified CT-1 & Assumed NH-3 Certifiable w/ Investment in PM Control	50	0	0%	340	12%
Eligible in more than one Class I market[19]	31	0	0%	205	7%

States require the ability to alter a policy direction based on changing circumstances, facts or priorities. However, arbitrarily altering eligibility that would 'pull the rug out' from under past investors violates the fairness principles enumerated in Section 2.2, and also serves as a warning to future investors relying on state policy. Before recommending changes in such policies, consideration should be given to including grandfathering and ample notice provisions, as well as other mechanisms (as discussed further in Section 6) to address past policy reliance and fairness issues.

Finally, as noted above, some generators made investments subsequent to adoption of the CT RPS in reliance on, and in response to, the policy. Some investments in biomass plants were modest relative to the cost of building a new power plant (i.e. emissions retrofits), although such investments can still be in the millions of dollars. Others were far more substantial, including more extensive repowering, or an investment in or purchase of an operating Class I-eligible plant. Prior to altering the eligibility of such plants, DEEP should consider:

- The cost impact to Connecticut ratepayers of the change, which may be a function of whether targets also change, or whether other supply better aligned with the State's Class I RPS objectives replaces the supply;
- Whether investors should have the opportunity to recoup investments made in reliance on the CT RPS policy;
- Whether (or by when) such investors have had adequate opportunity to recover such investments; and
- Whether some form of permanent or temporary grandfathering is appropriate for plants that have committed substantial capital in response to Class I RPS that have not had adequate opportunity to recoup; and
- The nature and timing of any changes to CT's RPS.

Table 7 below summarizes the nature of investments made by plant owners based on their understanding at the time of a plant's eligibility for CT's Class I RPS. As shown, the majority of the biomass capacity currently certified for CT's Class I RPS made some form of investment in response to the Class I RPS, although the timing, nature, amount of investment, and the degree to which Connecticut was the only driver of the investment varies by plant. This fact pattern suggests that a nuanced

[19] Legacy plants in this category have qualified in other states due to repowering, return to service after shut down, or other investment sufficient to meet other states' requirements.

approach may be advisable as DEEP weighs the State's RPS objectives in light of best practices and design principles when recommending any RPS eligibility changes as discussed in Section 2.2.

Table 7: Biomass Plant Investment in Response to CT-I RPS

Facility Name	State	Eligibility Sub-Category	Currently Operating?	In Service Date	Capacity (MW)	Investment in Response to CT-I RPS[20]
Bridgewater	NH	3	Yes	9/1/1987	15.70	Emissions controls
DG Whitefield	NH	3	Yes	4/1/1988	17.00	Emissions controls
Gallop Power Greenville	ME	5	Yes	3/1/1987	16.00	Repowering driven by Connecticut and other markets
Hemphill 1 (Springfield Power)	NH	3	Yes	12/1/1987	17.00	Emissions controls
Indeck Alexandria	NH	5	Yes	11/1/1993	14.60	Emissions controls
J & L Electric	ME	5	?	11/1/1984	0.49	
J C McNeil	VT	1	Yes	2/1/1984	50.00	Emissions controls
Tillotson One	NH	1	?	12/31/1978	0.49	
Tillotson two	NH	1	?	12/31/1978	0.49	
Pinchbeck	CT	1	Yes	7/1/1987	0.15	
Zilka Biomass Energy	NH	4	Yes	3/1/2008	1.50	
Reenergy Livermore Falls	ME	1	Yes	10/1/1992	34.00	Emissions controls; Recent purchase of facility by new owner
Reenergy Stratton	ME	1	Yes	9/1/1989	45.70	Emissions controls; Recent purchase of facility by new owner
ReEnergy Ashland	ME	1	No	1/1/1993	39.00	Emissions controls; Recent purchase of facility by new owner
Schiller 5	NH	4	Yes	10/15/2006	45.00	Repowering driven by Connecticut and other markets
Swans Falls	ME	4	Yes	7/2/2007	0.50	
Pinetree Power -- Tamworth	NH	2	Yes	12/15/1987	19.98	Emissions controls
Pinetree Power -- Bethlehem	NH	2	Yes	12/24/1986	15.69	Emissions controls

Key:	
1	certified only in CT-1
2	certified CT-1 & NH-3
3	certified CT-1 & assumed NH-3 certifiable w/ investment in PM controls
4	New or repowered, relying, in part, on CT Class I
5	eligible in >1 Class I market

[20] Source: Based on SEA industry research and project familiarity

5.1.4 Impact of Vintage Changes on Legacy Landfill Gas

This section reviews the contribution of legacy landfill gas to electricity generators to Connecticut Class I RPS compliance, and the potential impact of eliminating, phasing out this generation as a source of eligible supply, or diminishing the credit conveyed to such generators. The issues motivating any potential contraction of eligibility are similar to those for legacy biomass, i.e. that:

- these plants were typically built 15 years ago or more, and their initial investment cost has already been fully paid;
- support of the legacy fleet by Connecticut ratepayers disproportionately exceeds support provided to these facilities by any other state;
- the initial investments were clearly not made in response to the CT Class I policy, and subsequent investment to keep plants operating has been quite limited; and
- conveying RECs to this category of generators may not lead to the displacement of fossil fuels and their resulting emissions if these projects are economic without Class I revenues.

Unlike biomass plants, landfill methane plants are usually much less costly , do not typically have to pay for fuel,[21] and generally have very low variable operating costs. For these reasons, they are far less likely to stop producing if deprived of Connecticut Class I revenues.

Table 8 divides existing (legacy) landfill gas into three categories, providing detail on the distribution of the associated MW between Connecticut and other markets, an estimate of the annual production from these facilities, and an estimate of the percentage of 2012 Connecticut Class I demand that could have been served by the facilities in these categories. In stark contrast to biomass, there is only one 25 MW landfill gas facility that is only certified for Connecticut Class I (located in Quebec, although it is currently not importing into New England and thus not contributing to CT Class I supply). Beyond that plant, facilities have either successfully completed certification for New Hampshire Class III, or are definitively eligible but not yet certified (47.9 MW), or were constructed after 1998 and before July 1, 2003 and are therefore eligible in more than one Class I RPS market. The landfill gas generators commencing commercial operation prior to July of 2003, the majority of which are located outside of Connecticut, could have accounted for up to 8% of Connecticut Class I demand in 2012[22]. In the absence of eligible production from these facilities, Connecticut Class I RECs would be obtained from new, regional RPS generators eligible in multiple Class I markets. However, contracting eligibility would reduce available REC supply and may lead to higher REC prices. If a contracted large hydro tier is established, a portion of the void left by legacy landfill gas would likely be replaced by contracts for which incremental (e.g. post-2003) large hydro would be eligible. The loss of Connecticut Class I eligibility would impact pre-1998 legacy facilities by leaving them eligible only for maintenance tier markets. As they are eligible for NH-III RPS, however, they would continue to reap revenues of between $25 and $30 per MWh unless New Hampshire made substantial changes in their RPS market. Because of their operating costs, these plants would be unlikely to cease operations; rather, their owners would simply cease receiving the REC premiums from Connecticut ratepayers that are only available in Connecticut. Facilities which came on-line after 1997, but before July 1, 2003, represent supply developed in response to early RPS demand that would continue to be eligible in other Class I markets.

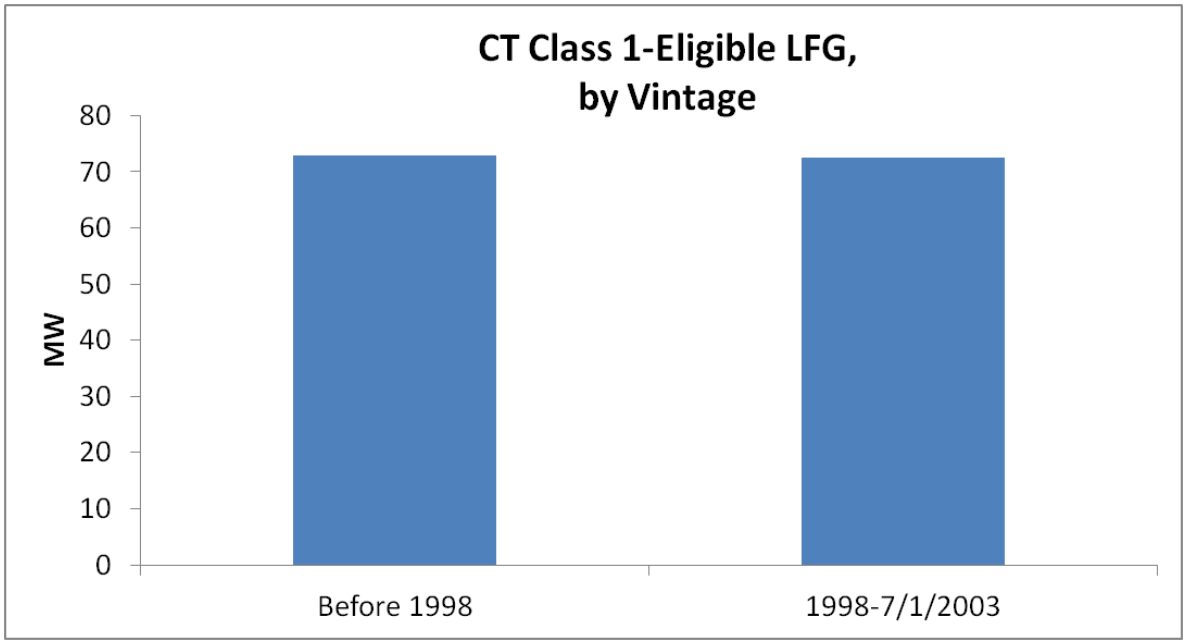
[21] Although exceptions exist where collection systems and generators are owned by different parties.
[22] Or, over 14% if the one Quebec landfill project were to import its supply into New England.

Table 8: Breakdown of Existing (Legacy) Landfill Gas Supply[23]

Legacy LFG Sub-Categories	Total MW	MW in CT	% in CT	Est. Annual GWh	% of 2012 CT-1 Demand
Certified Only in CT-1	0	0	N/A	0	0%
Canadian supply certified but not currently importing	25.00	0	0%	175	6%
Certified in CT-1 and Certified or Assumed Eligible in NH-3	47.92	2.40	5%	225	8%
Pre-7/1/2003 and either certified, pending or eligible in more than one Class I market	72.6	2.80	4%	438	17%

Figure 6 allocates Connecticut Class I eligible landfill gas according to vintage. In this case, the research and analysis demonstrate that landfill gas facilities were built prior to (pre-1998), as well as in response to regional RPS demand, including a significant amount after July 1, 2003. These latter categories of supply would not be impacted by changes to the vintage eligibility criteria, and would continue to be eligible for multiple Class I RPS markets.

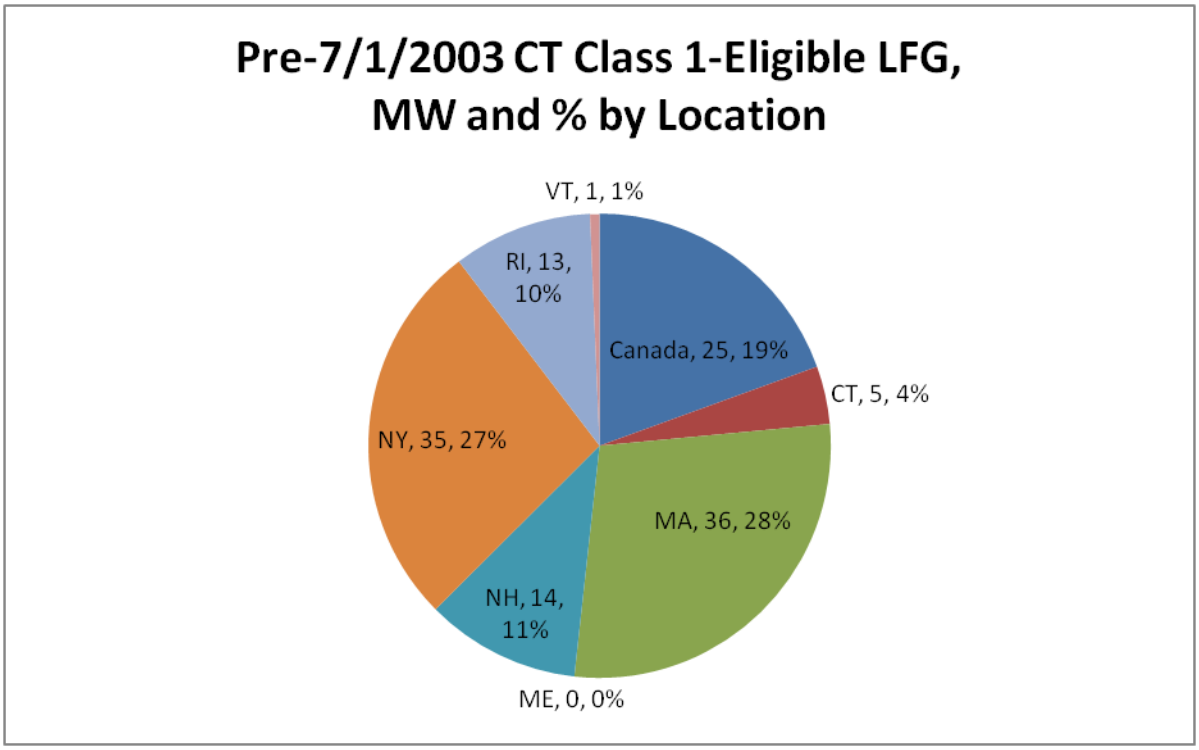
Figure 6: New and Existing Landfill Gas Supply, by Vintage



[23] We note that approximately 17 MW of *capacity* is double counted between the 'Certified in CT-1 and Certified or Assumed Eligible in NH-3' category and the 'Pre-7/1/2003 and either certified, pending or eligible in more than one Class I market' category, corresponding to 4 generators which Massachusetts grants Class I RECs to for annual production above a historic 1995-1997 average 'vintage' baseline level. The Annual GWh figures reflect an estimated split between production eligible in these two categories.

Figure 7 shows the physical distribution across New England of the subset of Connecticut Class I eligible landfill gas supply which has come into commercial operation prior to July 1, 2003.

Figure 7: Pre-7/1/2003 Connecticut Class I-Eligible Landfill Gas, by State, 2012 Snapshot[24]



5.1.5 Impact of Vintage Changes on Legacy Wind

A single 6 MW wind project, in Searsburg, Vermont, is eligible for CT Class I RPS, but no other Class I RPS markets. This project is owned by Green Mountain Power Company (GMP) and its costs are included in the utility's rate base. It was developed prior to the CT RPS and therefore the investment was not in response to CT's or any other RPS demand. Wind projects also have very low operating costs. If it were to lose eligibility due to an eligibility change, it would continue to operate, but reduce the credit currently accruing to GMP's ratepayers in Vermont currently being paid by CT ratepayers through REC awards. However, this changes would reduce available REC supply by a very small amount, and may lead to slightly higher Class I REC prices.

[24] The Johnston Landfill facility, representing the majority of the Rhode Island supply in this graph, is being replaced by a larger facility that will qualify as Rhode Island 'new', and Class I for other New England RPS requirements.

5.1.6 Other Possible Changes

There are number of other potential vintage-related changes that might be considered by Connecticut to limit Class I eligibility, and customer expenditures, while remaining consistent with RPS objectives. Three of these concepts are introduced here for further consideration.

One concept that policymakers have been discussing over the last few years would be disqualifying "legacy" Class I generation from Class I eligibility after a plant reaches the end of its "economic life".[25] This approach may reduce ratepayer costs without destabilizing RPS markets. The New Hampshire PUC conducted a 2011 RPS program review workshop a (New Hampshire Public Utilities Commission, 2011) that included discussion about an approach that would transition these legacy resources from Class I to Class II. In order to avoid disruption to the RPS market, under this approach and quantity removed from Class I RPS eligibility would also be removed from Class I RPS targets (and added to Class II RPS targets), leaving the net supply-demand balance for the marketplace undisturbed. The rationale for this approach is that, after a period of time has passed to allow project investors to recoup their initial investment and earn anticipated investment returns, ratepayers should no longer pay a high premium for generation from that source. To our knowledge this approach is not been implemented anywhere, so some of the implementation details would need to be worked out (i.e., establishing a standard technology – specific economic life). The benefit of this approach is that it would allow ratepayer support to be redirected to new renewable generation. A hybrid approach could also be developed that phased out support over a period of time after a project no longer required such support to be economic. This approach might be most effective with capital-intensive renewable resources that have very low operating costs. As noted above, biomass plant economics suggest that their ability to operate without some level of continued support will depend on whether commodity market prices are sufficient to cover operating costs.

Another option that could be used, in combination with that discussed above, would be to allow a Class I facility to continue Class I eligibility after its 'economic life' if it is refurbished or repowered to modernize the plant, making it viable to continue to operate. This approach has been used for the Maine Class I RPS. In Maine, legacy generators otherwise only eligible for Class II can qualify as Class I resources by making refurbishment investments to allow them to operate beyond their initially expected useful lives. The approach has turned out to be somewhat problematic in Maine, however, due to two primary factors. The first is a lack of a bright line standard for what the level of investment in refurbishment would be deemed sufficient to gain Class I eligibility, which has led to appeals, lawsuits, and unclear and evolving standards which make the market unpredictable for market participants. The other factor is a combination of unusually inclusive biomass eligibility rules (Maine allows black liquor, a papermaking waste stream not eligible and other states, as eligible), and an extensive fleet of potentially-eligible large legacy biomass plants (particularly old paper mills), relative to the annual Class I RPS demand. Many applications from such plants await PUC ruling on certification, and considering the amount of potential supply in relation to demand this uncertainty has destabilized the Maine class I market, and threatens to swamp the marketplace. However, if crafted to avoid these particular pitfalls, and applied in concert with the concept introduced in the prior paragraph, such an approach might be

[25] Economic life, as used here, represents a standard, average expected life of a technology when installed, which is typically a period over which projected cash flows are considered in assessing the initial investment. In the policy context discussed here, economic life would be selected as a standard duration applied to a particular technology, e.g. 20 or 25 years.

effective in Connecticut. At a minimum, the State would need to adopt clear rules for what would constitute eligible refurbishment and/or repowering.

In addition to these approaches, Connecticut could also impose a vintage threshold, and allow incremental production above an historic baseline to be eligible for new class I RECs as Massachusetts, Rhode Island and New Hampshire have done.

5.2 Changes to Biomass Eligibility Requirements

As an alternative to, or in addition to, establishing a vintage threshold for biomass eligibility, other aspects of eligibility might be used to address DEEP's goal of limiting the role of out-of-state biomass in meeting Connecticut Class I RPS requirements, and/or better aligning these resources with Connecticut RPS objectives. Biomass eligibility criteria in New England are diverse, as summarized in Table 3 earlier in this paper. In addition to vintage, such biomass eligibility criteria include emissions limits on various criteria pollutants, minimum efficiency thresholds, fuel standards, project size and greenhouse gas impact requirements. Some states also utilize input standards, technology standards, or output standards, or a combination of these criteria.

Connecticut's Class I RPS biomass eligibility criteria establish maximum NO_x emissions limits and a sustainable biomass standard which is limited to excluding construction and demolition debris (with some explicit exceptions). This means that a broad group of biomass plants have qualified for Connecticut Class I, by investing in plant post-combustion emission controls. While such modifications provide emission reduction benefits, for the reasons enumerated earlier regarding the legacy vintage concern, DEEP has questioned whether these emission benefits have sufficient merit to continue qualifying them as Connecticut Class I resources in perpetuity. In contrast to Connecticut, Massachusetts Class I now includes a complex combination of minimum efficiency requirements, fuel harvest standards, sustainability (net greenhouse gas) standards and emission limits, which, are cumbersome to both comply with and administer. Rhode Island strictly limits what can be used as fuel, and requires the filing of a few plans for certification. New Hampshire Class I sets NO_x and particulate matter (PM) emission limits, as well as fuel requirements. Maine Class I standards, on the other hand, are comparatively lax, allowing biomass without restrictions on either fuel source or emissions.

In addition to better aligning eligibility with RPS policy objectives, Connecticut should consider options that are administratively feasible, efficient and, where possible, enhance rather than detract from regional consistency. Here, we consider changes to emission standards for particulate matter, and potential approaches to setting greenhouse gas standards. Potential conversion efficiency standards and fuel standards are not considered further.[26]

[26] Conversion efficiency criteria were recently adopted in Massachusetts, where the result appears to drive a policy shift away from central station biomass and towards encouraging small scale combined heat and power biomass systems that result in a more efficient use of the limited renewable biomass resource. Thus represents a command-and-control approach to addressing an underlying objective of greenhouse gas reduction and utilizing scarce fuel resources efficiently. Output they standards are generally lower cost and therefore more in line with Connecticut RPS objectives.

5.2.1 PM Standards

To better align Class I RPS eligibility with Class I RPS objectives, Connecticut might consider phasing in more stringent criteria pollutant emissions limits. Options that advance regional consistency include lowering the NO_x emission standard to the level utilized in Massachusetts, or establishing a PM emission limit corresponding to that used in New Hampshire. As noted in Table 7, a large number of operating biomass plants have already invested in NO_x controls, and incremental NO_x control may be quite expensive. Further, as Massachusetts seems to be moving away from qualifying biomass more generally, aligning with Massachusetts criteria make little sense. On the other hand, there is much commonality between the New Hampshire Class I and Connecticut Class I emission criteria. New Hampshire's NO_x emission limit is identical to that of Connecticut Class I, but adds a PM emission limit. As noted earlier, several of the legacy biomass plants and most of the new biomass plants can meet New Hampshire's PM limit. Those plants that cannot meet the limit may be able to do so with additional expenditure on PM control.[27] As PM emissions are a concern to DEEP, applying New Hampshire's PM emission limits to new plants in the near-term, and to operating plants after appropriate notice and lead time, may serve to advance Connecticut's objectives of making biomass inclusion more consistent with environmental RPS objectives. The impact on the biomass fleet depends in part on the relative economics of PM control relative to market revenues.

5.2.2 Greenhouse Gas Standards

Greenhouse gas reductions required by the State's Global Warming Solutions Act (PA08-98) are one the primary driving objectives of the Connecticut Class I RPS. We note that several of the Class I RPS eligible technologies, including biomass, landfill gas, and (potentially) biogas plants, as well as natural gas fuel cells, emit greenhouse gases.[28,29] It is generally accepted that landfill gas to electricity plants are often considered zero greenhouse gas emission facilities, as most landfills are required to collect and flare methane from organic matter decomposition whether or not electricity is generated at the site. Anaerobic digestion and biogas applications that, in the process of generating electricity, capture methane (a potent greenhouse gas) that would otherwise escape directly to the atmosphere are widely considered to have a positive greenhouse gas impact.

Biomass plants have long been considered greenhouse gas-neutral by EPA, many states, and the biomass industry (with the exception of greenhouse gas emissions related to fuel use to transport fuel to a power plant, which we discussed further below). This position relies on the presumption of sustainable harvesting of biomass fuel sources which in aggregate grow and sequester carbon dioxide from the atmosphere at a rate equal to or exceeding the rate of harvest. However, recent research has

---

[27] This might not be possible at all legacy plants, which may be limited by the physical space and plant layout from retrofitting stack gas controls.

[28] Other technologies may have varying degrees of greenhouse gas impact on a lifecycle basis, however they are not considered further here.

[29] Fuel cells utilizing natural class are clearly not truly renewable, in the traditional use of the term. The inclusion of fuel cells fueled by natural gas in the Class I RPS is consistent with supporting the commercialization of fuel cells and driving down of their installed cost, and using natural gas as a transition fuel to renewable fuels in the future. For the reasons outlined in this paper, if Connecticut were to apply greenhouse gas standard for RPS eligibility, it would be consistent and may be appropriate to either phase out Class I RPS eligibility for new fuel cells not using a renewable fuel, or alternatively, require that carbon offsets be purchased and retired by owners of fuel cells utilizing fossil fuels.

brought into question the time profile of greenhouse gas emissions versus subsequent sequestration. This 'debt-then-dividend' framework applicable to woody forest biomass (Manomet Center for Conservation Sciences, Biomass Energy Resource Center, Pinchot Institute for Conservation, 2010), suggests differences in the greenhouse gas impact of different fuel stocks and applications, and more broadly the desirability of biomass combustion if one goal is to dramatically reduce greenhouse gases in the near term. While of concern to Connecticut, the state of knowledge about how to adequately determine the greenhouse gas impact is still evolving and somewhat controversial (National Alliance of Forest Owners, 2010). Therefore, it is premature to recommend that such a standard be added to Connecticut Class I RPS eligibility requirements.

Fully embracing greenhouse gas-related objectives using output based metrics might entail a full lifecycle net greenhouse gas impact standard that would be burdensome to administer. In contrast, an eligibility standard that required biomass plants to offset the greenhouse gas emissions associated with transporting the biomass that fuels the power plants would be far simpler to administer, help level the playing field between emitting and non-emitting resources and move the State in the direction of greenhouse gas reduction, while imposing only a modest cost increase. Even ardent supporters of designating biomass as greenhouse gas neutral would acknowledge that the use of diesel fuel to transport biomass fuel to power plants, and the emissions that result, prevent even biomass plants using sustainably harvested fuel from being 100% greenhouse gas neutral unless such emissions are offset. Connecticut might consider requiring biomass generators to purchase and retire carbon offsets based on an industry average transportation emission factor determined through an independent study.

5.2.3 Impacted supply

A broader set of biomass projects than those discussed in Section 5.1.2 would be impacted if any of the above changes to biomass eligibility were applied as an alternative to a vintage threshold. Such changes would impact legacy plants as well as some or all of plants that were built in response to Class I RPS demands in Connecticut and elsewhere. Impacted supply would include all of the uncontracted Connecticut Class I eligible supply depicted in Figure 4. Of particular note, the Schiller plant, owned by Northeast Utilities subsidiary PSNH, was primarily developed to meet Massachusetts and Connecticut Class I demand (although eligible in some smaller states as well). The adoption by Massachusetts of efficiency thresholds for biomass plants will result in this plants loss of Massachusetts Class I eligibility by the end of 2015. Thereafter, Schiller will become largely dependent on CT Class I, as it is quite large compared to RI, NH and ME demands. In addition to legacy biomass discussed earlier, the magnitude of new non-Legacy biomass either operating or under construction is summarized in Table 9.

Table 9: Non-Legacy Biomass (Operating or Under Construction) is Relying on CT Class I RPS

New Biomass Role in CT Class I	Total MW	MW in CT	% in CT	Est. Annual GWh	% of 2012 CT-1 Demand
New (Post-Restructuring) Biomass relying, in part, on CT Class I	**64**	**7.5**[30]	**12%**	**461**	**16%**

[30] Represents uncontracted portion of Plainfield Renewable Energy facility. Remaining 30 MW of PRE's 37.5 MW is under contract to a CT distribution utilities under a Project 150 EPA.

5.3 Conversions of Legacy Storage Hydroelectric to Run-of-River

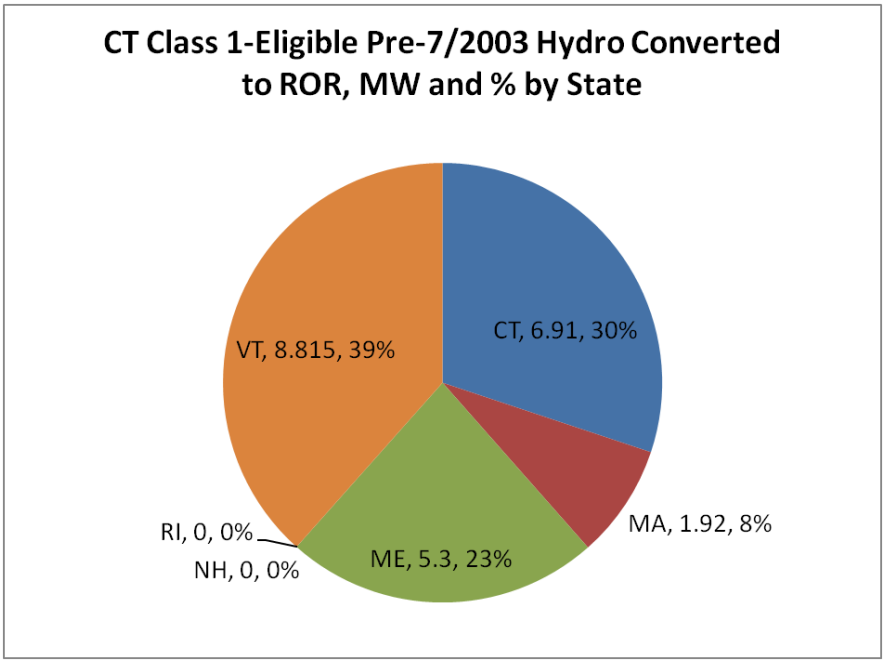
Connecticut is unique in allowing Class II RPS hydropower generators that are smaller than 5 megawatts and convert to run-of-river operations after July of 2003 to become Class I eligible. This treatment is based on the former DPUC's precedential rulings interpreting the RPS statute, that were made in the absence of any policy discussion that might have embraced considerations such as those outline in Section 2.1. In retrospect, although these projects may provide modest benefits to fisheries and water quality by reducing interference with the natural flow of water associated with storing water behind dams, encouraging legacy small hydroelectric facilities to change operation to run-of-river appears to be poorly aligned with these RPS objectives since these projects do not create additional renewable energy ,, materially displace fossil fuel use and emissions or increase system diversity. Further, conversion to run-of-the-river operations actually degrades reliability, reducing energy and capacity value by reducing the ability to store hydro for use during peak demand hours.

Table 10: Legacy (pre-7/2003) Conversions to ROR, Certified and Pending through February 2013

Total MW	MW in CT	% in CT	Est. Annual GWh	% of 2012 CT-1 Demand
22.95	6.91	30%	80.40	3%

Figure 8: Geographic Distribution of Legacy Hydro Conversions to Run-of-River

(Certified and Pending through February 2013)



As Table 10 and Figure 8 above show, most of this supply is located outside of Connecticut. The initial investment in legacy hydro is generally paid for long ago, and operating costs are typically low compared to revenues. Occasional major components do break requiring major refurbishments, and in such instances, it may be difficult to finance such refurbishments without REC revenue (although we note this

is a broader issue which has nothing to do with the run-of-river issue). As a result, if eligibility for this category was eliminated for certified plants in addition to future applications, these plants would not generally be expected to cease production.

5.4 Eliminating Potential Supply Counted in Other State Policies

A fundamental premise underpinning the credibility of RPS policies, and the REC system used for verification, is that renewable energy production counted towards RPS compliance in one state is not also counted towards RPS compliance in another. This principle applies to the claim that the energy is, in fact, renewable. Those who buy RECs are buying the claim to the renewable energy, within a voluntary purchase or policy compliance context. Any claims made with respect to renewable energy by an entity not holding the RECs would conflict with the Federal Trade Commission guidelines regarding renewable energy claims (U.S. Federal Trade Commission, 2012).[31]

Another way for Connecticut to use eligibility requirements in a way that would advance stated RPS objectives would be to disqualify renewable energy production counted in other states. Doing so could impact resources in two states that are currently used for CT Class I RPS compliance. While these states – Vermont and New York - do not *explicitly* claim the applicable renewable energy generation towards renewable portfolio standards in their states, both have established goals that include counting generation that is also being used for CT Class I RPS compliance, thus *implicitly* counting the same renewable energy production twice.

New York Renewable Energy Goals.

In September 2004 the New York Public Service Commission (PSC) issued an Order adopting New York's RPS. The Order "called for an increase of renewable energy in the State's retail electricity mix from a baseline of approximately 19.3% in 2003 to 25% by 2013" (KEMA, Inc., 2009), goals subsequently increased to 30% renewable energy by 2015. The goals are to be met by adding to the *Baseline of Existing Resources*, contributions from the New York RPS Main Tier Program, RPS Customer-Sited Tier Program, Executive Order 111 (state facilities purchases), voluntary market purchases, and additional procurement activities of the Long Island Power Authority and New York Power Authority. In 2003, a calculation was performed to quantify the contribution of these Baseline Resources, which included legacy hydroelectric, biomass (including landfill gas) and other renewable energy generation, which comprised approximately 19% of New York's generation portfolio, or 31,543,624 MWh per year. (KEMA, Inc., 2009) The RPS targets were established to fill a designated portion of the gap between the Baseline Resources and the (now 30%) goal. New York has not established any mechanism nor has it proceeded to increase its RPS targets to account for the fact that New York-based landfill gas generators (that began operation prior to 2003) are exporting their production to New England, and earning RECs issued by the NEPOOL GIS that are being used for CT Class I compliance. Unless and until New York recalibrates the baseline so that sales from facilities for which RECs are used in other states are removed from the baseline, the same generation is being counted both towards meeting New York's 30% goal and for CT Class I compliance. There are currently

[31] For example § 260.15 (d) provides that: "If a marketer generates renewable electricity but sells renewable energy certificates for all of that electricity, it would be deceptive for the marketer to represent, directly or by implication, that it uses renewable energy."

about 21.6 MW of landfill gas, hydroelectric and biomass sources certified for Connecticut Class I that are counted as part of New York's baseline renewable energy supply,

Vermont's Renewable Energy Goals.

Vermont's Sustainably Priced Energy Development (SPEED) Program was enacted in June 2005 in 30 V.S.A. § 8005 and § 8001, with a goal of promoting "the development of in-state energy sources which use renewable fuels (SPEED resources) to ensure that to the greatest extent possible the economic benefits of these new energy sources flow to the Vermont economy in general and to the rate paying citizens of the state in particular." (Vermont Speed Administrator) The SPEED Web Site describes the current statutory renewable energy goals as follows:

> **SPEED Goal:** 20 % of total statewide electric retail sales during the year commencing January 1, 2017 must be generated by SPEED resources that constitute new renewable energy.
>
> **Total Renewables Goal**: 55 % of each retail electricity provider's annual electric sales during the year beginning January 1, 2017, increasing by an additional 4 % each third January thereafter, until reaching 75 % on January 1, 2032, must consist of total renewable energy. (Vermont Speed Administrator)

The Vermont SPEED program is comprised of (a) a voluntary goal which fosters long-term bundled (energy, capacity and REC) contracts between Vermont utilities and renewable energy generators in Vermont[32] and (in limited instances) elsewhere in the region, and (b) a SPEED 'Standard Offer' program which, similar to a feed-in tariff, offers fixed price long-term contracts to distributed renewable generation resources in Vermont. Vermont does not require REC retirement as part of the SPEED program; rather, Vermont utilities resell the RECs associated with the voluntary bundled contracts into southern New England RPS markets. The same holds true for SPEED Standard Offer contracts. The energy is included in the utility portfolio and the RECs are resold into RPS markets. Both SPEED contracts with regional generators and Standard Offer contracts with Vermont based distributed generation are incorporated into the individual utilities' regulated rates, and the REC revenues are used to reduce the contract costs for Vermont's ratepayers.

[32] In addition, Green Mountain Power Company, Vermont's largest utility, has developed and owns the Kingdom Community Wind project, a 63 MW wind farm that came online late in 2012. This project was developed proactively by GMP with a sale of at least a portion of the RECs as part of GMP's motivation. In the Vermont Public Service Board's order approving a Certificate of Public Good approving the project (Vt. PSB Docket 7628 at 154), the PSB ordered that "Petitioners shall not sell any renewable energy credits (RECs) or other environmental attributes directly attributable to the Project's electrical production to more than one consumer, or make any claims regarding those disaggregated attributes in any marketing or advertising if they have sold those disaggregated attributes…. We are applying this condition because we find it appropriate to limit the Petitioners' ability to make claims and representations regarding the power produced by the proposed project if the Petitioners sell the environmental attributes to a third party; something they have stated they intend to do." As GMP is expressly precluded from making claims and representations with respect to this project if RECs are sold into Connecticut, if Connecticut adopts a restriction as discussed in this section, Connecticut may find it appropriate to exempt this project from the exclusion *if* it deems the appropriate conditions for no double claim by utility or state are met, or more broadly, to the extent that this or other projects are subject to similar conditions or take the utility beyond the state's goals.

> In January of 2013, the Vermont Public Service Board released its final RPS Report to the legislature in accordance with the provisions of Section 7 of Act 170 (The Vermont Energy Act of 2012).[33] The report makes recommendations to the legislature for consideration in the event they choose to establish a renewable portfolio standard. Within its recommendations, the PSB specifically discusses the process outlined above. Acknowledging that Vermont currently allows its utilities to resell the RECs associated with SPEED-qualifying resources, the Board recommends that "in designing any renewable policy, the policy drafters should keep in mind the guidelines of the Federal Trade Commission (FTC) regarding the use of environmental claims generally, and specifically those regarding renewable energy. This will help will ensure that electric utility customers will have certainty as to the nature of the electricity that they purchase, and will protect Vermont's electric utilities from exposure related to claims about the nature of their supply portfolios. Any renewable energy policy for Vermont that seeks to directly facilitate the environmental goals of 30 V.S.A. Section 8001, such as protecting and promoting clean air and water quality in the state and region and contributing to global climate change, should include a requirement that renewable energy certificates (RECs) associated with utility-owned (or purchased) renewable energy be retired. Such a requirement also would be more likely to avoid double counting of environmental benefits."
>
> Many small Vermont SPEED Standard Offer facilities have been certified or may soon seek certification for Connecticut Class I compliance; by our count, this figure could exceed 20 MW for facilities operating as of late 2012. Although the SPEED program provides benefits by facilitating financing of new renewable energy projects, there is cause to question whether allowing these facilities to receive payment from Connecticut ratepayers for compliance with CT Class I RPS while also counting these resources toward achieving Vermont's goals is consistent with the FTC guidelines.

Based on the differences between New York and Vermont policies, it is likely that if Connecticut made a change to its RPS eligibility criteria that disqualified the purchase of RECs for CT's Cass I RPS from any facility that is also counted towards satisfying another state's renewable energy goals, many legacy facilities located in New York, and new facilities located primarily in Vermont would no longer qualify. As noted earlier, legacy landfill gas projects have low variable operating costs and would be unlikely to cease production even if they were no longer eligible for Connecticut's Class I. If Vermont SPEED supply was to lose CT Class I eligibility, these facilities would still have contracts with Vermont's utilities that would be respected. The impact would be the loss of a revenue credit from these REC sales for Vermont's ratepayers.

6 Implementation Options: Grandfathering and Transitional Options

Any changes in RPS eligibility raise political, statutory and/or regulatory risk concerns to the market, among investors and others who may take financial risk to bring eligible resources to market, as these changes can result in significant market disruption or instability. A demonstrated willingness to contemplate changes without regard for their impact on past or current investments signals that investing on the basis of CT's RPS is highly risky, which is generally counter to the State's desire to drive down costs (e.g. through lower cost of capital). As noted in Section 2.2, a number of best practices have

[33] (Vermont Public Service Board, 2013).

been identified to guide balancing the motivation for eligibility changes with fairness and predictability principles necessary for an effective RPS policy. In this light, the establishment of one or more new eligibility thresholds should be combined with some form of adequate, advance notice, grandfathering, phasing down or out, or other similar impact limitation measures.

Examples of impact limitation measures include:

- Implement changes with ample notice and lead time until new eligibility thresholds go into effect, as they pertain to already certified generators. The appropriate notice should be measured in years, consistent with development lead times, as well as an appropriate recognition of reasonable and fair treatment of past investments.
- Provide notice that state will cease accepting new certification applications under old criteria as of a specified date.
- Consider some form of grandfathering, e.g.:
    - Permanent grandfathering: letting all who are certified under old criteria continue to participate; or
    - Transitional grandfathering combined with either a defined grandfathering term, phase out or a phase down. A defined term would provide a number of years of continued eligibility before removing eligibility. Phasing out would entail setting up a trajectory over a set amount of time during which criteria transition from today's to the future criteria at which time they apply to all eligible generators, even those who are certified, whereas phasing down would entail some remaining participation at a lower level, e.g. valuing generation coming from sources that do not conform to new criteria at something less than 1 REC per MWh.
- Addressing stranded pre-existing contracts and commitments for RECs and FCM in the phase down/out process (postpone impact until contract ends).
- Modify class II so there is a place for displaced Class I MWs to participate in CT market.

Table 11 summarizes, for each potential modification, the expected results and market supply responses of potential modifications under consideration.

Table 11: Implications of Approaches to Eligibility Contractions

(example provided for Establishing Vintage Threshold)

Option	Description	Implications
1	Status Quo	- Increased $ sent out-of-state to existing biomass fleet - Avoid attrition of these generators, replacement with fossil generators
2A	Vintage Threshold (immediate)	- Immediately increase new renewables demand - Shift legacy biomass RECs to other markets with limited support - Likely REC price increase, barring additional supply or replacement supply
2B	Vintage Threshold (ramp-down)	- Gradually increase demand for new renewables - Provide transition period for investors, allowing for adjustment to CT market or movement to NH-III or others
3A	Fractional RECs (immediate)	- Immediate increase in demand for new renewables, not as much as 2A - Likely REC price increase, though not as drastic as 2A
3B	Fractional RECs (ramp-down)	- Gradually increase demand for new renewables - Allows most efficient plant operators to make necessary adjustments to stay in the market

Eliminating any supply sources, in the absence of modifying targets or expanding eligibility elsewhere, will tend to increase the probability of shortage and have an upward impact on Class I REC prices. When considering the economic and policy implications of these scenarios, it is important to factor in the role of any concurrent policy changes, including those undertaken by other states. Any price increases driven by decreased eligible supply may be mitigated to varying degrees by including additional supply (e.g. Contracted Class I Tier contracts, large hydro). The potentially disruptive impacts of phasing out or eliminating legacy biomass that currently only qualifies as Class I in Connecticut are largely offset by the benefits of creating a more consistent regional playing field and by ensuring that Connecticut ratepayer dollar are being used to advance the State's RPS goals.

7 Bibliography

Baker & McKenzie. (n.d.). *What is additionality?* Retrieved December 28, 2012, from CDM Rulebook: Clean Development Mechanism Rules, Practices & Procedures: http://cdmrulebook.org/84

Connecticut Department of Energy & Environmental Protection. (2012). *2012 Integrated Resource Plan for Connecticut, Appendix D: Renewable Energy.*

Connecticut Public Utilities Regulatory Authority. (n.d.). *Background on CT RPS Compliance Area.* Retrieved December 15, 2012, from Renewable Portfolio Standard: http://www.dpuc.state.ct.us/electric.nsf/60a3df2c610b4cd6852575b3005ce06c/1b7f856c367736438525767000064adce/$FILE/Background%20on%20CT%20RPS%20Compliance%20Area.doc

Coste, W. (2010, July 5). Preliminary Assumptions for Economic Studies (slide 10). *ISO New England Planning Advisory Committee* .

Elefant, C., & Holt, E. (2011, March 1). The Commerce Clause and Implications for State Renewable Portfolio Standard Programs. Clean Energy States Allliance.

Emera. (n.d.). *Maritime Link Information Centre*. Retrieved February 5, 2013, from Emera Newfoundland & Labrador: http://www.emeranl.com/en/home/ourbusiness/aboutthemaritimelink/informationcentre.aspx

Grace, R. C., & Wiser, R. H. (2002). *Transacting Generation Attributes Across Market Boundaries: Compatible Information Systems and the Treatment of Imports and Exports.* Berkeley, CA: Lawrence Berkeley National Laboratory.

Grace, R. C., Donovan, D. A., & Melnick, L. L. (2011). *When Renewable Energy Policy Objectives Conflict: A Guide for Policymakers.* Silver Spring, MD: National Regualtory Research Institute.

ISO New England. (2011, April 1). ISO New England Available Transfer Capability Implementation Document. (Version 1.0). Retrieved February 15, 2013, from http://www.nationalgridus.com/oasis/non_html/pdf/ISNE_ATCID_V1.pdf

KEMA, Inc. (2009). *New York Main Tier RPS Impact & Process Evaluation Report.* Prepared for: The New York State Energy Research and Development Authority.

Low Impact Hydropower Institute. (2011, December). Certification Handbook. Portland, Maine. Retrieved December 15, 2012, from http://www.lowimpacthydro.org/assets/files/LIHI%20HandbookDecember%202011%281%29.pdf

Manomet Center for Conservation Sciences, Biomass Energy Resource Center, Pinchot Institute for Conservation. (2010). *Biomass Sustainability and Carbon Policy Study.* Brunswick, ME.

Molodetz, S. (2012, November 12). Vice President, Business Development, HQ Energy Services US . (R. Grace, Interviewer)

Nalcor Energy. (n.d.). *Backgrounder Lower Churchill Project.* Retrieved February 5, 2013, from www.nalcoreenergy.com: http://www.nalcorenergy.com/uploads/file/lcp%20background%20information%20november%2018%202010.pdf

Nalcor Energy. (n.d.). *Lower Churchill Project*. Retrieved December 15, 2012, from Nalcor Energy: http://www.nalcorenergy.com/lower-churchill-project.asp

National Alliance of Forest Owners. (2010). *Manomet Renewable Biomass Study Analysis - Clarifying Statements.* Retrieved March 7, 2013, from http://nafoalliance.org/wp-content/uploads/manomet-study-clarifying-statements.pdf

New England Power Pool. (2013). Generation Infortmation System Operating Rules, Rule 2.7.

New Hampshire Public Utilities Commission. (2011, February 14). 2011 RPS Review: Public Stakeholder Kickoff Meeting. Concord, New Hampshire.

Newfoundland Labrador Department of Environment and Conservation. (n.d.). *Labrador - Island Transmission Link*. Retrieved Feburary 5, 2013, from Department of Environment and Conservation: http://www.env.gov.nl.ca/env/env_assessment/projects/Y2010/1407/index.html

Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio, ORDER REGARDING RETAIL RENEWABLE PORTFOLIO STANDARD, Docket 03-E-0188 (September24 2004).

Scottish Enterprise. (2008). *Additionality & Economic Impact Assessment Guidance Note: A Summary Guide to Assessing the Additional Benefit, or Additionality, of an Economic Development Project or Programme.* Glasgow, Scotland.

Synapse Energy Economics. (2011). *Avoided Energy Supply Costs in New England: 2011 Report.*

Synapse Energy Economics. (2012, February 14). Hydropower Greenhouse Gas Emissions: State of the Research. Cambridge, MA, USA.

The Northern Pass. (n.d.). Retrieved December 15, 2012, from The Northern Pass: http://northernpass.us/

U.S. Federal Trade Commission. (2012, October 1). PART 260– GUIDES FOR THE USE OF ENVIRONMENTAL MARKETING CLAIMS. Washington, D.C., USA.

United Nations. (1998). *Kyoto Protocol to the United Nations Framework, Article 12(5).* United Nations, New York.

Vermont Public Service Board. (2013). *Further Analysis and Report on Renewable Energy Requirements.* Montpelier, VT.

Vermont Speed Administrator. (n.d.). *Vermont Renewable Energy Goals*. Retrieved March 4, 2013, from Vermont SPEED: http://vermontspeed.com/

Wiser, R., Porter, K., & Grace, R. (2004). *Evaluating Experience with Renewable Portfolio Standards in the United States.* Berkeley, California: Lawrence Berkeley National Laboratory.