Renewable Energy 101
Training Day 2
Section 5
(continued)

Connecticut PURA & DEEP

March 12, 2013

Sustainable Energy Advantage, LLC

5. Renewable Energy Policies: Connecticut

a. [already presented on Feb 14]

b. CT RPS - Structure

c. CT RPS vs. Other New England States

d. CT RPS Experience, History, Expectations

5b. CT RPS - Structure

Eligible Technologies

Class I (growth)

- **Solar**
- **Wind**
- **Fuel Cell**
- **Landfill Gas**
- **Ocean thermal power**
- **Wave or tidal power**
- **Low emission advanced renewable energy conversion technologies**
- **Run-of-the-river hydropower facility**
  - < 5 MW and COD after 7/1/2003
- **"Sustainable Biomass"**
  - Avg NO_x <0.075 lb/MMBtu Or <500 kW with COD before 7/1/2003
  - **No construction & demolition debris (C&DD)***

Class II

- **Trash-to-energy**
- **Biomass**
  - COD before 7/1/1998 and avg. NOx emission rate < 0.2 lb/MMBtu
- **Run-of-river hydropower**
  - COD before 7/1/03 < 5 MWRun-of-river

Class III

- **Combined Heat & Power (CHP)**
- **Energy Efficiency**
- **Waste heat recovery systems**
  - COD after 4/1/07

* = temporary/permanent exemptions apply

Some CT RPS Unique Features

- Class I:
  - No vintage requirement other than small hydro
  - Much of the ‘legacy’ pre-restructuring RE fleet only eligible in CT
  - C&DD exemption for Plainfield Renewable Energy (by statute) and other plants until PRE on-line
  - Only state in region allowing fuel cells using natural gas
  - Landfill methane brought by pipeline from out of region allowed as eligible (requires gas ‘contract path’)
  - Allows older hydro to be deemed ‘new’ and therefore eligible if switches to run-of-river operation
- Class III
  - Only NE RPS tier with firm price floor ($10/MWh)

Connecticut RPS Requirements
% of Applicable (IOU) Load

Year	Class I	Class II or Class I (add'l)	Class III	Total
2005	1.5%	3.0%		4.5%
2006	2.0%	3.0%		5.0%
2007	3.5%	3.0%	1.0%	7.5%
2008	5.0%	3.0%	2.0%	10.0%
2009	6.0%	3.0%	3.0%	12.0%
2010	7.0%	3.0%	4.0%	14.0%
2011	8.0%	3.0%	4.0%	15.0%
2012	9.0%	3.0%	4.0%	16.0%
2013	10.0%	3.0%	4.0%	17.0%
2014	11.0%	3.0%	4.0%	18.0%
2015	12.5%	3.0%	4.0%	19.5%
2016	14.0%	3.0%	4.0%	21.0%
2017	15.5%	3.0%	4.0%	22.5%
2018	17.0%	3.0%	4.0%	24.0%
2019	19.5%	3.0%	4.0%	26.5%
2020	20.0%	3.0%	4.0%	27.0%

Source: DPUC 2008 Compliance Decision & DPUC Web site

5c. CT RPS vs. Other New England States

Comparison of NE RPS Tiers

	New/Growth Tier			Other Classes		
CT	Class I	All (old and new) except sm. hydro Post 7/1/2003only		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 + Refurbished or "operating beyond useful life"		Class 2: Existing. 30% target		
NH	Class I: New	Post 2005 only + Incr. production > historic baseline + Repowered	***New:*** Useful Thermal Energy Carve-out	Class 2: New Solar target 2013 : 0.2%, 2014 – 2025: 0.3%	Class III: Existing, 8% target by 2025	Class IV: small hydro, 1.5% by 2025
RI	New	Post 1997 only + Incremental production > historic baseline + Repowered		Existing, 2% target		

NOTE: VT has no RPS, only a voluntary RE goal. RECs associated with long-term utility contracts are currently resold into regional RPS markets.

Growth Tier (target grows as % of load over time)

Quasi-Growth Tier (growing target, but allows existing RE)

Class I Eligibility – Important Distinctions (simplified*)

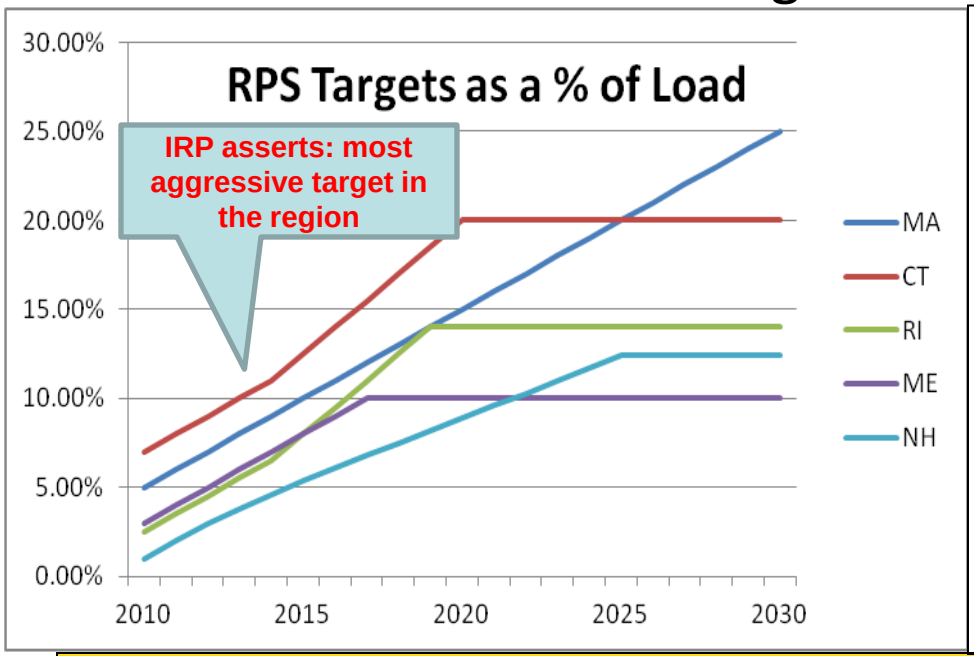
	Common (Wind, Solar, Ocean, Tidal, LFG)	**Biomass**		**Hydro**		**Specials** (Other state specific)
CT	All	Emissions limits	●	Post 2002	◖	•Natural gas fuel cells •Landfill gas by pipe
		Sustainable Biomass (excludes CD&D waste with exceptions)	◖	Size (<5 MW)	◖	
				Run-of-river	◖	
MA	All	Emissions limits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

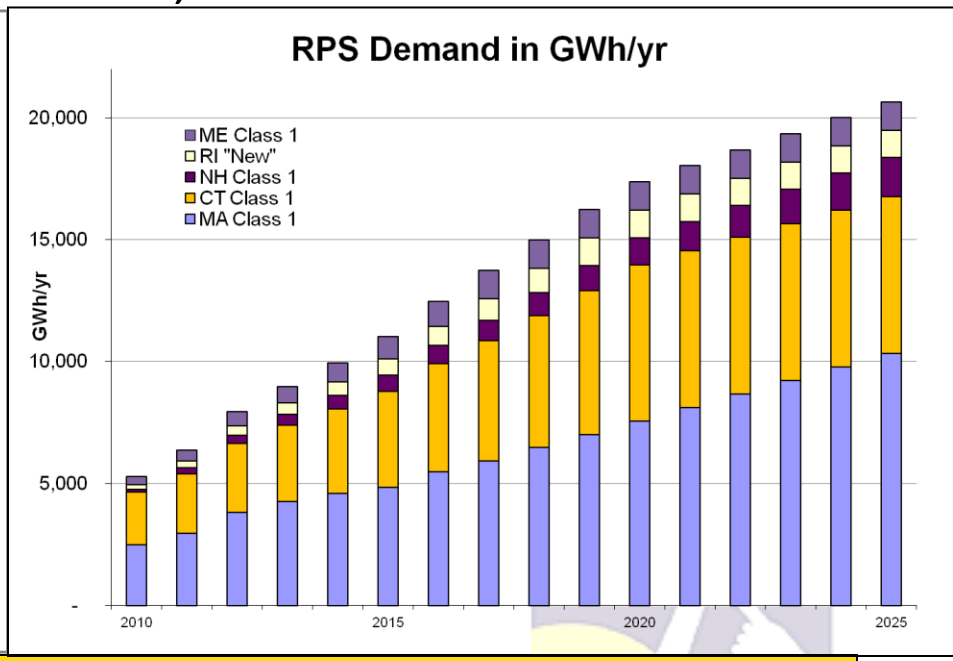
●	Majority
◖	Some
○	Very few

*Minor distinctions omitted

NE Class I RPS Targets

- "Class I" RPS in NE:
  - MA-I, NH-1, ME-I & RI "new" all **growth** tiers
  - CT-I has elements of **growth** & **maintenance**
- In 2020 CT-I ~⅓ of regional Class –I, share shrinks thereafter





SEA forecast using ISO-NE 2010 CELT Report load forecast, Base case net of passive demand response

NOTE: NH Class 1 RPS target excludes Useful Thermal carve-out of 2.6% by 2025.

Current Class I RPS Policies are Designed to…

	Common	Also designed to…			
MA-I, RI-New NH-I	More Renewable Energy @ least cost	Support development of selected in-state resources through RPS carve-out ➔ ex: MA: Solar; NH: Useful Thermal			
ME-I		Support older plants "Refurbished &/or Operating Beyond Useful Life"			
CT-I		Support local clean energy industry *(Fuel Cells using natural gas)*	Encourage existing small hydro to change operation to run-of-river (trading less energy, capacity value for environmental benefits) ✓	Support older plants (LFG & wind) ✓	Encourage older Biomass plants to continue operating while reducing NOx emissions ✓

Observations:

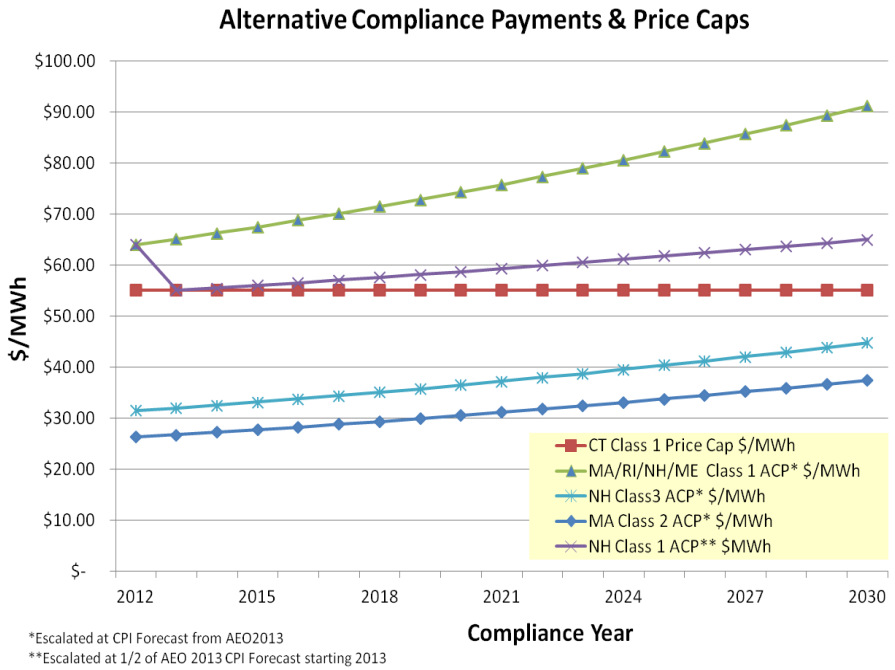
- Design reflect the *implicit* objectives. What is CT *explicitly* trying to accomplish?
- Differential eligibility + price differentials can cause a policy to become a regional sink for certain supply categories (✓)

Comparison of Banking & Borrowing

State	Banking of Excess Compliance	Borrowing from Following Yr for Shortage
CT	Up to 30% per class, can be used for 2 years	May borrow RECs from Q1-Y2
MA	Up to 30%,10% for solar, can be used for 2 years	n/a
RI	Up to 30% per class, can be used for 2 years	n/a
NH	Up to 30% per class, can be used for 2 years	May borrow RECs from Q1-Y2
ME	May satisfy one-third of RPS requirement with banked RECs from the prior year	n/a

Different Alternative Compliance Payment (ACP) between States Impact RPS Compliance Dynamics

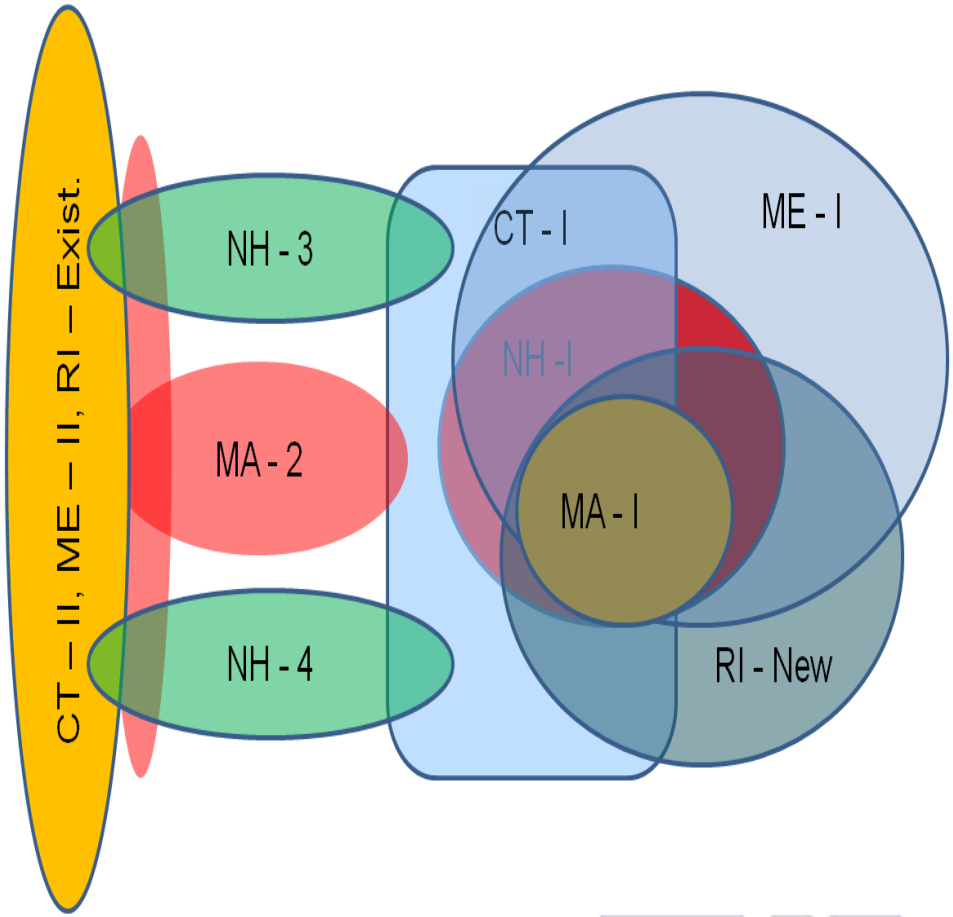
- ACP level = upper bound on RPS compliance cost/MWh (a price cap).
- Degree of ACPs reliance depends on:
  - Supply v. demand balance, and
  - Relative ACP levels vs. other states in the region
- Under a REC shortage:
  - Available RECs will migrate to higher value markets.
  - REC prices differ by state largely due to different ACP levels.
- Utilities with LT contracting obligations can retain RECs (rather than resell into the market) to stabilize cost, reduce exposure to ACP (ex: RI, MA)



Why does eligibility matter? (1)

Because REC Markets Linked but Balkanizing

- **Differing eligibility** is the primary driver causing state REC prices divergence;
- Degree of swing is sensitive to supply and demand;
- Market linkages also affected by ACPs, contracting policies and banking/ borrowing rules.



Why does eligibility matter? (2)
The Market Liquidity Dilemma

- Variation in state eligibility is considered by many to be a major blemish on RPS policies
  - Stratification & balkanization, REC market fragmentation frustrates creation of liquid RPS REC market
  - Load-serving entities, customers, traders, and *some* investors, developers and policymakers prefer homogenous market
- However… Each state RPS was adopted in large part to achieve some degree of localized benefits…

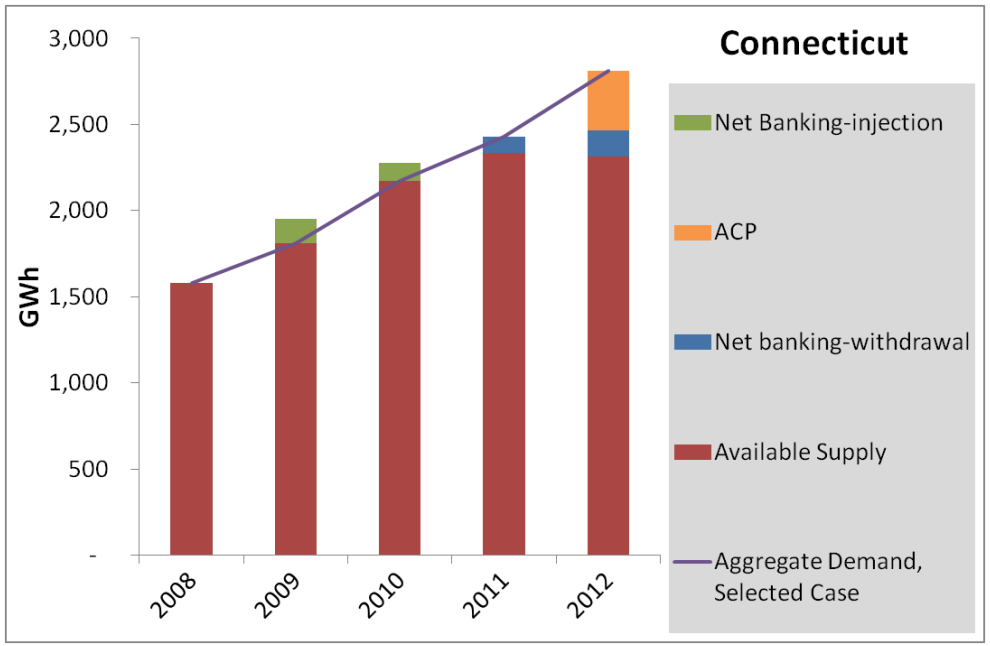
  ➔ Unrealistic to ignore state motivations
- Efforts so far to 'unify' REC markets have gone nowhere

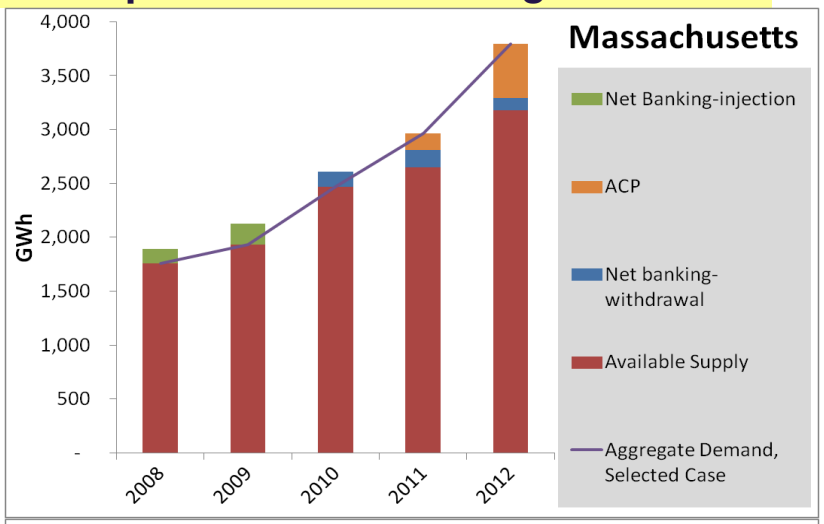
  ➔Are unified state markets a feasible goal?

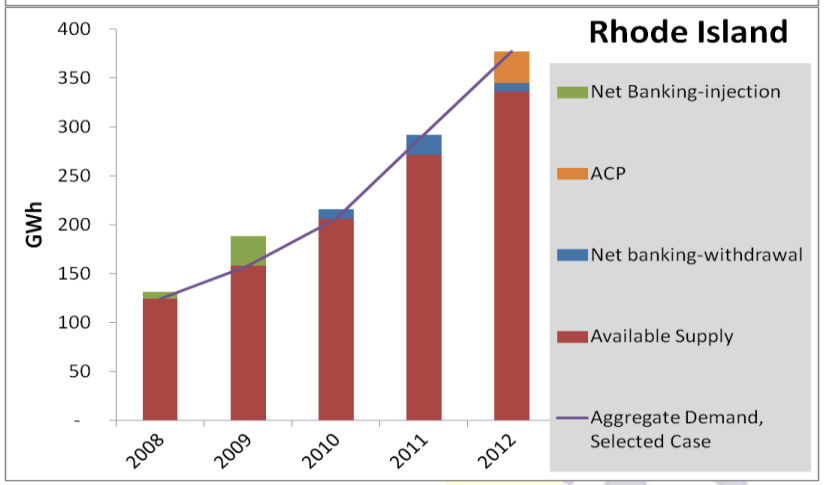
5d. CT RPS Experience, History, Expectations

Supply vs. Demand

CT, and Region, Has Moved from Surplus back to Shortage



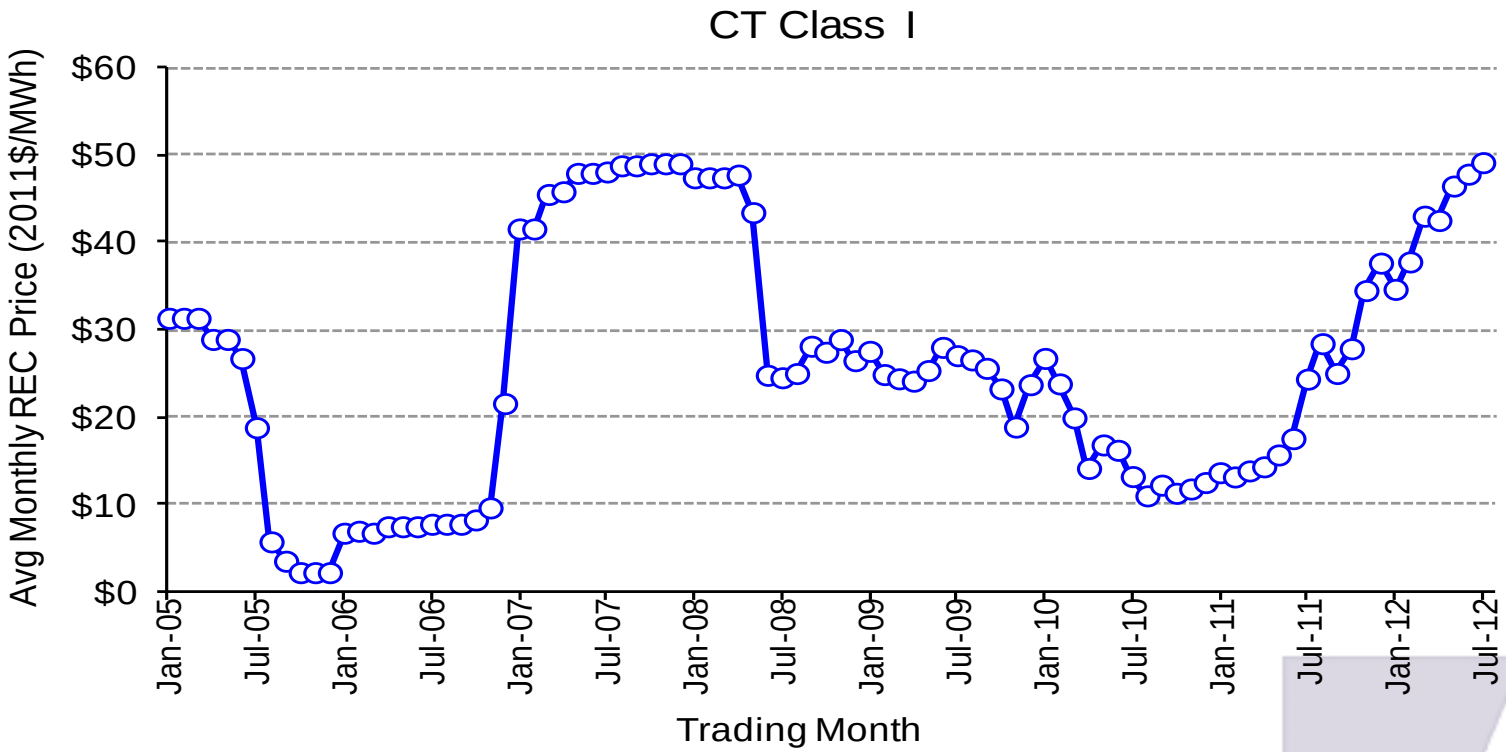




Banking was not allowed in CT until 2009

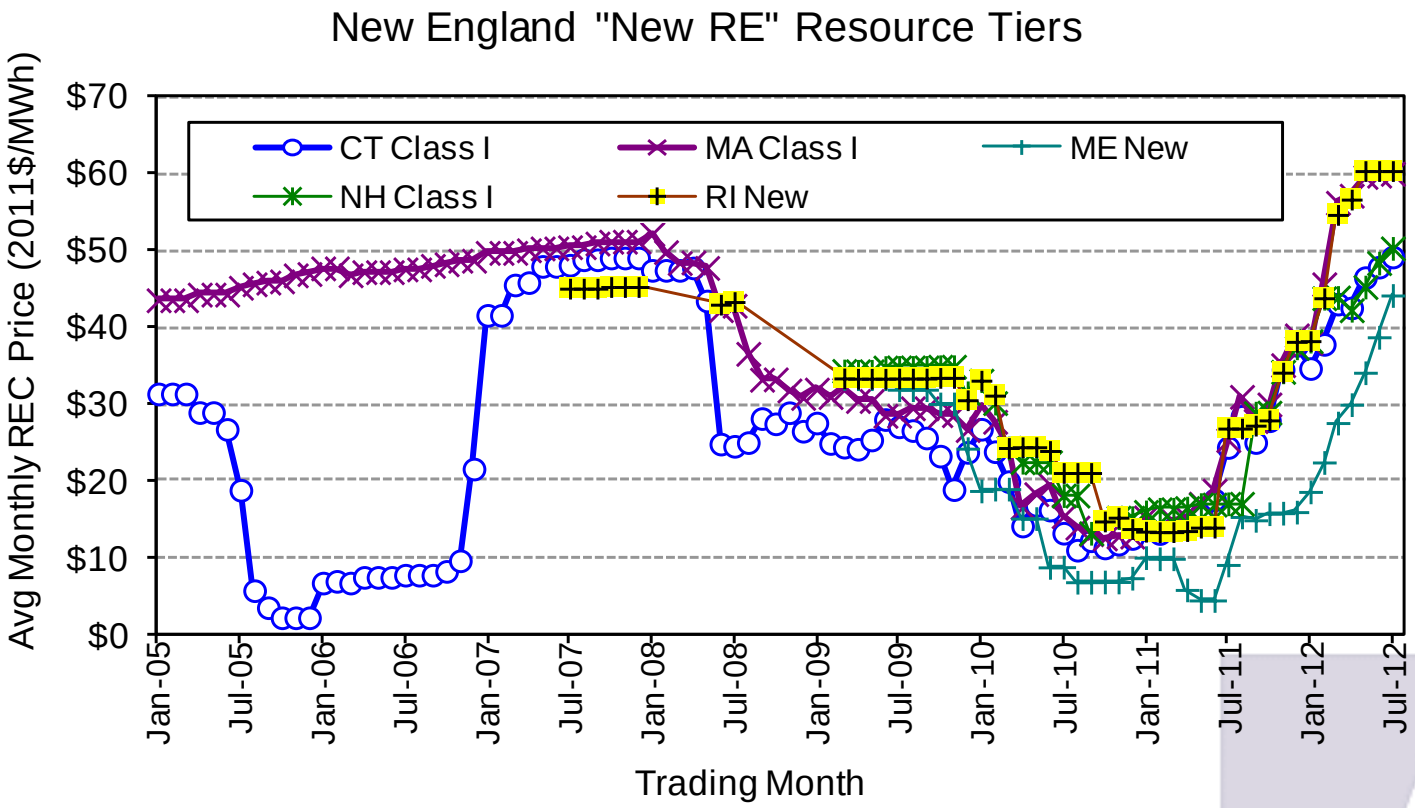
Source: REMO 2012#3 *2010 CT Compliance estimated based on partial reported data

CT Class I REC Prices Particularly Volatile…



Sources: Evolution Markets (through 2007) and Spectron (2008 onward). Plotted values are the last trade (if available) or the mid-point of Bid and Offer prices, for the current or nearest future compliance year traded in each month.

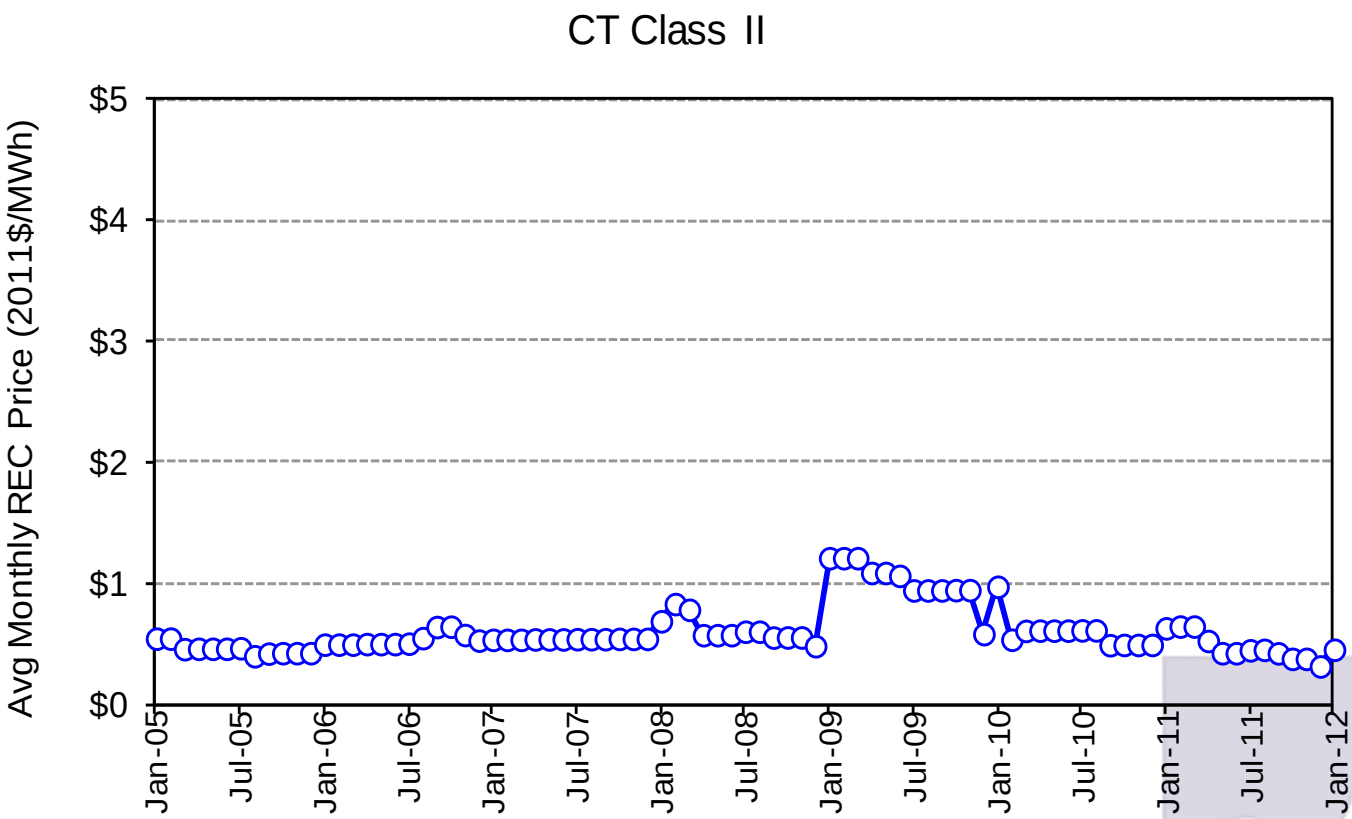
…Compared to REC Prices for Similar Tiers in the Region



Sources: Evolution Markets (through 2007) and Spectron (2008 onward). Plotted values are the last trade (if available) or the mid-point of Bid and Offer prices, for the current or nearest future compliance year traded in each month.

CT-II Prices Very Low, Very Stable

Supply >> Demand, no Target Growth



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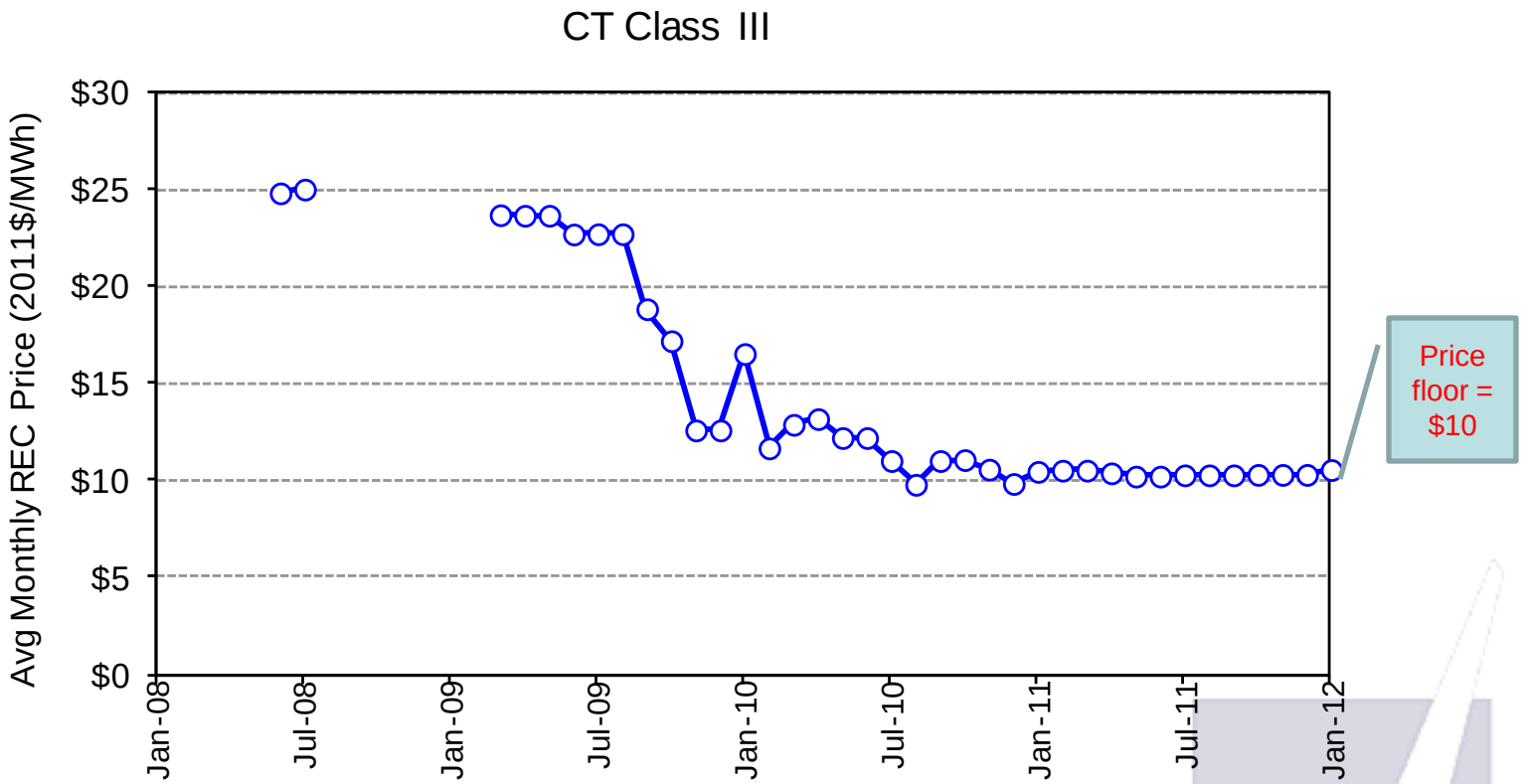
CT-III Price at Floor



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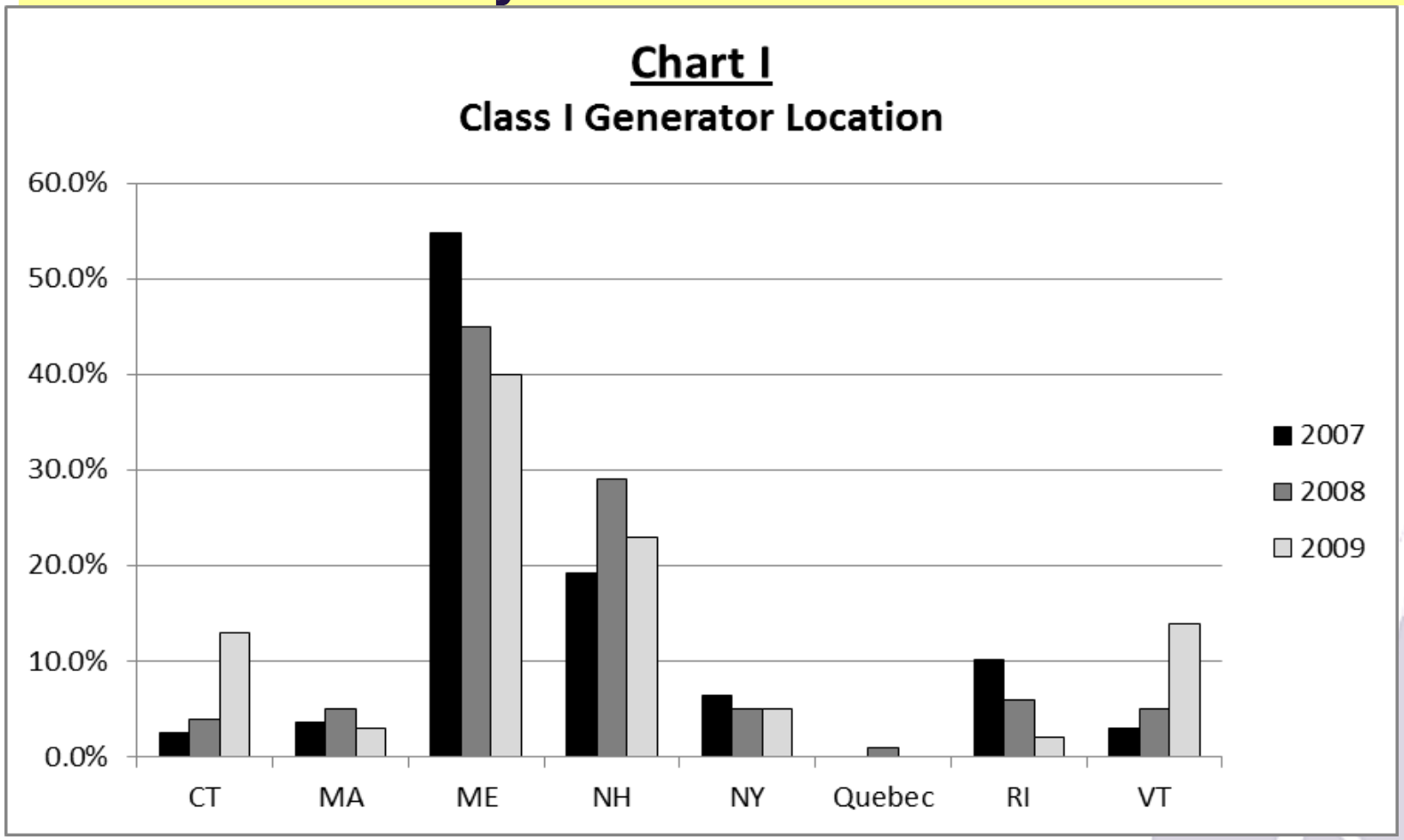
Historical CT Class I RPS Compliance

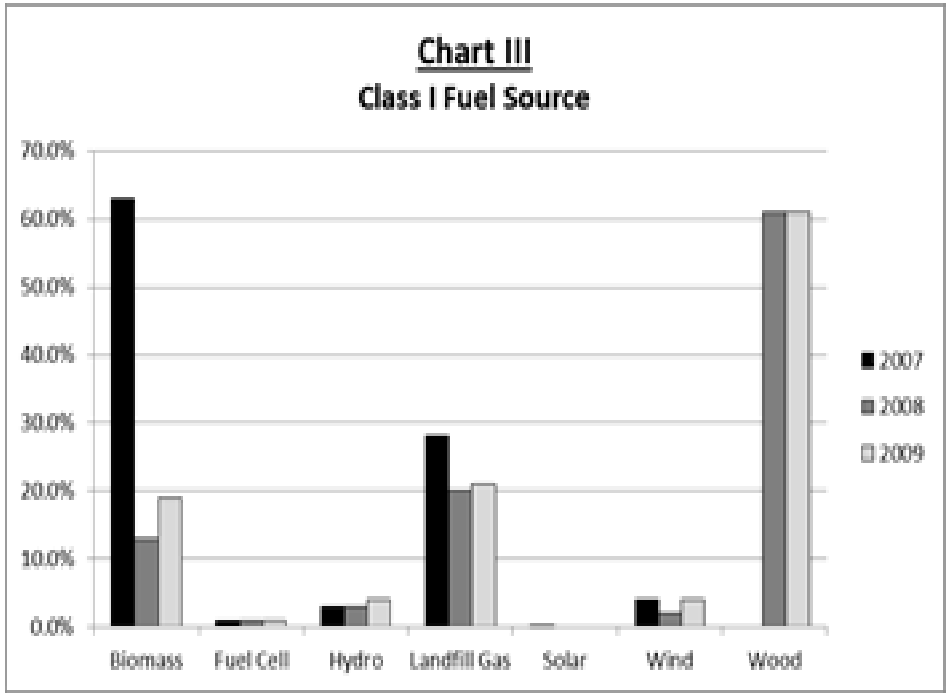
Nearly All From Out of State



Source: DPUC RPS Compliance Report 2009 (2010 and 2011 not yet complete)

Past CT-I RPS Compliance Mostly Ineligible for Other Class I Targets…

But This is Changing



Observations: Through 2009…

- Nearly all "existing" in other states
- NG Fuel Cells and LFG-by-pipeline only eligible in CT

→ Almost no "new" generation driven by CT Class I

The Future looks different…

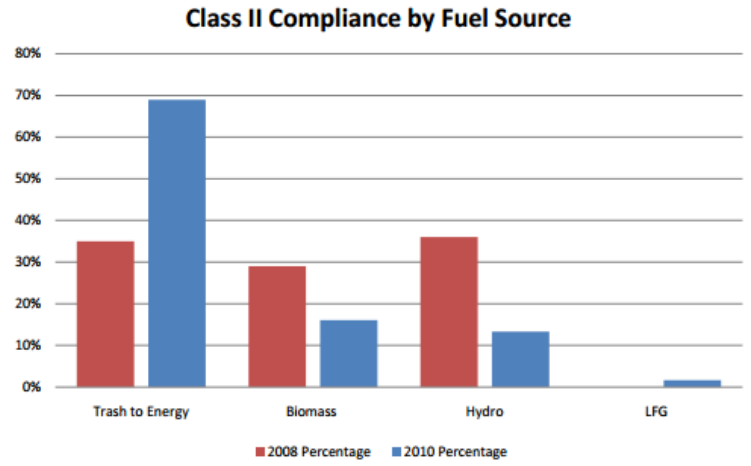
- (a) increasing demand is now outstripping "existing" supply,
- (b) Class I prices have risen above NH-3, MA-2 "existing" tier prices – temporary ending past migration from CT Class 1 to NH-3 and MA-2, and
- (c) expansion of in-state programs (LREC, ZREC, & P.A.11-80) boost proportion of new CT-I RECs in CT

Source: CT DPUC 2009 (2010 and 2011 not yet complete)

Historic Generation Mix for Class II Compliance

Class II
Fuel Sources Used

Since 2008, share of trash to energy resources has nearly doubled



- Between 2.5MM – 3.5MM credits Class II credits are currently available for demand of ~900K RECs, resulting in Class II prices under $1/REC

Source: CT Docket # 11-09-03; CT Docket # 09-10-09

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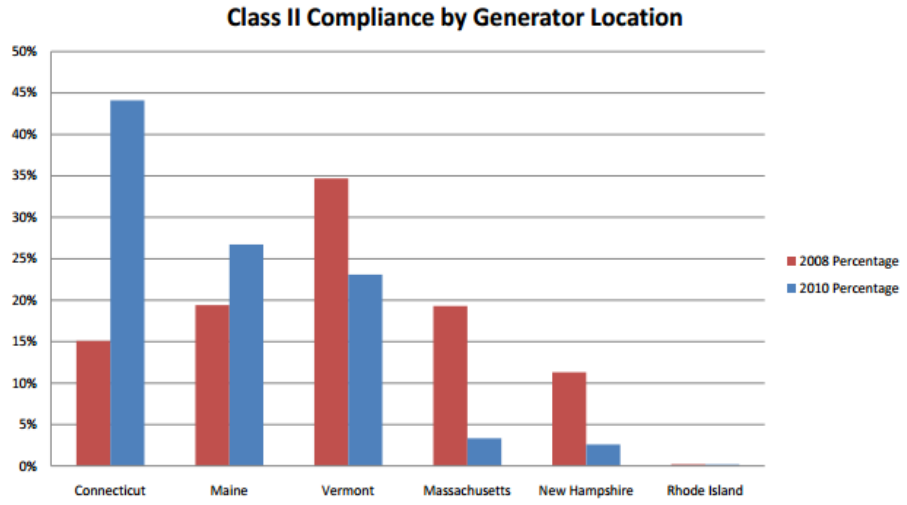
Class II
Location of Renewable Generation

CT's share of Class II resources has increased as other states (MA, NH) have designed policies to accomplish their specific state-level environmental objectives



Source: CT Docket # 11-09-03; CT Docket # 09-10-09

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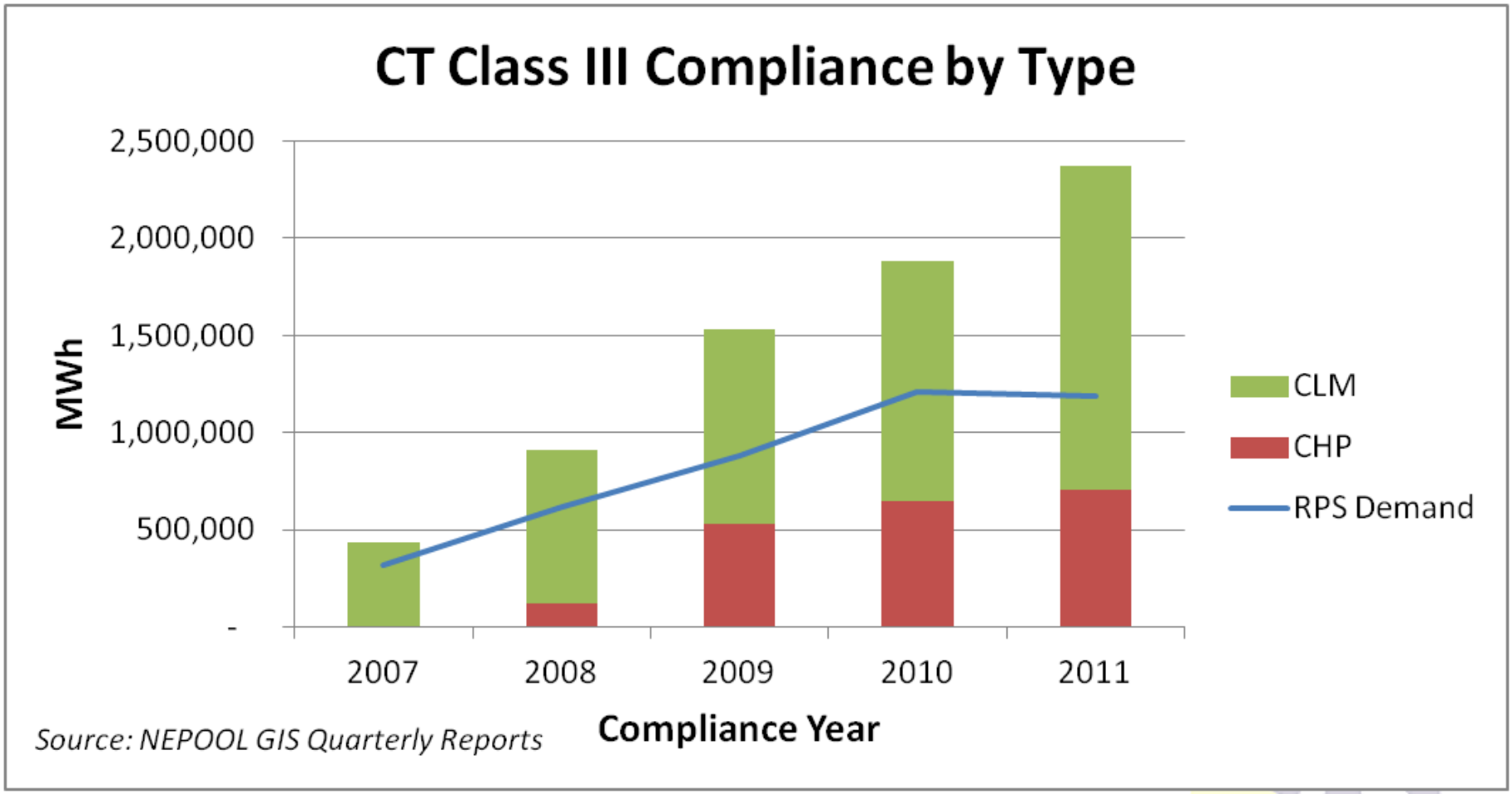
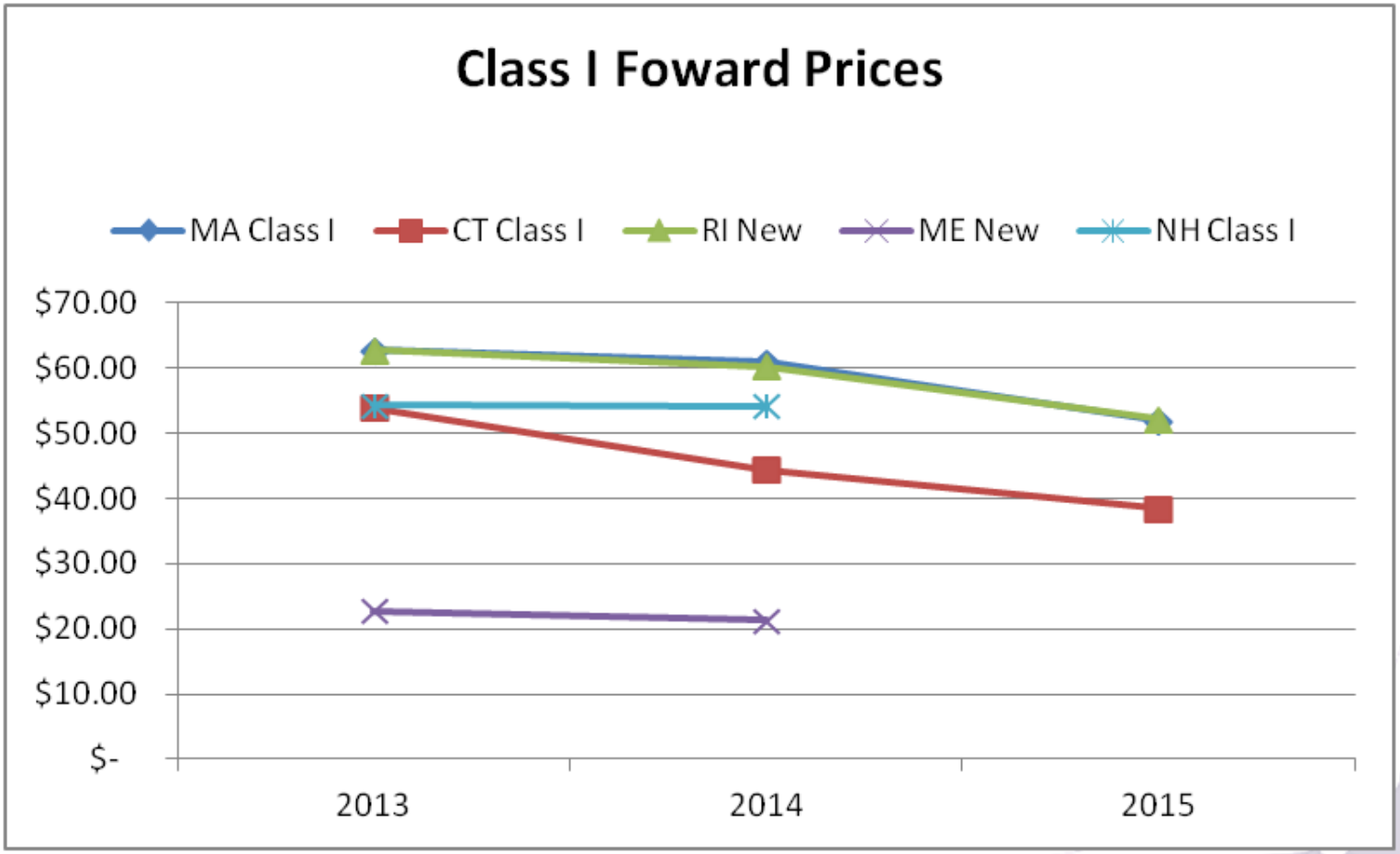
Source: Ken Nelson (Element Markets) Presentation to CT Business and Industry Assn., 10/12
http://www5.cbia.com/events/wp-content/uploads/2012/10/Panel-III-130-p-m-Ken-Nelson.pdf

Class III Historic Compliance by Project Type

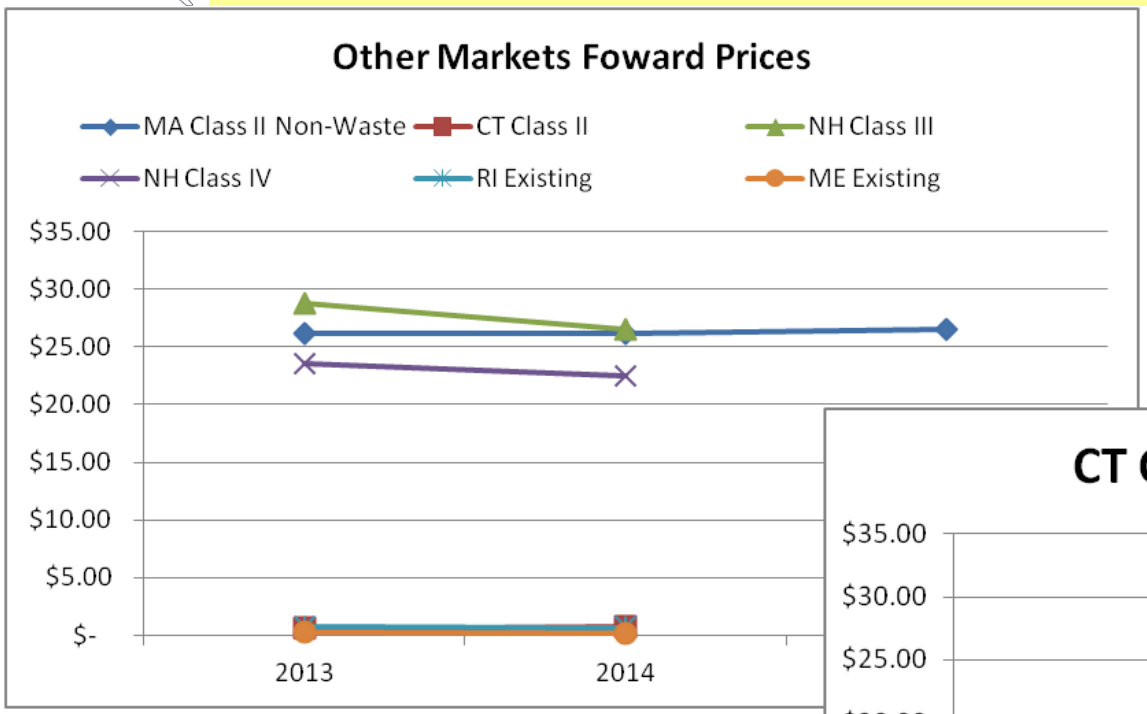


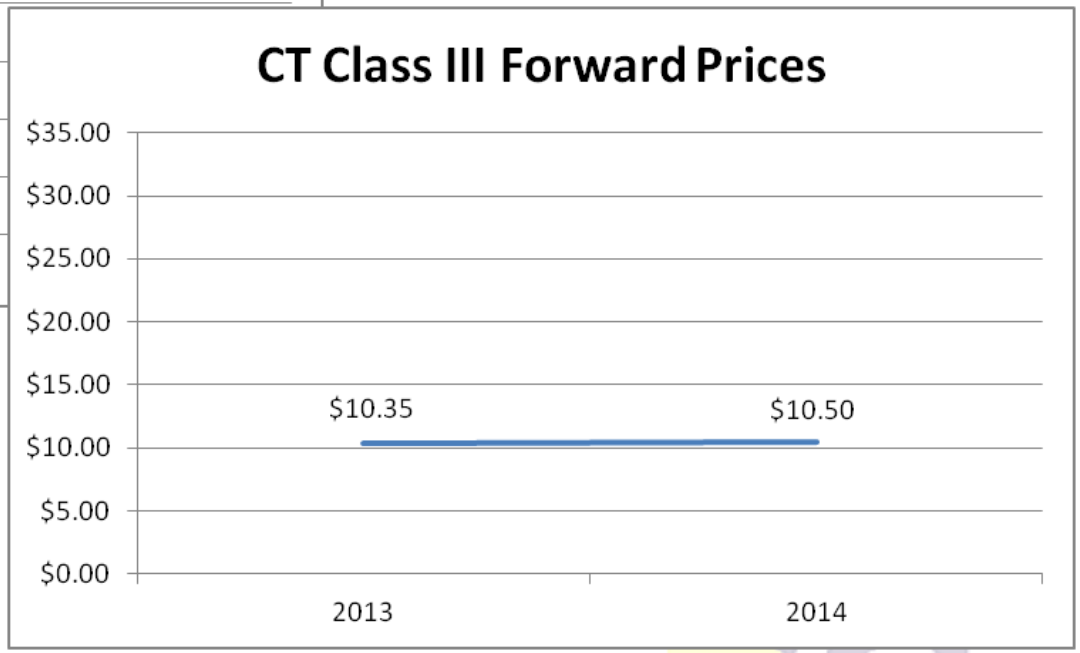
Class I Forward REC Prices



Data Source: Derivedfrom ICAP United and Spectron Futures February, 8, 2013

Class II and III Forward REC Prices





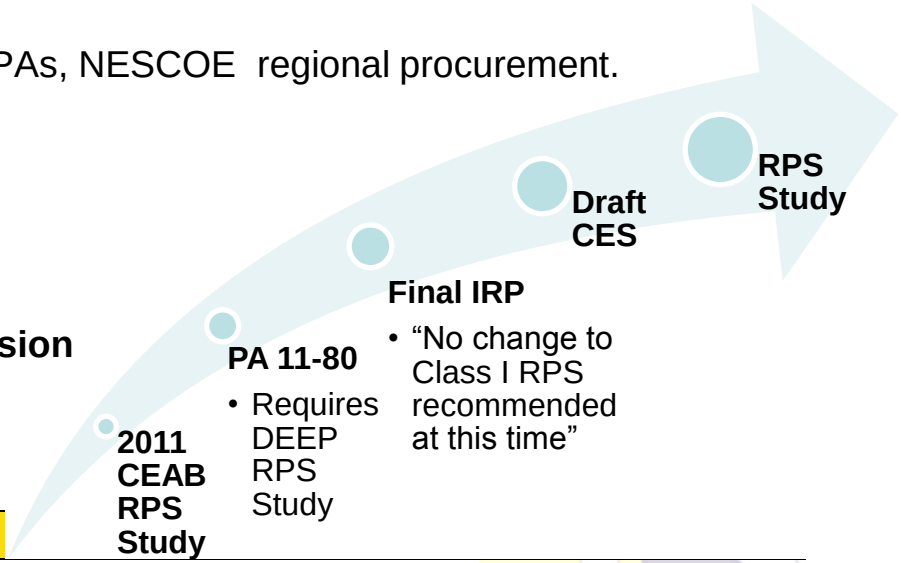
Data Source: Derived from ICAP United and Spectron Futures February, 8, 2013

CT RPS Study *Contemplates* Changes

Pending release of study, perception of political risk heightened

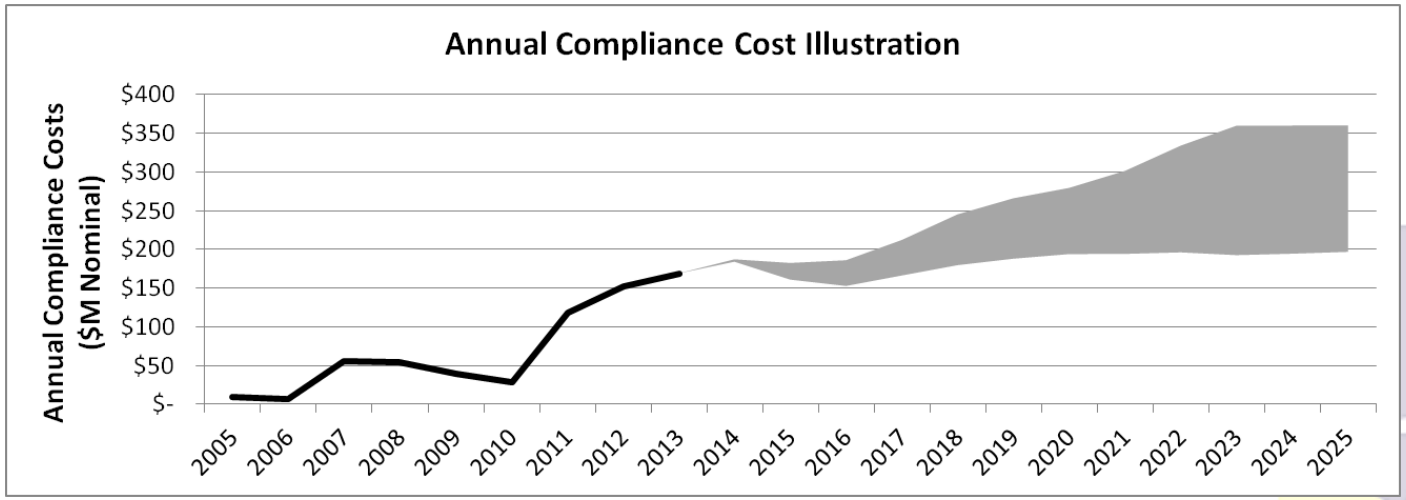
- **DEEP Comprehensive RPS Review underway, to examine, consider many options: *What's been said…***
  - Explore whether/which modifications might be considered if RPS become "unnecessarily costly."
  - ↓ ratepayer costs, exposure to ACP.
  - Develop & implement policies designed to ↓ RE cost, incl. reverse auctions, declining subsidies, & PPAs → to be competitive with fossil fuels over time.
  - Feasibility of ↑ targets.
  - Canadian hydro= major opportunity; look @ benefits, costs, impacts as Class I, explore TX rqmnts.
  - Broadening CT-I definition (large hydro? EE?).
  - To ensure CT meets RPS targets, consider LT PPAs, NESCOE regional procurement.
  - ↑ clean energy generated in-state.
  - Impact of developing large biomass resources.
  - Help meet Global Warming Solutions Act goals.
  - Class II and III changes.

  → **Expect draft release shortly for legislative session**



CT Class I RPS – Future Total Compliance Cost Trends

- RPS is currently being reviewed for cost impacts
- Potential Changes:
  - DEEP/PURA looking for ways to reduce ratepayer impacts
  - Possible changes to targets &/or eligibility
  - Choices could lead to wide range of costs and impacts



Source: SEA