

Agenda Item 4.0

PSPC Meeting 279

September 9, 2010

Installed Capacity Requirement (ICR) & Related Values for the

- **2011/12 Third Annual Reconfiguration Auction (2011/12 ARA3) &**
- **2012/13 Second Annual Reconfiguration Auction (2012/13 ARA2)**

Objective of this Presentation

- Review the NEPOOL Committee review/vote schedule and FERC filing schedule
- For the 2011/12 3rd Annual Reconfiguration Auction (ARA2) and 2012/13 2nd Annual Reconfiguration Auction (ARA3), review the ISO proposed:
 - Installed Capacity Requirement (ICR),
 - Local Resource Adequacy Requirement (LRA),
 - Transmission Security Analysis (TSA) [As part of Agenda Item 3.0]
 - Local Sourcing Requirement (LSR), and
 - Maximum Capacity Limit (MCL),
- The ICR, LSR and MCL are collectively the ICR Values

ICR Review and FERC Filing Schedule

- PSPC review of all assumptions – **Aug 19, 2010**
- PSPC review of ISO recommendation of ICR values – **Sep 9, 2010**
- RC review/vote of ISO recommendation of ICR values – **Oct 20, 2010**
- PC review/vote of ISO recommendation of ICR values – **Nov 18, 2010**
- File with the FERC – by **Dec 1, 2010**
- 2011/12 3rd Annual Reconfiguration Auction – **March 1, 2011**
- 2012/13 2nd Annual Reconfiguration Auction – **May 2, 2011**

ICR Values for the 2011/12 ARA3 and 2012/13 ARA2

ISO Proposed ICR (MW)

	2011/12 ARA3	2012/13 ARA2
Calculated ICR	32,175	32,841
Net ICR	31,264	31,927
Reserve Margin Gross-up Adjustment	288	0
Final Net ICR	31,552	31,927

ICR Calculation Details

Total Capacity Breakdown		
	2011/12 ARA3	2012/13 ARA2
Internal Installed Capacity	29,561	29,561
Tie Benefits	1,800	1,665
Imports/Sales	1,085	1,085
Demand Resources	2,355	2,355
OP 4 Voltage Reduction - Min Res	203	208
Expansion Unit Capacity	-	-
Capacity	35,004	34,874
Installed Capacity Requirement Calculation Details		
	2011/12 ARA3	2012/13 ARA2
Annual Peak	27,660	28,165
Total Capacity	35,004	34,874
Tie Benefits	1,800	1,665
HQICCs	911	914
OP4 - Action 6 & 8 (Voltage Reduction)	403	408
Minimum Reserve Requirement	(200)	(200)
ALCC	1,536	947
Installed Capacity Requirement	32,175	32,841
Net ICR	31,264	31,927
Reserve Margin Gross-up Adjustment	288	-
Reserve Margin with HQICCs	17.4%	16.6%
Reserve Margin without HQICCs	14.1%	13.4%

$$\text{Installed Capacity Requirement (ICR)} = \frac{\text{Capacity} - \text{Tie Benefits} - \text{OP4 Load Relief}}{1 + \frac{\text{ALCC}}{\text{APk}}} + \text{HQICCs}$$

- ALCC is the “Additional Load Carrying Capability” used to bring the system to the 0.1 Reliability Criterion.
- Reserve Margin values for 2011/12 ARA3 are calculated with the RM Gross-up Adjustment included.

Reserve Margin Gross-up Adjustment for 2011/12 ARA3

- Adjustment is made to ICR, LSR and MCL to account for the 16.1% RM Gross-up given to DR and NYPA imports in the auction
- Values for the RM Gross-up adjustment are shown on the next slide
- RTEG are not included in the DR adjustment calculation since only 600 MW of RTEG are counted toward meeting the ICR and there is an excess amount

Reserve Margin Adjustment Calculation Details (MW)

- DR Reserve Margin at 16.1%:

Load Zone	On-Peak	Seasonal Peak	RT Demand Response	RT Emergency Gen	Total
MAINE	3.628	-	28.534	-	32.162
NEW HAMPSHIRE	7.701	-	5.146	-	12.847
VERMONT	9.227	-	3.231	-	12.458
CONNECTICUT	15.411	30.770	38.980	-	85.162
RHODE ISLAND	7.984	0.241	7.629	-	15.854
SOUTH EAST MASSACHUSETTS	14.190	0.241	19.057	-	33.488
WEST CENTRAL MASSACHUSETTS	12.612	2.101	18.452	-	33.166
NORTH EAST MASSACHUSETTS & BOSTON	22.070	-	26.978	-	49.048
Total New England	92.824	33.353	148.006	-	274.184

- NYPA Imports Reserve Margin at 16.1% = 13.54 MW
- Total Reserve Margin Gross-up Adjustment for 2011/12 ARA3 ICR: 274 MW + 14 MW = 288 MW
- Margin Gross-up Adjustment for DR is applied to:
 - CT LSR = 85 MW
 - NEMA/Boston LSR = 49 MW
 - ME MCL = 32 MW

Effect of Assumptions Updates on ICR

Assumption	2011/2012 ARA3		2011/2012 ARA2		Effect on ICR (MW)
Tie Benefits	173 MW New York		173 MW New York		-
	716 MW Maritimes		716 MW Maritimes		
	911 MW Quebec (HQICCs)		911 MW Quebec (HQICCs)		
	1,800 MW		1,800 MW		
	MW	Weighted Forced Outage	MW	Weighted Forced Outage	
Generation & IPR	29,560 MW	4.6%	32,207 MW	4.7%	27
Demand Resources	2,355 MW	16.6%	2,529 MW	17.2%	-153
Imports & Sales	1,085 MW	1.7%	2,284 MW	2.6%	52
	MW		MW		
Load Forecast	27,660		28,575		-646
	MW	%	MW	%	
OP 4 5% VR	403	1.50%	654	2.36%	233
Updated Skewness Model					480
Calculated ICR	32,175		32,336		-161

- Begin with 2011/12 ARA2 ICR model and update with 2011/12 ARA3 ICR assumptions one at a time to gauge their effect on the ICR

TSA Requirements

- See PSPC Agenda Item 3.0

LRA Calculation Details for Connecticut

Local Resource Adequacy Requirement - Connecticut			
Connecticut Zone		2011/12 ARA3	2012/13 ARA2
Resource _z	[1]	8,365	8,365
Proxy Units _z	[2]	0	0
Proxy Units Adjustment _z	[3]	0	0
Firm Load Adjustment _z	[4]	1,300	1,225
FOR _z	[5]	0.0607	0.0607
LRA _z	[6]=[1]+[2]-([3]/(1-[5]))-([4]/(1-[5]))]	6,981	7,061
Rest of New England Zone			
resource	[7]	24,635	24,635
Proxy Units	[8]	0	0
Proxy Units Adjustment	[9]	0	0
Firm Load Adjustment	[10] = -[4]	-1,300	-1,225
Total System Resource	[11]=[1]+[2]-[3]-[4]+[7]+[8]-[9]-[10]	33,001	33,001

- Total Resources excludes HQICCs

LRA Calculation Details for NEMA/Boston

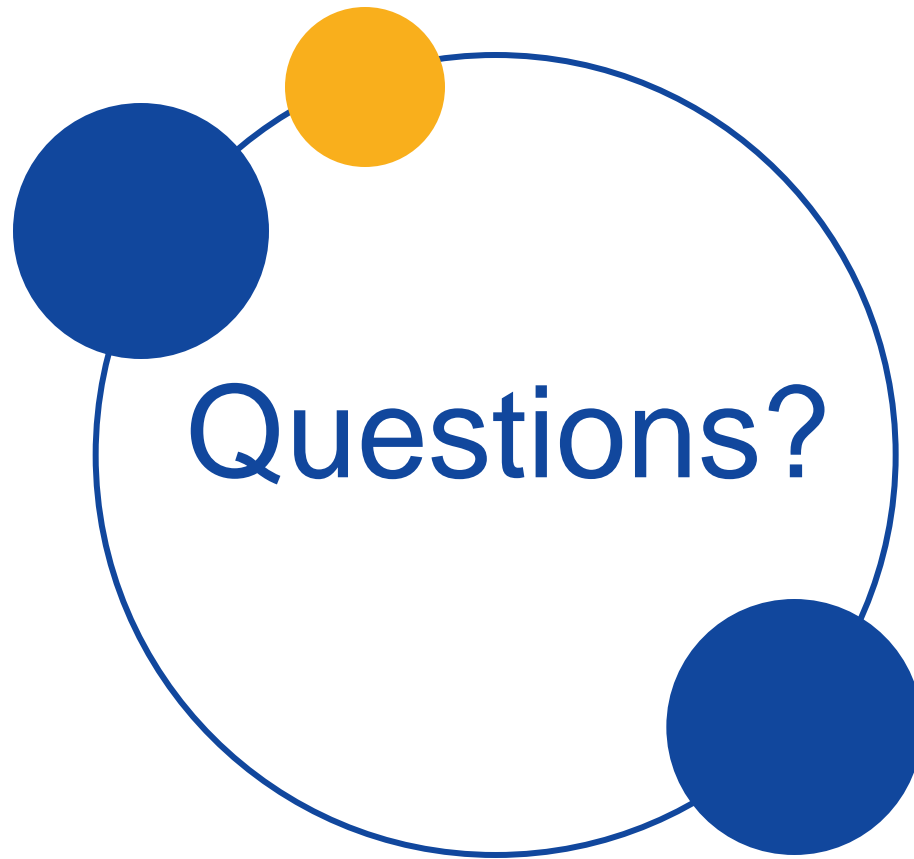
Local Resource Adequacy Requirement - NEMA/BOSTON			
NEMA/BOSTON Zone		2011/12 ARA3	2012/13 ARA2
Resource _z	[1]	3,344	3,344
Proxy Units _z	[2]	0	0
Proxy Units Adjustment _z	[3]	0	0
Firm Load Adjustment _z	[4]	1,050	980
FOR _z	[5]	0.0688	0.0688
LRA _z	[6]=[1]+[2]-([3]/(1-[5]))-([4]/(1-[5]))]	2,217	2,292
Rest of New England Zone			
Resource	[7]	29,656	29,656
Proxy Units	[8]	0	0
Proxy Units Adjustment	[9]	0	0
Firm Load Adjustment	[10] = -[4]	-1,050	-980
Total System Resource	[11]=[1]+[2]-[3]-[4]+[7]+[8]-[9]-[10]	33,001	33,001

- Total Resources excludes HQICCs

MCL Calculation Details for Maine

Local RA Requirement - RestofNewEngland (for Maine MCL calculation)			
Rest of New England Zone		2011/12 ARA3	2012/13 ARA2
Resource _z	[1]	29,661	29,661
Proxy Units _z	[2]	0	0
Surplus Capacity Adjustment _z	[3]	1,750	1,060
Firm Load Adjustment _z	[4]	-80	120
FOR _z	[5]	0.0567	0.0567
LRA _z	[6]=[1]+[2]-([3]/(1-[5]))-([4]/(1-[5]))]	27,891	28,410
Maine Zone			
Resource	[7]	3,340	3,340
Proxy Units	[8]	0	0
Proxy Units Adjustment	[9]	0	0
Firm Load Adjustment	[10] = -[4]	80	-120
Total System Resource	[11]=[1]+[2]-[4]+[7]+[8]-[9]-[10]	33,001	33,001
Maximum Capacity Limit - Maine			
Commitment Period		2011/12 ARA3	2012/13 ARA2
ICR for New England	[1]	31,264	31,927
LRA _{RestofNewEngland}	[2]	27,891	28,410
Maximum Capacity Limit _y	[3]=[1]-[2]	3,374	3,517

- Total Resources excludes HQICCs
- 2011/12 ARA3 MCL value will have a Reserve Margin Gross-up Adjustment of 32 MW applied



Questions?

Modeling the New England Control Area

The New England ICR is calculated using the Westinghouse Capacity Model

- Internal transmission constraints are not modeled. All loads and resources are assumed to be connected to a single electric bus.
- Internal transmission constraints are addressed through Local Sourcing Requirements and Maximum Capacity Limits.

Assumptions for the 2011/12 ARA3 & 2012/13 ARA2 ICR

- *Load Forecast*
 - Load Forecast distribution
- *Resource Data Based on 2011/12 ARA2 Results*
 - Generating Capacity Resources
 - Intermittent Power Capacity Resources
 - Import Capacity Resources
 - Demand Resources (DR)
- *Resource Availability*
 - Generating Resources Availability
 - Intermittent Power Resources Availability
 - Demand Resources Availability
- *Load Relief from OP 4 Actions*
 - Tie Reliability Benefits
 - HQICCs
 - Maritimes
 - New York
 - 5% Voltage Reduction

Load Forecast Data

- **Load forecast assumption from the 2010 CELT Report Load Forecast**
- **The load forecast weather related uncertainty is represented by a weekly distribution of daily peak loads for calculating system resource adequacy.**
 - Weekly distributions of daily peak loads represented by the expected value (mean), the standard deviation and the skewness.

Load Forecast Data – New England System Load Forecast

Monthly Peak Load (MW) – 50/50 Forecast

Year	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
2011/12	24,575	27,660	27,660	22,370	18,000	19,485	22,225	22,225	21,390	20,046	17,581	19,724
2012/13	25,024	28,165	28,165	22,778	18,045	19,533	22,280	22,280	21,443	20,096	17,624	20,007

There is a distribution associated with each monthly peak. The distribution associated with the Summer Seasonal Peak (July & August) is show below:

Probability Distribution of Annual Peak Load (MW)

Year	10/90	20/80	30/70	40/60	50/50	60/40	70/30	80/20	90/10	95/5
2011/12	26,365	26,595	26,910	27,265	27,660	28,080	28,510	29,125	29,835	30,455
2012/13	26,845	27,080	27,400	27,765	28,165	28,595	29,030	29,655	30,390	31,025

Resource Data – Capacity Modeled in ICR

- Capacity Supply Obligations (CSO) resulting from the 2011/12 ARA2 used to simulate 2011/12 ARA3 and 2012/13 ARA2 ICRs
- Resource data resulting from the 2012/13 FCA was presented for comparison purposes at the August 19, 2010 PSPC Meeting.

See: http://www.iso-ne.com/committees/comm_wkgrps/reliability_comm/pwrsuppln_comm/mtrls/2010/aug192010/icr2011ara3_2012ara2_assumptions_081910.pdf for details.

Resource Data – Generating Capacity Resources (MW)

Load Zone	Summer (MW)
MAINE	2,657.131
NEW HAMPSHIRE	3,702.563
VERMONT	824.005
CONNECTICUT	7,200.469
RHODE ISLAND	2,439.189
SOUTH EAST MASSACHUSETTS	5,300.744
WEST CENTRAL MASSACHUSETTS	3,658.050
NORTH EAST MASSACHUSETTS & BOSTON	2,853.306
Total New England	28,635.457

- Generating capacity resources with supply obligations resulting from the 2011/12 ARA2

Resource Data – Intermittent Power Capacity Resources (MW)

Load Zone	Summer	Winter
MAINE	171.294	257.852
NEW HAMPSHIRE	132.241	171.663
VERMONT	66.567	113.686
CONNECTICUT	368.256	387.937
RHODE ISLAND	3.315	7.223
SOUTH EAST MASSACHUSETTS	80.512	86.140
WEST CENTRAL MASSACHUSETTS	40.475	68.342
NORTH EAST MASSACHUSETTS & BOSTON	62.293	65.659
Total New England	924.953	1,158.502

- Intermittent capacity resources with supply obligations resulting from the 2011/12 ARA2
- Intermittent resources have both summer and winter values modeled

Resource Data – Import Capacity Resources

ID	Import	MW	Interface	EFORd
12450	NYPA - CMR	68.800	New York AC Ties	0.0
12451	NYPA - VT	15.300	New York AC Ties	0.0
12452	VJO - Highgate	200.000	Hydro-Quebec Highgate	1.0
12453	VJO - Phase I/II	70.000	Phase I/II HQ Excess	3.0
14600	Hydro-Québec Control Area	284.000	New Brunswick	1.0
14601	Hydro-Québec Control Area - Phase I/II HQ Excess	391.930	Phase I/II HQ Excess	3.0
14602	Hydro-Québec Control Area - New York AC Ties	54.845	New York AC Ties	0.0
	Total	1084.875		1.7

- Import capacity resources with supply obligations resulting from the 2011/12 ARA2
- System-backed imports modeled as 100% available
- Hydro unit-backed imports modeled with EFORd based on NERC class average data for large Hydro
- Tie lines have 3% forced outage (FO) assumptions for Phase I/II, 1% FO for NB and Highgate and 0% FO for New York AC Ties
- Total EFORd is the weighted average using the Summer Capacity
- NYPA imports are modeled without the Reserve Margin Gross-up

Resource Data – Demand Resources (MW)

Load Zone	On-Peak	Seasonal Peak	RT Demand Response	RT Emergency Gen	Total
MAINE	22.536	0.000	177.229	27.180	226.945
NEW HAMPSHIRE	47.831	0.000	31.963	25.843	105.637
VERMONT	57.313	0.000	20.069	11.512	88.894
CONNECTICUT	95.724	191.117	242.113	267.617	796.570
RHODE ISLAND	49.589	1.496	47.384	62.586	161.055
SOUTH EAST MASSACHUSETTS	88.140	1.496	118.363	60.543	268.543
WEST CENTRAL MASSACHUSETTS	78.337	13.053	114.610	80.635	286.634
NORTH EAST MASSACHUSETTS & BOSTON	137.081	0.000	167.563	116.436	421.080
Total New England	576.550	207.162	919.295	652.352	2355.358

- The DR capacity shown is the DR supply obligation minus Reserve Margin Gross-up from the results of the 2011/12 ARA2
- Includes the Transmission and Distribution (T&D) Loss Adjustment (Gross-up) of 8%.

Resource and Load Forecast Assumptions for the LRA & MCL Calculations

Type of Resource	New England	Connecticut	NEMA/Boston	Maine
Generating Resources	28,635.457	7,200.469	2,859.846	2,657.131
Intermittent Power Resources	924.953	368.256	63.244	171.445
Demand Resources	2,355.358	796.570	421.080	226.945
Import Resources	1,084.875	-	-	284.000
Total MW Modeled in LRA and MCL	33,000.643	8,365.295	3,344.170	3,339.521
2011/12 Load Forecast 50/50	27,660	7,275	5,655	2,065
2012/13 Load Forecast 50/50	28,165	7,390	5,740	2,105

- Total Resources excludes HQICCs

Availability Assumptions - Generating Resources

- **Forced Outages Assumption**

- Each generating unit's Equivalent Forced Outage Rate on Demand (non-weighted EFORd) modeled
- Based on a 5-year average (December 2004 – November 2009) of generator submitted Generation Availability Data System (GADS) data
- NERC GADS Class average data will be used for immature units

- **Scheduled Outage Assumption**

- Each generating unit weeks of Maintenance modeled
- Based on a 5-year average (January 2005 – December 2009) of each generator's actual historical average of planned and maintenance outages scheduled at least 14 days in advance
- NERC GADS Class average data will be used for immature units

- **Same per unit values as those calculated for 2013/14 ICR**

Availability Assumptions - Generating Resources

Resource Category	Summer MW	Assumed Average EFORd Weighted by Summer Ratings	Assumed Average Maintenance Weeks Weighted by Summer Ratings
Combined Cycle	10,474	4.38	5.9
Fossil	8,646	7.41	4.1
Nuclear	4,292	1.39	3.1
Hydro (Includes Pumped Storage)	2,751	1.80	2.7
Combustion Turbine	2,175	6.64	2.0
Diesel	210	5.92	1.1
Miscellaneous	86	7.26	3.8
Total System	28,635	4.79	4.3

- Assumed summer MW weighted EFORd and Maintenance Weeks are shown by resource category for informational purposes. In the LOLE simulations, individual unit values are modeled.

Availability Assumptions - Intermittent Power Resources

- Intermittent Power Resources are modeled as 100% available since their outages have been incorporated in their 5-year historical output used in their ratings determination.

Availability Assumptions - Demand Resources (%)

Load Zone	On-Peak	Seasonal Peak	RT Demand Response	RT Emergency Gen
MAINE	100	-	100	100
NEW HAMPSHIRE	100	-	74	74
VERMONT	100	-	99	45
CONNECTICUT	100	100	76	87
RHODE ISLAND	100	100	48	17
SOUTH EAST MASSACHUSETTS	100	100	56	58
WEST CENTRAL MASSACHUSETTS	100	100	67	72
NORTH EAST MASSACHUSETTS & BOSTON	100	-	72	87

- DR performance values are those calculated for the 2013/14 ICR
- Weighted average performance of all DR is 83%
- For more information on the DR performance assumption calculation see: http://www.iso-ne.com/committees/comm_wkqrps/reblty_comm/pwrsuppln_comm/mtrls/2010/feb182010/dr_performance_fca4_2_18_2010.pdf

OP 4 Assumptions - Tie Reliability Benefits (MW)

Control Area	2011/12		2012/13	
	Summer	Winter	Summer	Winter
Québec - Phase II	911	911	914	914
Québec - Highgate	-	-	6	6
Maritimes	716	716	609	609
New York	173	173	136	136
Total	1,800	1,800	1,665	1,665

- **Results of the 2011/12 and 2012/13 FCA Tie Benefits studies**
- **Modeled with Forced Outage assumptions of 3% for Québec, 1% for Maritimes, and 0% for New York due to tie line unavailability**

OP 4 Assumptions - Action 6 and 8 Voltage Reduction (MW)

	Peak Load	Passive DR	Action 6 & 8 5% Voltage Reduction
2011/12 Summer	27,660	780	403
2011/12 Winter	22,225	764	322
2012/13 Summer	28,165	969	408
2012/13 Winter	22,280	950	320

- Formula is: $(50/50 \text{ Peak load} - \text{Passive DR}) * 1.5\%$

Summary of all MW Modeled in the ICR Calculations

Type of Resource	2011/12	2012/13
Generating Resources	28,635.457	28,635.457
Intermittent Power Resources	924.953	924.953
Demand Resources	2,355.358	2,355.358
Import Resources	1,084.875	1,084.875
OP 4 Voltage Reduction	403.000	408.000
Minimum Operating Reserve	(200.000)	(200.000)
Tie Benefits (includes HQICCs)	1,800.000	1,665.000
Total MW Modeled in ICR	35,003.643	34,873.643

Notes:

- Generating Resources is the summer capacity values
- Intermittent Power Resources have both the summer and winter capacity values modeled
- Demand Resources is the summer CSO value excluding the Reserve Margin Gross-up
- Import Resources is the summer CSO value excluding the Reserve Margin Gross-up to the NYPA imports
- OP 4 Voltage Reduction includes both Action 6 and Action 8 MW assumptions.
- Minimum Operating Reserve is the 10-Minute minimum Operating Reserve requirement for ISO Operations



Questions?