Future Representative Installed Capacity Requirements for CCP 2023-2024 through CCP 2027-2028

- *Net Installed Capacity Requirements (NICR)*
- *Local Sourcing Requirements (LSR)*
- *Maximum Capacity Limit (MCL)*

Manasa Kotha

BACKGROUND

- ISO-NE calculates an annual forecast of representative Installed Capacity Requirement (ICR) values for use in planning studies and resource adequacy assessments covering Capacity Commitment Periods (CCPs) beyond the Forward Capacity Market timeframe
- This year's forecast covers the CCPs 2023-2024 through 2027-2028
- The historical values for CCPs 2018-2019 through CCP 2021-2022 are based on the latest values that were filed and approved by FERC and are included in this presentation
- ICR values for CCP 2022-2023 are currently under development, in other words: 'to be determined' (TBD)
- Today we are sharing with you the representative ICR values that ISO-NE has calculated

Objective of this Power Point

To present the representative ICR Values[1] for the forecast period of CCPs 2023-2024 through 2027-2028 using the same capacity and transmission transfer capability assumptions[2] used to develop ICR Values for FCA 12 but with the 2018 – 2027 Forecast Report of Capacity, Energy, Loads and Transmission (2018 CELT) load forecast. The representative ICR Values include:

- Representative Net ICR (NICR)
- Representative values for the Southeast New England (SENE) import-constrained Capacity Zone comprising:
  - Local Resource Adequacy (LRA) Requirements
  - Transmission Security Analysis (TSA) Requirements
  - Local Sourcing Requirements (LSR)
- Representative Maximum Capacity Limit (MCL) values for the Northern New England (NNE) export-constrained Capacity Zone

[1]For this presentation the ICR Values consist of ICR, NICR, LRA, TSA, LSR and MCL

[2]The latest transmission transfer capability assumptions for 2023-2024 through 2027-2028 had no changes from the FCA 12 assumptions

Recap – ICR Calculation Assumptions for CCP 2021-2022

- The actual ICR and related values calculated for the twelfth Forward Capacity Auction (FCA 12) were based on the 2017 CELT load forecast and capacity and transmission assumptions reviewed by the Power Supply Planning Committee (PSPC) and Reliability Committee (RC)
- Three Capacity Zones were modeled for FCA 12
  - The SENE import-constrained Capacity Zone comprised of NEMA/Boston, SEMA and RI
  - The NNE export-constrained Capacity Zone comprised of Maine, New Hampshire and Vermont
  - The rest-of-pool Capacity Zone comprised of Connecticut and Western/Central MA

Helpful Links:

- Summary of all ICR Values can be found on the ISO-NE website at: https://www.iso-ne.com/static-assets/documents/2016/12/summary_of_historical_icr_values.xlsx
- RC presentation on the ICR Values for CCP 2021-2022 (FCA 12) is available here: https://www.iso-ne.com/static-assets/documents/2017/09/a7_icr_and_tie_benefits_for_fca12.zip

Methodology and Assumptions

- The ICR Values (actual and representative) are calculated according to Market Rule 1 Section III.12 *Calculation of Capacity Requirements:* http://www.iso-ne.com/static-assets/documents/2014/12/mr1_sec_1_12.pdf
- Detailed capacity and transmission transfer capability assumptions are included in the Representative ICR Values Calculation Assumptions section of this presentation

Net Installed Capacity Requirements

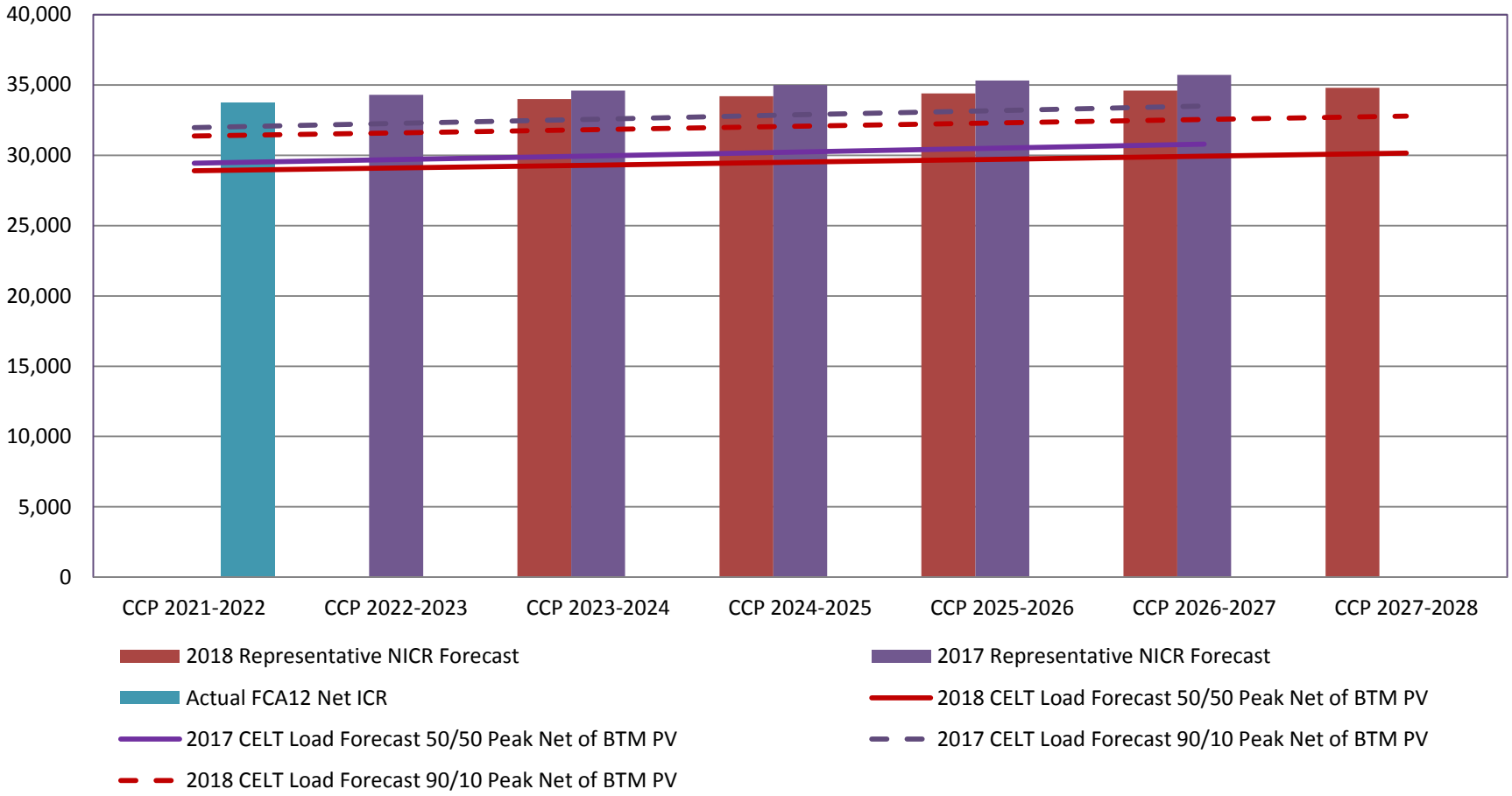
Status	CCP	2018 CELT Forecast 50/50 Peak (MW)[a]	Actual and Representative Future NICR (MW)[b]	Actual Resulting Reserves[c]
A	**2018-2019**	28,427	33,247	17.0%
A	**2019-2020**	28,577	33,407	16.9%
A	**2020-2021**	28,714	33,660	17.2%
A	**2021-2022**	28,893	33,725	16.7%
	2022-2023	**TBD [d]**		
R	**2023-2024**	29,300	34,000	16.0%
R	**2024-2025**	29,506	34,200	15.9%
R	**2025-2026**	29,712	34,400	15.8%
R	**2026-2027**	29,926	34,600	15.6%
R	**2027-2028**	30,141	34,800	15.5%

- [a] The 2018 CELT forecast 50/50 peak loads reflect the load reduction associated with the behind-the-meter PV forecast (BTM PV) from the gross load forecast
- [b] NICR values for 2018-2019 to 2021-2022 are the latest values approved by FERC. These NICR values were developed using the 2017 CELT Report load forecast
- [c] The table shows the resulting reserves percentage calculated using the 2018 CELT Report load forecast. The resulting reserves percentage for 2018-2019 to 2021-2022, when calculated using their respective 2017 CELT Report loads, ranged from 14.6% to 15.6% (These values are not shown in the above table)
- [d] The NICR for 2022-2023 is under development and scheduled to be filed with FERC in November 2018

Notes:

- Status field A: Actual Values, R: Representative Values
- The Representative NICR values are rounded to the nearest 100 MW
- The resulting reserves decrease through time because the amount of capacity resources to meet the Loss of Load Expectation (LOLE) remains relatively constant while the load forecast increases throughout the study period

Comparison of 2018 and 2017 Net ICR Forecasts (MW)



Note:

- This chart compares this year's (2018) representative Net ICR forecast versus the forecast presented to the PAC last year on May 21, 2017, which were calculated with the 2017 CELT load forecast

ICR Calculation Details (MW)

Total Capacity Breakdown	2021-2022 FCA 12	2022-2023	2023-2024	2024-2025	2025-2026	2026-2027	2027-2028
Generating Resources	31,273	TBD	31,273	31,273	31,273	31,273	31,273
Demand Resources	3,212		3,212	3,212	3,212	3,212	3,212
Import Resources	82		82	82	82	82	82
Tie Benefits	2,020		2,020	2,020	2,020	2,020	2,020
OP4 - Action 6 & 8 (Voltage Reduction)	431		429	433	436	440	443
Minimum Reserve Requirement	(200)		(700)	(700)	(700)	(700)	(700)
Proxy Unit Capacity	-		-	-	-	400	400
Total Capacity	**36,818**		**36,316**	**36,320**	**36,323**	**36,727**	**36,730**

Installed Capacity Requirement Calculation Details	2021-2022 FCA 12	2022-2023	2023-2024	2024-2025	2025-2026	2026-2027	2027-2028
Annual Peak	29,436	TBD	29,300	29,506	29,712	29,926	30,141
Total Capacity	36,818		36,316	36,320	36,323	36,727	36,730
Tie Benefits	2,020		2,020	2,020	2,020	2,020	2,020
HQICCs	958		958	958	958	958	958
OP4 - Action 6 & 8 (Voltage Reduction)	431		429	433	436	440	443
Minimum Operating Reserve Requirement	(200)		(700)	(700)	(700)	(700)	(700)
ALCC	735		488	329	153	291	118
Installed Capacity Requirement	**34,683**		**34,958**	**35,144**	**35,348**	**35,588**	**35,788**
Net ICR	**33,725**		**34,000**	**34,185**	**34,390**	**34,630**	**34,830**
Reserve Margin with HQICCs	17.8%		19.3%	19.1%	19.0%	18.9%	18.7%
Reserve Margin without HQICCs	14.6%		16.0%	15.9%	15.7%	15.7%	15.6%

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

Notes:

- ALCC is the "Additional Load Carrying Capability" used to bring the system to the 0.1 Days/Year LOLE reliability criterion
- ICR for 2022-2023 (FCA 13) is currently under development and shown as "To Be Determined (TBD)"

SENE Requirements for CCP 2023-2024 through CCP 2027-2028 (MW)

Status	CCP	LRA	TSA	LSR
A	**2019-2020**	9,473	9,743	9,743
A	**2020-2021**	9,560	9,854	9,854
A	**2021-2022**	9,705	10,018	10,018
	2022-2023	**TBD**		
R	**2023-2024**	10,101	10,320	10,320
R	**2024-2025**	10,230	10,457	10,457
R	**2025-2026**	10,360	10,594	10,594
R	**2026-2027**	10,490	10,738	10,738
R	**2027-2028**	10,600	10,881	10,881

Notes:

- Status field A: Actual Values, R: Representative Values
- LRA/TSA for CCP 2022-2023 (FCA 13) are currently under development and shown as “To Be Determined (TBD)”
- LSR is determined as the higher of the LRA or TSA Requirement

SENE LRA Calculation Details

Local Resource Adequacy Requirement - SENE								
Southeast New England Capacity Zone		**2021-2022 FCA 12**	**2022-2023**	**2023-2024**	**2024-2025**	**2025-2026**	**2026-2027**	**2027-2028**
Resource,	[1]	11,715	TBD	11,715	11,715	11,715	11,715	11,715
Proxy Units,	[2]	0		0	0	0	0	0
Firm Load Adjustment,	[3]	1,848		1,484	1,365	1,245	1,126	1,025
FOR,	[4]	0.081		0.081	0.081	0.081	0.081	0.081
LRA,	[5]=[1]+[2]-([3]/(1-[4]))	**9,705**		**10,101**	**10,230**	**10,360**	**10,490**	**10,600**
Rest of New England Zone								
Resource	[6]	22,852		22,852	22,852	22,852	22,852	22,852
Proxy Units	[7]	0		0	0	0	400	400
Firm Load Adjustment	[8] = -[3]	-1,848		-1,484	-1,365	-1,245	-1,126	-1,025
Total System Resources	[9]=[1]+[2]-[3]+[6]+[7]-[8]	34,567		34,567	34,567	34,567	34,967	34,967

Notes:

- All values in the table are in MW except the Forced Outage Rate (FOR_z)
- ICR Values for 2022-2023 (FCA 13) are currently under development and shown as “To Be Determined (TBD)”

SENE TSA Calculation Details (MW)

TSA Requirement for SENE	2021-2022 FCA 12	2022-2023	2023-2024	2024-2025	2025-2026	2026-2027	2027-2028
Capacity Zone 90/10 Load	**13,413**	TBD	13,688	13,813	13,938	14,069	14,199
Reserves (Largest unit or loss of import capability)	1,413		1,413	1,413	1,413	1,413	1,413
Sub-area Transmission Security Need	14,826		**15,101**	**15,226**	**15,351**	**15,482**	**15,612**
Existing Resources	11,715		11,715	11,715	11,715	11,715	11,715
Assumed Unavailable Capacity	-1,043		-1,043	-1,043	-1,043	-1,043	-1,043
Sub-area N-1 Import Limit	5,700		5,700	5,700	5,700	5,700	5,700
Sub-area Available Resources	16,372		**16,372**	**16,372**	**16,372**	**16,372**	**16,372**
TSA Requirement	**10,018**		**10,320**	**10,457**	**10,594**	**10,738**	**10,881**

$$\text{TSA Requirement} = \frac{\text{(Need – Import Limit)}}{\text{1 – (Assumed Unavailable Capacity / Existing Resources)}}$$

Note:

- ICR Values for 2022-2023 (FCA 13) are currently under development and shown as “To Be Determined (TBD)”

NNE MCL Requirements for CCP 2023-2024 through CCP 2027-2028 (MW)

Status	CCP	MCL
A	**2020-2021**	8,890
A	**2021-2022**	8,790
	2022-2023	**TBD**
R	**2023-2024**	8,618
R	**2024-2025**	8,644
R	**2025-2026**	8,674
R	**2026-2027**	8,708
R	**2027-2028**	8,732

Notes:

- Status field A: Actual Values, R: Representative Values
- MCL for CCP 2022-2023 (FCA 13) is currently under development and shown as “To Be Determined (TBD)”

NNE MCL Calculation Details (MW)

Rest of New England Zone		2021-2022 FCA 12	2022-2023	2023-2024	2024-2025	2025-2026	2026-2027	2027-2028
Resource$_z$	[1]	26,273	TBD	26,273	26,273	26,273	26,273	26,273
Proxy Units$_z$	[2]	0		0	0	0	400	400
Surplus Capacity Adjustment$_z$	[3]	850		575	383	177	337	135
Firm Load Adjustment$_z$	[4]	391		251	295	340	360	398
FOR$_z$	[5]	0.0726		0.073	0.073	0.073	0.072	0.072
LRA$_z$	[6]=[1]+[2]-([3]/(1-[5]))-([4]/(1-[5]))	**24,935**		**25,382**	**25,542**	**25,716**	**25,922**	**26,098**
NNE Zone								
Resource	[7]	8,294		8,294	8,294	8,294	8,294	8,294
Proxy Units	[8]	0		0	0	0	0	0
Firm Load Adjustment	[9] = -[4]	-391		-251	-295	-340	-360	-398
Total System Resources	[10]=[1]+[2]-[4]+[7]+[8]-[9]	34,567		34,567	34,567	34,567	34,967	34,967

Maximum Capacity Limit - NNE								
Commitment Period		**2021-2022 FCA 12**	**2022-2023**	**2023-2024**	**2024-2025**	**2025-2026**	**2026-2027**	**2027-2028**
NICR for New England	[1]	33,725	TBD	34,000	34,185	34,390	34,630	34,830
LRA$_{RestofNewEngland}$	[2]	24,935		25,382	25,542	25,716	25,922	26,098
Maximum Capacity Limit$_y$	[3]=[1]-[2]	**8,790**		**8,618**	**8,644**	**8,674**	**8,708**	**8,732**

Notes:

- All values in the table are in MW except the Forced Outage Rate (FOR$_z$)
- ICR Values for 2022-2023 (FCA 13) are currently under development and shown as “To Be Determined (TBD)”

REPRESENTATIVE ICR VALUES CALCULATION ASSUMPTIONS

Load Forecast

- The 2018 CELT Load Forecast was used to calculate Representative ICR Values
    - used for all probabilistic ICR Values calculations
    - modeled in GE MARS by Regional System Plan (RSP) 13-subarea representation
    - includes an 8% Transmission & Distribution Gross-up
- FCA 12 ICR and the 2018 forecast of representative ICR Values calculations used an hourly profile of BTM PV*
- The Energy Efficiency forecast is not included in the load forecast since this is a forecast of passive Demand Resources which are treated as resources in the Forward Capacity Market (FCM) and so modeled in the ICR calculations
- In the TSA, the 90/10 net load forecast for the SENE sub-areas are used

*For more information on the development of the hourly profile see: https://www.iso-ne.com/static-assets/documents/2017/06/pspc_6_22_2017_2002_PV_profile.pdf

Load Forecast Data – Applicable 50/50 & 90/10 Load Forecast for New England & Sub-areas (MW)

	Peak Load Forecast Net of BTM PV											
	2017 CELT Forecast				2018 CELT Forecast				Differences			
	New England	SENE		NNE	New England	SENE		NNE	New England	SENE		NNE
CCP	50/50	50/50	90/10	50/50	50/50	50/50	90/10	50/50	50/50	50/50	90/10	50/50
2022-2023	29,694	12,459	13,563	5,761	29,300	12,526	13,688	5,506	-394	67	125	-255
2023-2024	29,960	12,593	13,716	5,810	29,506	12,634	13,813	5,540	-454	41	97	-270
2024-2025	30,231	12,731	13,872	5,859	29,712	12,744	13,938	5,573	-519	13	66	-286
2025-2026	30,507	12,872	14,031	5,907	29,926	12,858	14,069	5,606	-581	-14	38	-301
2026-2027	30,785	13,015	14,192	5,955	30,141	12,973	14,199	5,639	-644	-42	7	-316

Notes:

- Capacity Zone load forecasts are the values for the Regional System Plan (RSP) sub-areas used as proxies for the Load Zone values as the interface Transmission Transfer Capability (TTC) limits are calculated using the 13-RSP sub-area representation
- 50/50 load forecast values shown for informational purposes. The GE MARS model sees a distribution of peak loads and uses an hourly profile of BTM PV to calculate ICR and LRA
- 90/10 load forecast values shown are a direct input into the calculation of TSA for import-constrained Capacity Zones

Comparison of Sub-area Load Forecasts

- Comparisons of the 2018 versus the 2017 CELT load forecasts show that while the overall New England load forecast went down, the forecast for the SENE sub-areas has increased
  - This is similar to the differences between the 2017 versus the 2016 CELT load forecasts discussed last year
- The increase is due to the Massachusetts economy growing faster relative to the other New England states as it was last year
  - Although other state economies continue to expand, they are not expanding as quickly as Massachusetts

LRA, TSA & MCL Internal Transmission Transfer Capability Assumptions (MW)

- Internal Transmission Transfer Capability
  - Southeast New England Import
    - N-1 Limit: 5,700
    - N-1-1 Limit: 4,600
  - Northern New England Export (North-South interface)
    - N-1 Limit: 2,725

Notes:

- Transmission transfer capability assumptions – presented at the PAC on March 15, 2018 : https://www.iso-ne.com/static-assets/documents/2018/03/a2_fca_13_zonal_boundary_determination.pdf

Summary of Resource Assumptions for CCPs 2023-2024 – 2027-2028 (MW)

	CCP	Generating Resources	Intermittent Power Resources	Demand Resources	Import Resources	Total Resources
New England	2021 - 2022 (FCA 12)	30,390	883	3,212	82	34,567
	2023-2024 - 2027-2028	30,390	883	3,212	82	34,567
SENE	2021 - 2022 (FCA 12)	10,034	185	1,495	-	11,715
	2023-2024 - 2027-2028	10,034	185	1,495	-	11,715
NNE	2021-2022 (FCA 12)	7,296	453	545	-	8,294
	2023-2024 - 2027-2028	7,296	453	545	-	8,294

TSA Resource Assumptions

– Based on FCA 12 Resource Assumptions

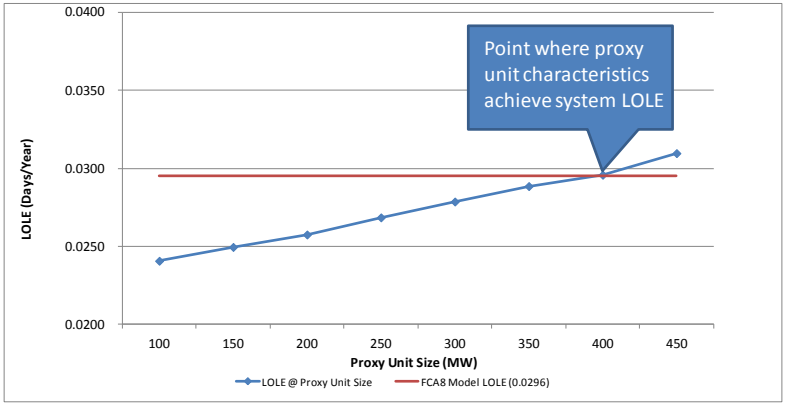
- Resource Data for SENE
  - 2021-2022 Existing Capacity Qualification data as of June 05, 2017
    - Generating capacity: 10,220* MW
      - Includes 9,101 MW of regular generation resources and 933 MW peaking generation resources, 186 MW of intermittent generation resources
    - Passive Demand Resources: 1,338MW
    - Active Demand Resources**: 157 MW

Notes:

- * Retirement De-list bids are deducted from the Existing Capacity Qualification data
- **RTEGs are no longer qualified beginning FCA 12
- All values have been rounded off to the nearest whole number

Proxy Unit Characteristics

- Proxy unit characteristics based on a study conducted in 2014 using the 2017-2018 FCA8 ICR Model
- Current proxy unit characteristics:
  - Proxy unit size equal to 400 MW
  - EFORd of proxy unit = 5.47%
  - Maintenance requirement = 4 weeks



- Proxy unit characteristics are determined using the average system availability and a series of LOLE calculations. By replacing all system capacity with the correct sized proxy units, the system LOLE and resulting capacity requirement unchanged

Note:

- The 2014 Proxy Unit Study was reviewed at the May 22, 2014 PSPC Meeting and is available at: http://www.iso-ne.com/static-assets/documents/committees/comm_wkgrps/relblty_comm/pwrsuppln_comm/mtrls/2014/may222014/proxy_unit_2014_study.pdf

Summary of Resource Availability Assumptions

-Based on the FCA 12 ICR Model

Resource Category	Summer MW	Assumed Average EFORd or FOR Weighted by Summer Ratings (%)	Assumed Average Maintenance Weeks Weighted by Summer Ratings
Total System Generation	**30,390**	**7.3**	**4.6**
Combined Cycle	14,661	3.9	5.0
Fossil	5,729	19.3	5.6
Combustion Turbine	3,507	10.4	2.6
Nuclear	3,343	1.9	3.6
Hydro (Includes Pumped storage)	2,998	3.5	4.7
Diesel	129	9.3	1.6
Miscellaneous	23	10.0	4.7
Intermittent Power Resources	**883**	**0.0**	**0.0**
Import Resources	**82**	**0.0**	**0.0**
Total Demand Resources	**3,212**	**98.2**	**0.0**
On-Peak	2,154	0.0	0.0
Seasonal Peak	548	0.0	0.0
Real-time Demand Response	509	89.7	0.0

Notes:

- Generator EFORd is calculated as a 5-year average of the latest ISO submitted NERC GADS data
- Intermittent Power Resources are assumed as 100% available since their outage history is incorporated in their ratings
- Imports are modeled with historical tie line availability factors and deratings for firm capacity contracts
- FOR (for Demand Resources) is an assumed Forced Outage Rate based on historical performance of Demand Resources in summer & winter 2012 – 2016

TSA Requirements Unavailability Assumptions

-*Based on the FCA 12 TSA Requirement Calculation*

- Resource Unavailability Assumptions
  - Regular Generation Resources - Weighted average EFORd
    - SENE sub-area: 10%
  - Peaking Generation Resources: 20%
  - Passive Demand Resources: 0%
  - Active Demand Resources - De-rating based on performance factors
    - NEMA/Boston sub-area: 14%
    - SEMA sub-area: 14%
    - RI sub-area: 24%

Note: All values have been rounded off to the nearest whole number

OP 4 Assumptions (MW)

- **Load Relief Available from 5% Summer Voltage Reduction (OP 4 Actions 6 & 8)**

Year	Actions 6 & 8 5% Voltage Reduction	
	Summer	Winter
2023-2024	429	318
2024-2025	433	319
2025-2026	436	321
2026-2027	440	323
2027-2028	443	324

Notes:

- Impact of implementing a 5% voltage reduction expressed as a percent of load is calculated using the ISO Operations value of 1.5%
- Calculated as [90-10 Peak Load Forecast] – [all Passive DR & Active DR] *1.5%

OP 4 Assumptions (MW)

- Tie Benefits

The following Tie Benefit assumptions are used for the Representative NICR Calculations for CCPs 2023-2024 through 2027-2028

Control Area	2023-2024 - 2027-2028
Québec via Phase II	958
Québec via Highgate	143
Maritimes	506
New York	413
Total Tie Benefits	2,020

Notes:

- Modeled with tie line availability assumptions
- The values are the same as those used for FCA 12

OP 4 Assumptions (MW)
- 700 MW of Minimum Operating Reserves

- As part of the review of ICR Assumptions currently undergoing discussions at the RC and PSPC, ISO-NE has proposed using 700 MW of minimum Operating Reserves in the ICR model

  Details available at:

  - https://www.iso-ne.com/static-assets/documents/2018/04/a6_pspc_rev_volt_reduct_04182018.pdf
  - https://www.iso-ne.com/static-assets/documents/2018/03/a2_assessment_of_icr_lsr_and_discussion_of_the_218_long_term_load_forecast.pptx

- This is an increase of 500 MW over the long-time assumption of 200 MW previously used
- Will be used in FCA 13 ICR calculations
- Was used in the representative ICR, LRA and MCL calculations

Summary of Resource and OP 4 Assumptions for (MW)

Type of Resource/OP4 Action	2021-2022 FCA 12	2022-23	2023-2024	2024-2025	2025-2026	2026-2027	2027-2028
Generating Resources	30,420	TBD	30,420	30,420	30,420	30,420	30,420
Intermittent Power Resources	883		883	883	883	883	883
Demand Resources	3,212		3,212	3,212	3,212	3,212	3,212
Import Resources	82		82	82	82	82	82
Import Derating	-30		-30	-30	-30	-30	-30
OP 4 Voltage Reduction (Actions 6 & 8)	431		429	433	436	440	443
Minimum Operating Reserve	-200		-700	-700	-700	-700	-700
Tie Benefits (includes 959 MW HQICCs)	2,020		2,020	2,020	2,020	2,020	2,020
Proxy Units	-		-	-	-	400	400
Total MW Modeled in ICR	**36,818**		**36,316**	**36,320**	**36,323**	**36,727**	**36,730**

Notes:

- Intermittent Power Resources have both the summer and winter capacity values modeled
- 5% Voltage Reduction of OP 4 includes both Action 6 and Action 8 MW assumptions
- A 700 MW is being proposed as the minimum Operating Reserve requirement for transmission system security https://www.iso-ne.com/static-assets/documents/2018/04/a6_pspc_rev_volt_reduct_04182018.pdf
- ICR Values for 2022-2023 (FCA 13) are currently under development and shown as “To Be Determined (TBD)”

Questions