FCA 11 MRI Based System-wide and Zonal Sloped Demand Curves

Reliability Committee (Revised)

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RESOURCE ADEQUACY

FOREWORD

We thank the staff of Market Operations and Market Development for their involvement in the development of the Marginal Reliability Impact (MRI) based demand curves for the Forward Capacity Auction for 2020-2021 (FCA 11).

FCM Demand Curves (Revised)

For Forward Capacity Commitment Period 2020-2021

- **The ISO is presenting the system and zonal demand curves for FCA 11**
  - Curves developed according to market rule filed with the FERC on April 15, 2016, which were approved by FERC on June 28, 2016
  - Curves revised from the ones presented to you on September 20, 2016
- **This meeting:**
  - Review the revised assumptions used to develop the FCA 11 demand curves
  - Review the updated system-wide and zonal demand curves for FCA 11
  - Answer any questions you may have regarding these curves
  - Review the comparison of the “Original” and the “Updated” demand curves, if you desire
  - Recap the MRI based demand curves theory, if you desire

ISO RECOMMENDED DEMAND CURVES FOR FCA 11

System-wide and Zonal Demand Curves

The ISO has developed System-wide and Zonal Demand Curves for FCA 11

For FCA 11, ISO determined that:

- NEMA/Boston, SEMA and Rhode Island Load Zones should be combined to form an import-constrained Capacity Zone named Southeast New England (SENE) Capacity Zone, and
- Maine, New Hampshire and Vermont Load Zones should be combined to form an export-constrained Capacity Zone named the Northern New England (NNE) Capacity Zone

Therefore, zonal demand curves are developed for the SENE import-constrained and NNE export-constrained Capacity Zones.

- See the link for the May 26, 2016 PSPC Meeting presentation on Capacity Zone determinations at: http://www.iso-ne.com/static-assets/documents/2016/05/PSPC_FCA11_Zone_Formation.pdf.

FCA 11 Demand Curves – Assumptions (Revised)

- MRI Simulations – simulations conducted to develop system-wide and zonal MRI curves
  - The same load and resource assumptions used for the development of the Installed Capacity Requirement (ICR) values for FCA 11 are used to develop the MRI simulations
- Zonal MRI simulations used the following assumptions:
  - SENE Import
    - N-1 Import Limit = 5,700 MW
    - N-1-1 Import Limit = 4,600 MW
    - LRA Requirement = 9,580 MW
    - TSA Requirement = 9,810 MW
    - Capacity transfer capability assumption for SENE zonal MRI calculations is:
      5,700 – max(9,810 TSA - 9,580 LRA, 0) = 5,470 MW
  - NNE Export (North-South Interface)
    - N-1 export limit = 2,725 MW

FCA 11 Demand Curves – Assumptions, cont.

- Cost of New Entry (CONE)
  - CONE for FCA11:
    - Gross CONE = $14.387/kW-month
    - Net CONE = $11.640/kW-month

See link for Forward Capacity Market (FCM) parameters by Capacity Commitment Period (CCP):
http://www.iso-ne.com/markets-operations/markets/forward-capacity-market

- Links to presentations relating to the assumptions used in the development of the MRI and demand curves

Transmission transfer capability limits – presented at the Planning Advisory Committee (PAC) meeting on March 22, 2016 (http://www.iso-ne.com/static-assets/documents/2016/03/a2_fca11_zonal_boundary_determinations.pdf)

Load and resource assumptions – presented at the PSPC meeting on July 28, 2016 (http://www.iso-ne.com/static-assets/documents/2016/06/FCA11_ICR_Assumptions_Update.pdf)

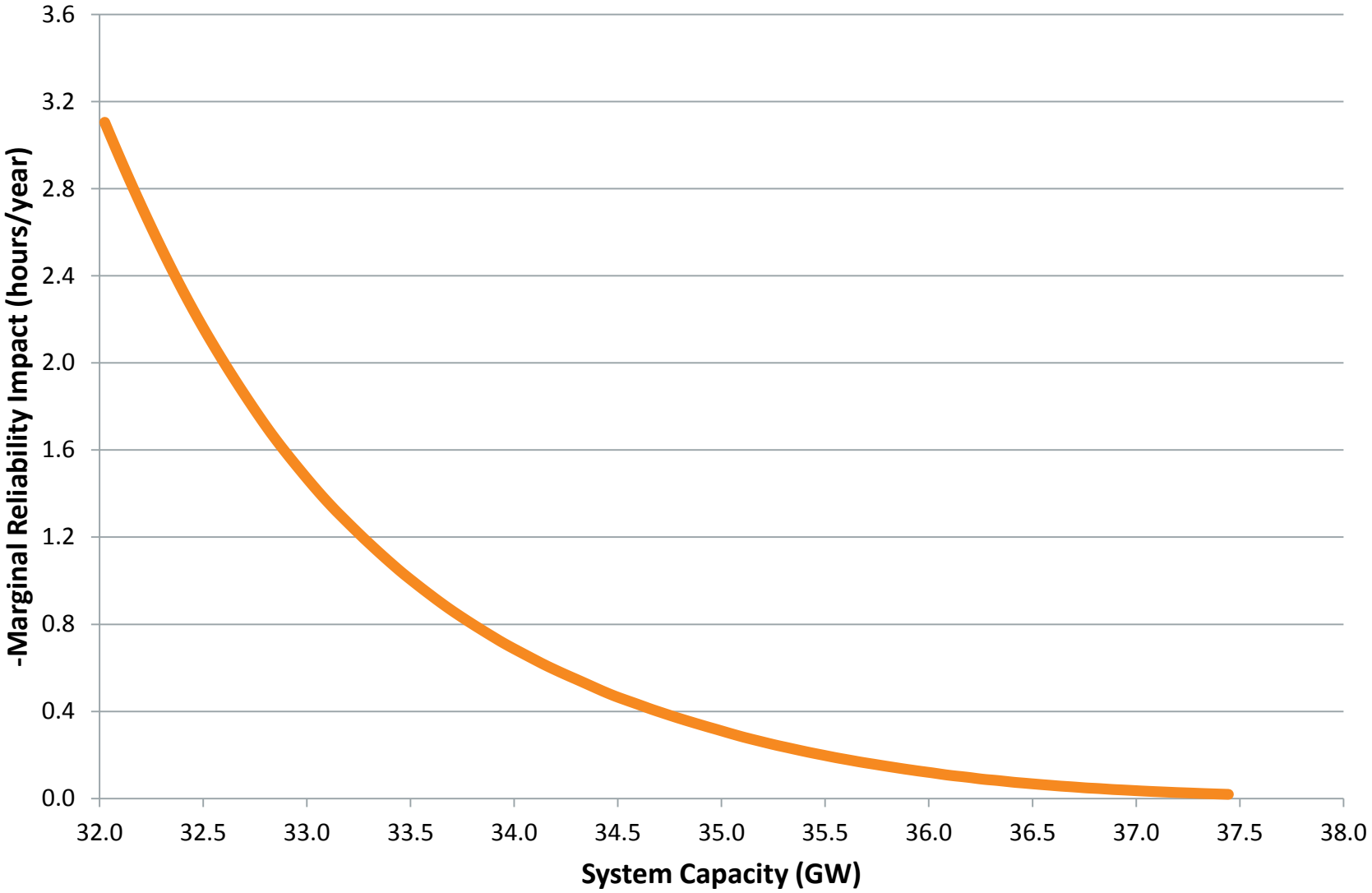
FCA 11 ICR Values – presented at the PSPC meeting on August 25, 2016 (http://www.iso-ne.com/static-assets/documents/2016/08/PSPC08252016_FCA11_ICR_Values_Results.pdf) and (http://www.iso-ne.com/static-assets/documents/2016/08/PSPC08252016_FCA11_TSA_Reqt.pdf)

SYSTEM-WIDE DEMAND CURVES FOR FCA 11

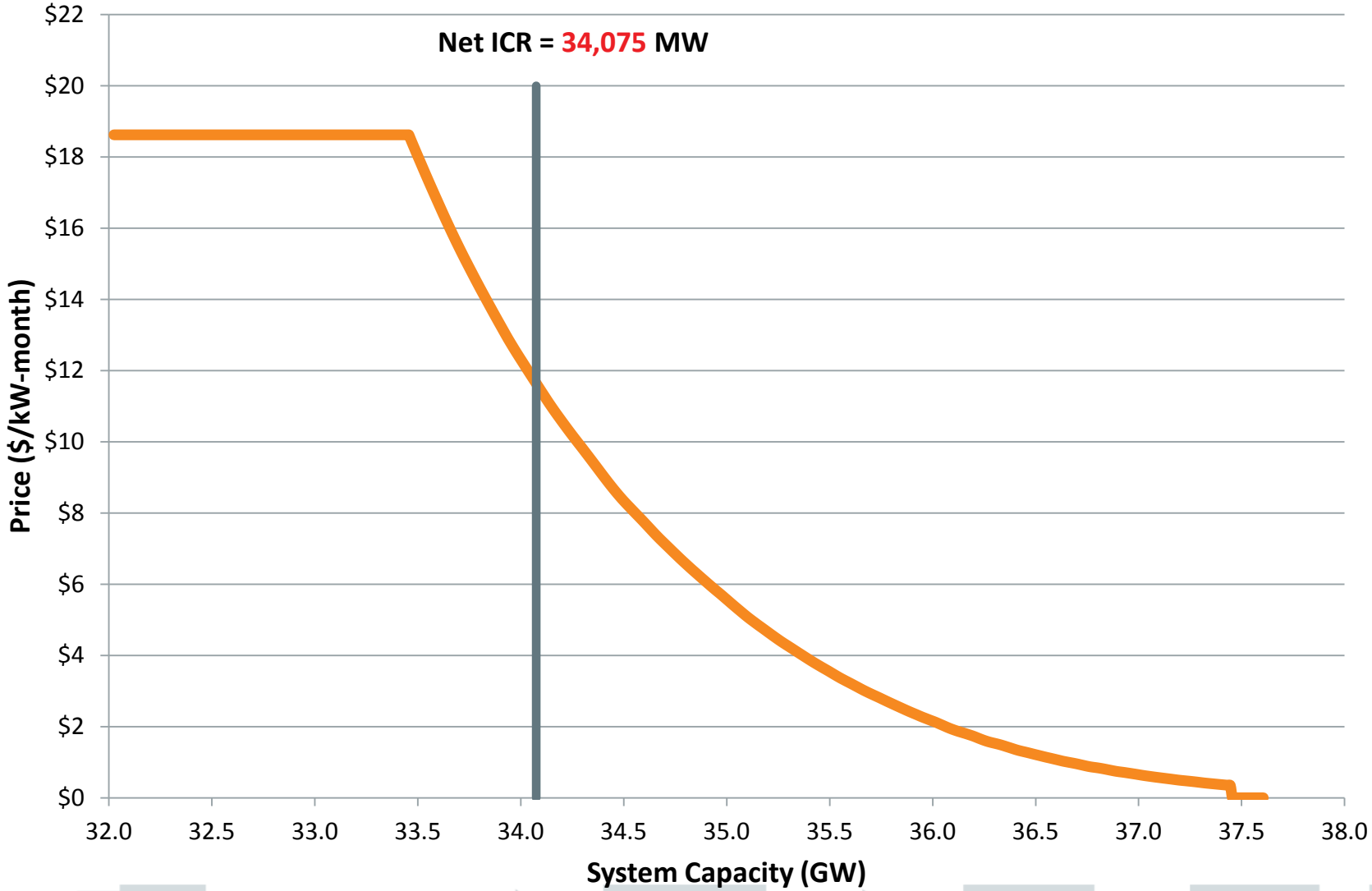
FCA 11 Demand Curves

An EXCEL spreadsheet containing granular demand curve data for the system and for the capacity zones has been posted on the ISO Website under PSPC meeting materials. These data are similar in format to the EXCEL file with “indicative” demand curves that were provided to the stakeholders in the Markets Committee during the design of MRI demand curves.

FCA 11 System-wide MRI Curve (Revised)



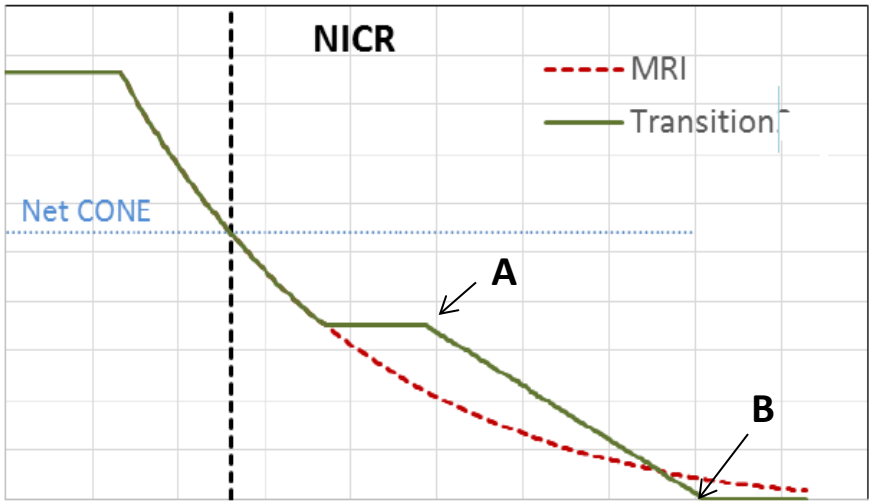
FCA 11 System-wide Demand Curve Prior to Transition Adjustment (Revised)



FCA 11 System-wide Demand Curve Transition

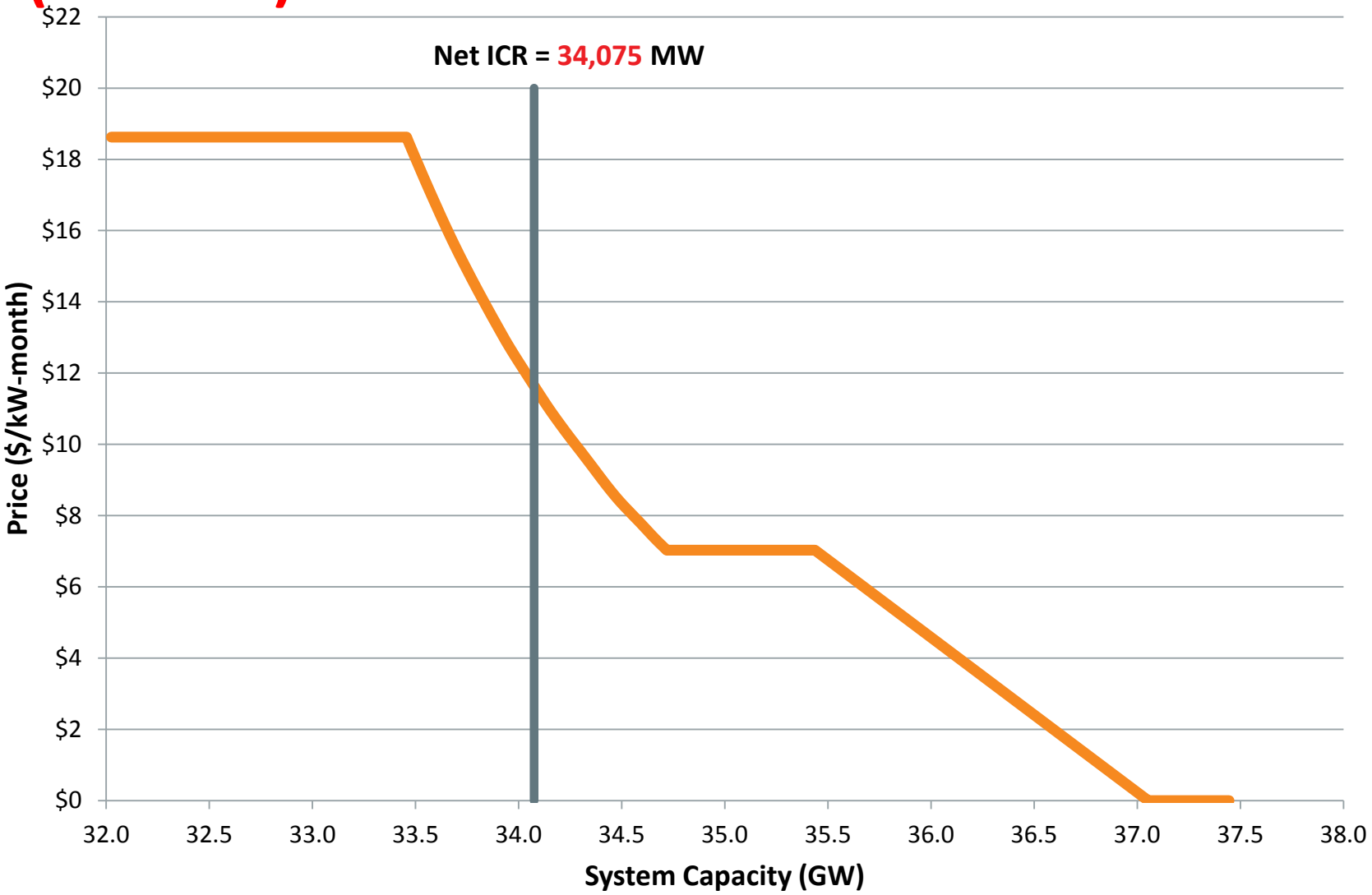
- Transition curve for FCA 11 is comprised of three segments:
  - Price above $7.03, use MRI implied curve,
  - Price below $7.03/kW-month:
    - FCA 11: A = ($7.03, Demand MW = curve + 722)
  - B = ($0.00, Demand MW = A + 1,616)
  - Straight line connecting curve segments

Note: the entire curve is subject to capping at the FCA starting price of $18.624.



Details relating to the transition from the system-wide sloped demand curve to the MRI based System-wide Demand Curve are available at: http://www.iso-ne.com/static-assets/documents/2016/07/PSPC072316_FirstLight_MRI_Transition_Curve_presentation.pdf

FCA 11 Final System-wide Demand Curve (Revised)



FCA 11 System-wide Demand Curve Parameters (Revised)

FCA Starting Price ($/kW-m)*	18.624
Net ICR (MW)	34,075
Net CONE ($/kW-m)	11.640
System MRI @ Net ICR (hr/yr)	-0.649
Scaling Factor [($/kW-m)/(hr/yr)]**	17.922

*Starting Price equals Net CONE x 1.6

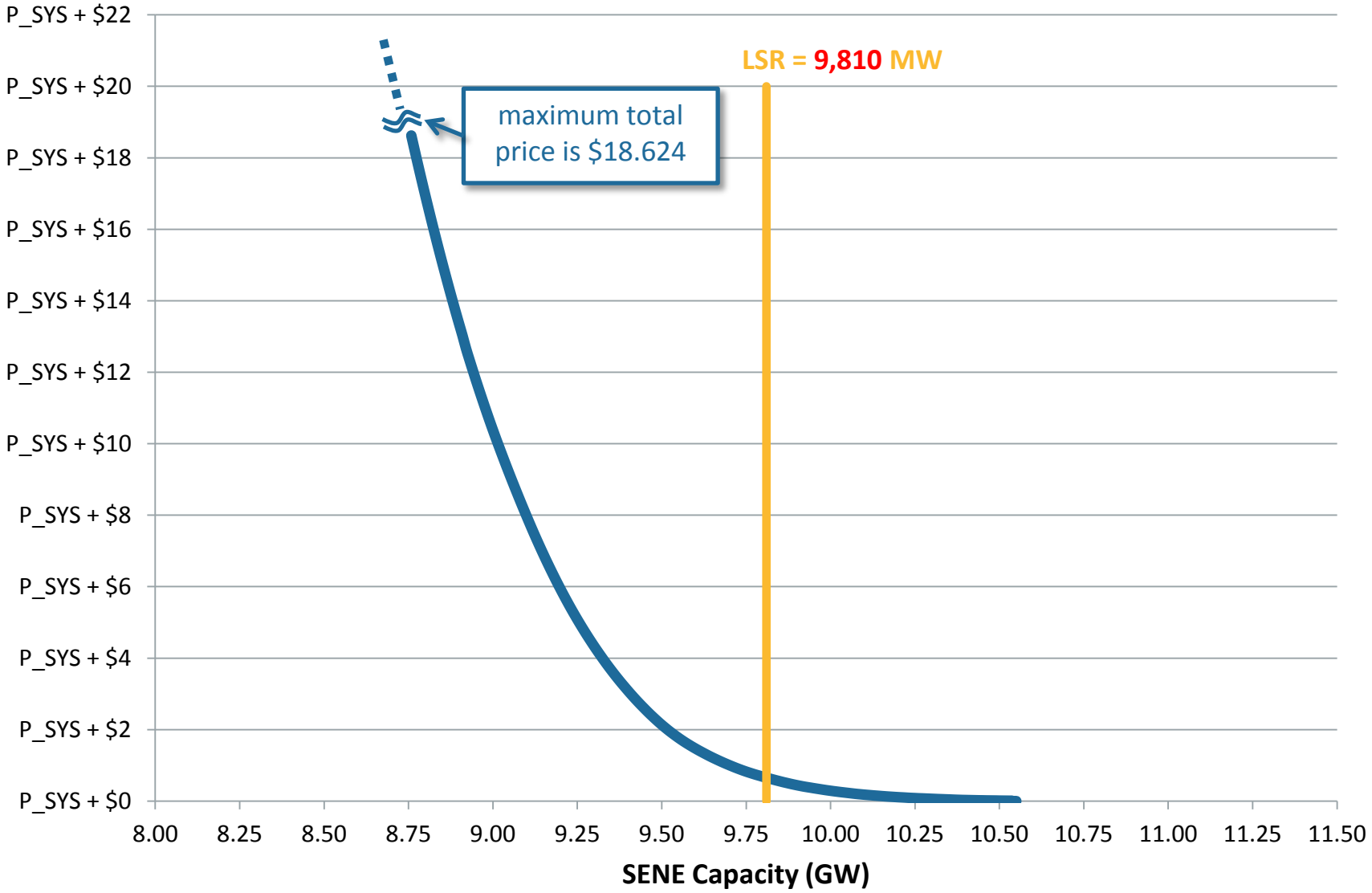
**Scaling Factor equals -1 * Net CONE / System MRI @ Net ICR

Condition for triggering transition: NICR (34,075 MW) < 34,151 MW + 722 MW

Starting Quantity (MW)	Ending Quantity (MW)	Starting Price ($/kW-m)	Ending Price ($/kW-m)
0	33,457	18.624	18.624
33,457	34,718	18.624	7.030
34,718	35,437	7.030	7.030
35,437	37,053	7.030	0.000

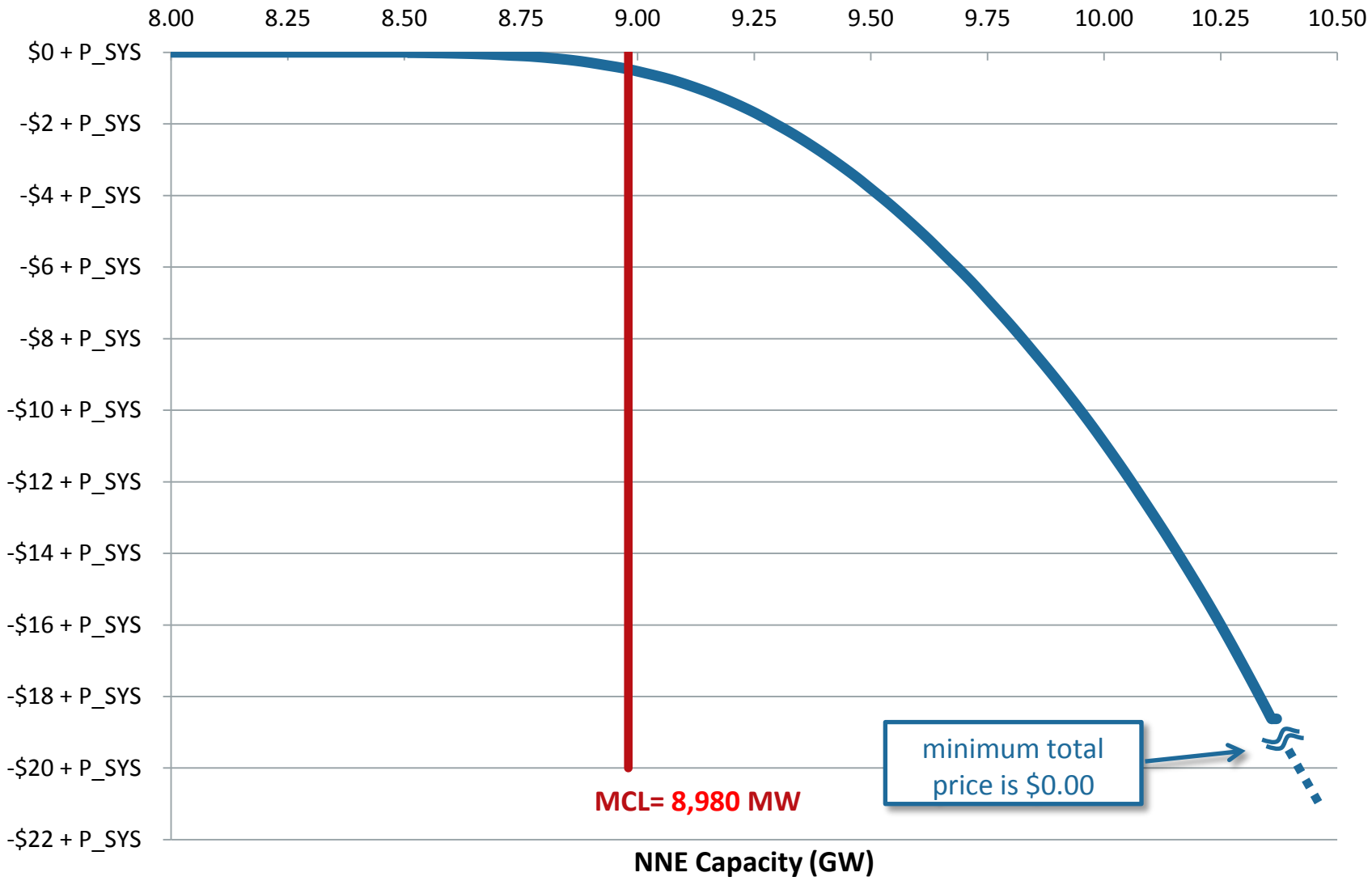
FCA 11 SENE DEMAND CURVE

FCA 11 SENE Demand Curve (Revised)



FCA 11 NNE DEMAND CURVE

FCA 11 NNE Demand Curve (Revised)



APPENDIX
BACKGROUND - MARGINAL RELIABILITY IMPACT BASED DEMAND CURVES

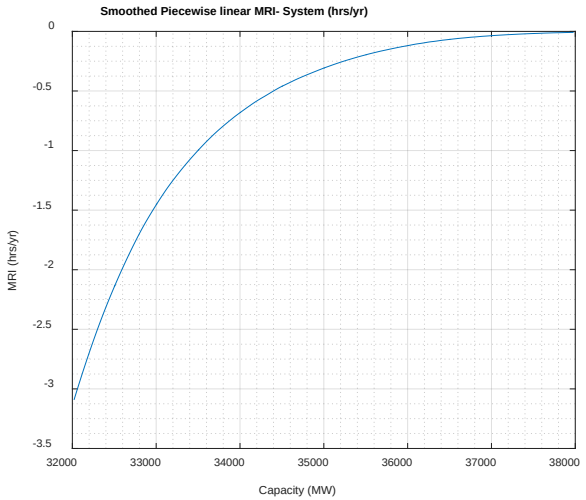
Reliability foundation for deriving demand curves

FCM's Sloped Demand Curves Aim to Satisfy

1. **Reliability**. Meet the ISO's reliability planning obligations
   - System LOLE of 0.1 or less, on average (over the long-term)
2. **Sustainability**. Over the long-term, the FCA's average clearing price should be sufficient to attract entry when needed
   - Competitive new suppliers recover their fixed entry costs (Net CONE)
   - Both in the system and import-constrained zones
3. **Cost-Effectiveness**. Procure capacity in zones cost-effectively
   - Zonal curves should allocate capacity purchases among zones, given bid prices, to meet the system's reliability requirements at least-cost

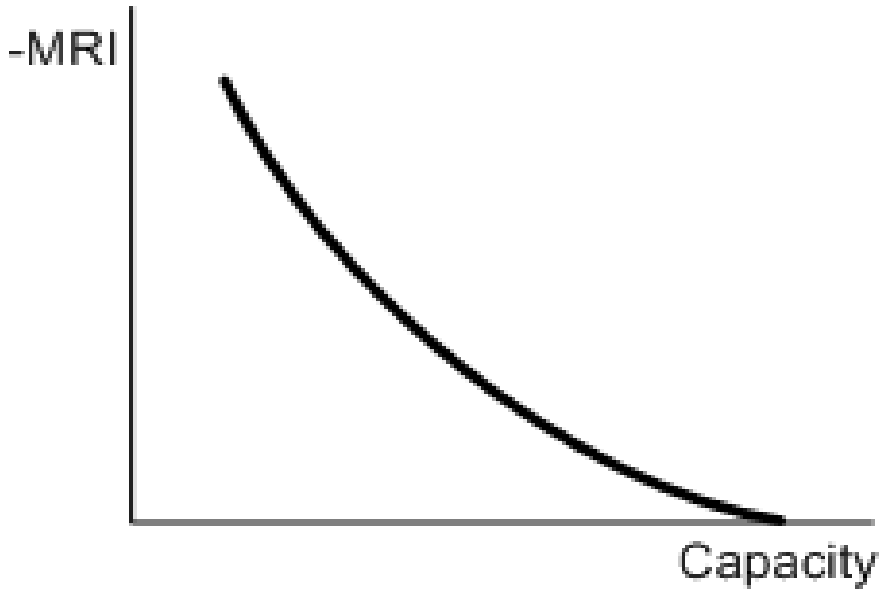
Marginal Reliability Impact of Capacity

- ISO's planning models can calculate **expected energy not served** (EENS) as a measure of the expected 'lost load'
  - Calculated on a MWh per year basis
  - EENS depends on capacity in system overall, and in each capacity zone
- **Marginal reliability impact** (MRI) is the change in EENS (expected 'lost load') with another 1 MW of capacity
  - Differs for system and each zone
- Methodology calculates the MRI at the system and zonal level for range of capacity values
  - May be greater in import-constrained zones where capacity can serve system or zone



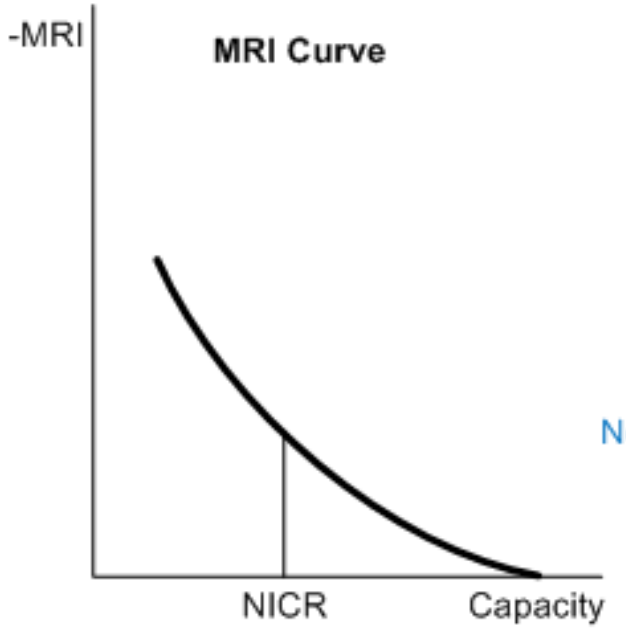
Marginal Reliability Impact of Capacity, cont.

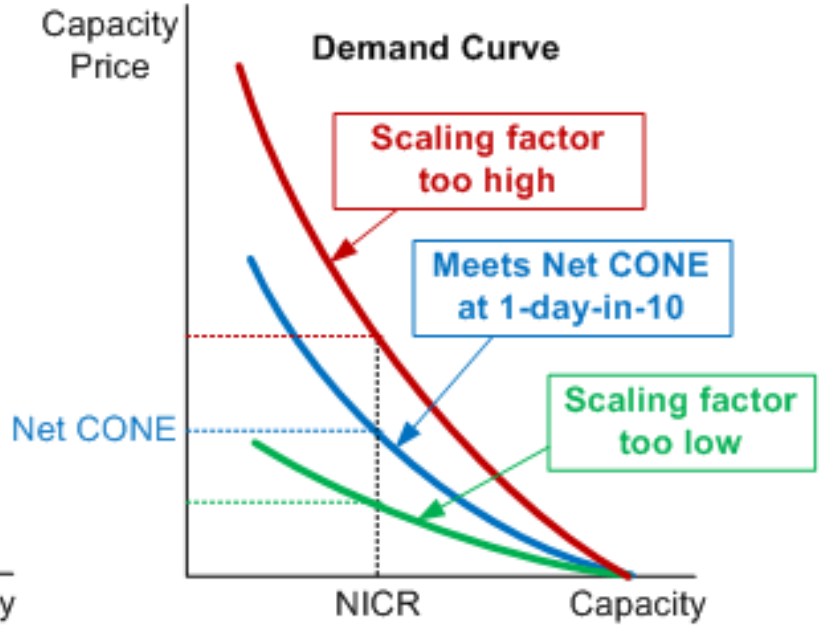
- MRI (after sign change) declines smoothly with capacity, as shown below
- ISO's planning models can calculate this function



Scaling Factor Translates Relative Slopes into Demand Curves

- Graphically, it 'stretches' the MRI curves vertically
- Demand Curve = -[Scaling factor] × [MRI curve]
- Stretch demand curves to procure capacity to meet 1-day-in-10 at price of Net CONE





Scaling Factor Ensures Curves Meet Reliability Criteria

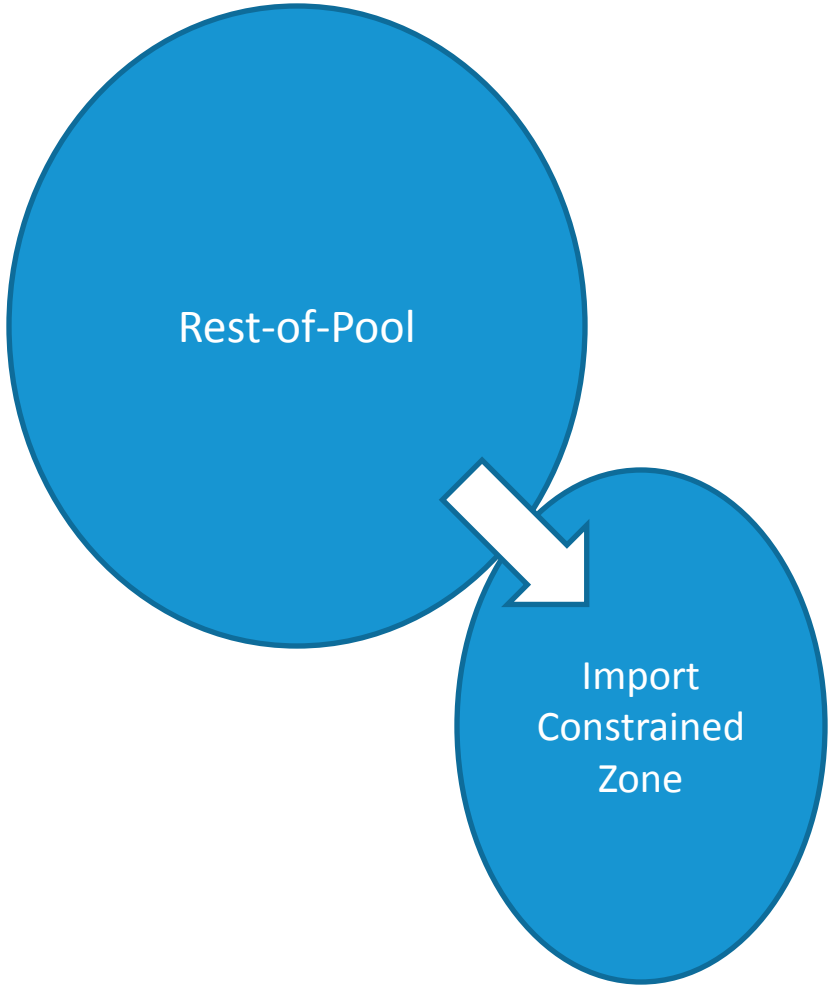
- Scaling factor is not assumed. It is derived, and is the (lowest) value that ensures the curves satisfy the reliability criteria and pay an average of estimated Net CONE
  - If less than the derived value, the demand curves would not meet the reliability criteria
  - If greater than the derived value, consumers would buy more reliability than the criteria requires
- Scaling factor is constant across zones and capacity values

Demand Curves Based on the Marginal Reliability Impact

- When the system is short, deficiencies can occur more frequently, so an additional MW of capacity significantly reduces EENS because
  - At low MW quantities, MRI value is high
  - As capacity is added, the MRI decreases quickly meaning the slope is relatively steep
- When the system is long, deficiencies are infrequent, so an additional MW of capacity has a small impact on EENS because
  - At high MW quantities, MRI value is low and relatively flat
- Consistent with these properties, the demand curves will be based on the MRI functions

Relative Impact

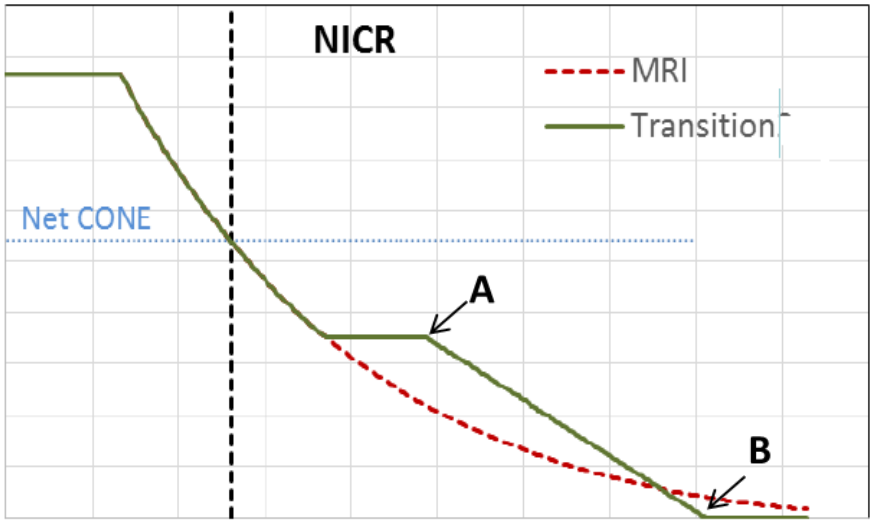
- The methodology captures the difference in relative impact of additional capacity in different zones



System Demand Curve Transition

- Transition curve will be comprised of three segments:
  - Price above $7.03, use MRI curve,
  - Price below $7.03/kw-month:
    - FCA 11: A = ($7.03, MRI MW = 722)
    - FCA 12: A = ($7.03, MRI MW = 375)
    - FCA 13: A = ($7.03, MRI MW = 150)
  - B = ($0.00, A= 1,616)
  - Horizontal line connecting curve segments

- Transition ends at the earlier of:
  - 3 year (full MRI curve no later than FCA 14), or
  - When the sum of the MRI curve MW value at $7.03 exceeds A



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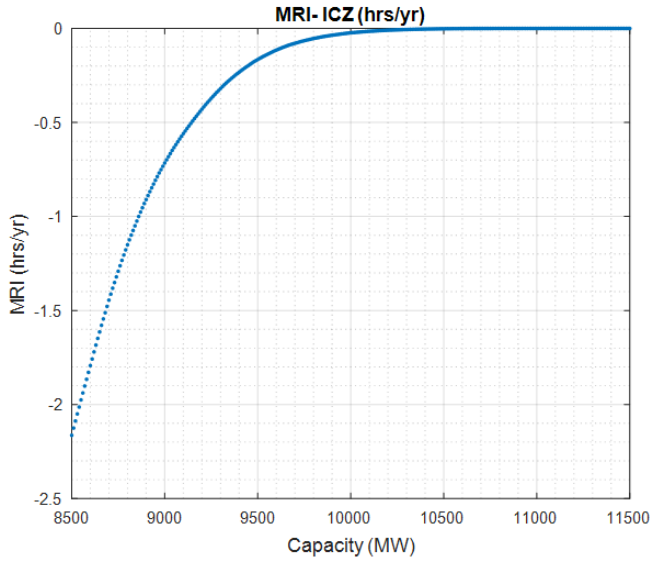
BACKGROUND - DEMAND CURVES FOR CAPACITY ZONES

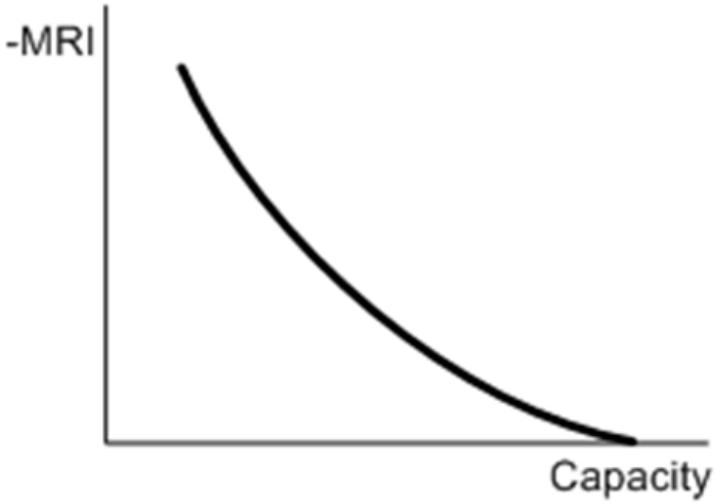
Marginal Reliability Impact Relating to Capacity Zones

- Curves in all constrained zones are based on the marginal reliability impact of shifting a MW of capacity from the rest-of-system zone into the constrained zone
- Shift of capacity into import-constrained zones improves system reliability (reduces EENS)
- Under this methodology, the total MRI value for a MW in the import-constrained zone is equal to the sum of the system value and the zonal value

Marginal Reliability Impact Relating to Capacity Zones, cont.

- At very high zonal MW level, shifting of capacity into import-constrained zone (ICZ) would not increase system reliability
  - Transmission limit would no longer be an issue, MW shifted into the zone has similar reliability impact as though the capacity is located outside the zone





Marginal Reliability Impact Relating to Capacity Zones, cont.

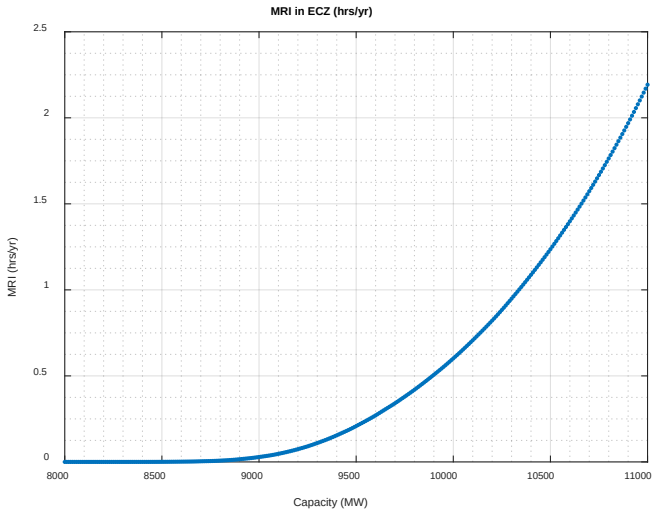
- ISO's modeling assumption builds on the methodology used to generate the Local Sourcing Requirement based on both the Transmission Security Analysis (TSA) and Local Resource Adequacy (LRA) Requirement values
  - "For each import-constrained Capacity Zone, the Local Sourcing Requirement shall be the amount needed to satisfy the higher of: (i) the Local Resource Adequacy Requirement as determined pursuant to Section III.12.2.1.1; or (ii) the Transmission Security Analysis Requirement as determined pursuant to Section III.12.2.1.2."
- MRI calculations will use a capacity transfer capability of:

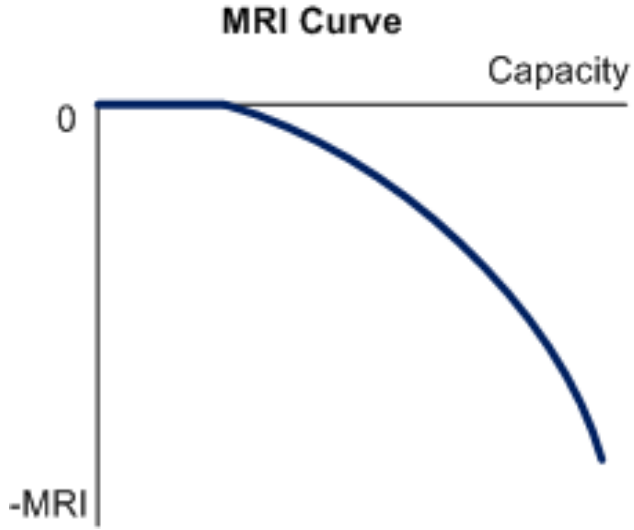
$$(\text{N-1 limit}) - \max(\text{TSA-LRA}, 0)$$

  - Starts with N-1 limit, but includes adjustment based on the positive difference between TSA and LRA

Marginal Reliability Impact Relating to Capacity Zones, cont.

- Shift of capacity into export-constrained zone (ECZ) decreases system reliability (increases EENS)
- MRI function is zero for low MW quantities as capacity in export-constrained zone provides equal reliability value to that in rest-of-system
- At very high zonal MW level, the MRI function slopes upward because (negative) marginal reliability impact of capacity in the zone increases





Questions