NYISO Capacity Accreditation: Continued Discussion of Marginal and Average Approaches

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Background

- In our 2020 State of the Market report, we recommend that NYISO revise its capacity accreditation rules.[1]
- We discussed shortcomings of NYISO's current capacity accreditation framework at our June 17, 2021 presentation to ICAPWG.
- We discussed a conceptual framework for designing efficient accreditation rules at our August 9 presentation to ICAPWG.
  - ✓ The presentation addressed the difference between marginal and average accreditation methods.
  - ✓ NYISO has proposed to use a marginal approach in its Straw Proposal.

[1] See Section VII.C and Appendix Section VI.I of 2020 Report.

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Overview

- **We support the use of a marginal accreditation approach.**
  - ✓ **Average accreditation would result in severe inefficiencies and overpayment in the long term.**
- This presentation provides additional discussion on marginal and average approaches:
  - ✓ Responses to common stakeholder concerns about marginal approaches.
  - ✓ Rationale for why average approaches are not compatible with the NYISO market framework.
- We intend to share a proposed capacity accreditation methodology in a future presentation.

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Review of Marginal and Average Approaches

- **Marginal approaches**
  - ✓ Compensate each resource based on the incremental reliability benefit the next unit of that resource type would provide.
  - ✓ Calculated from the impact of an incremental quantity of a given resource type on a reliability metric (LOLE or EUE), relative to that of 'perfect capacity'.
  - ✓ Include MRI and Marginal ELCC.
- **Average approaches**
  - ✓ Compensate each resource based on the aggregate reliability benefit of every unit of that resource type.
  - ✓ Calculated as 'perfect capacity' needed to replace all capacity of a given type while holding a reliability metric constant.
  - ✓ Include Average ELCC and "Portfolio ELCC".

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NYISO Market Design Principles

- A core principle of NYISO's wholesale market design is marginal cost scheduling and pricing.
- Other NYISO market constructs rely on marginal pricing logic:
  - ✓ All energy market sellers earn LBMP (marginal cost of serving load).
  - ✓ All reserve providers are paid marginal price to satisfy requirement.
  - ✓ All capacity market sellers are paid the capacity price (marginal reliability value as reflected by demand curve).
  - ✓ Revenue surpluses (e.g., difference between average and marginal transmission losses) and uplift are allocated in ways that generally avoid inefficient incentives.
- Frequently, the value of the service to the consumer exceeds the marginal price that is paid to suppliers. This is the source of consumer surplus in the NYISO markets and all other market-based systems.

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Common Misconceptions on Marginal Capacity Accreditation

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Misconception #1

- **Misconception #1: Marginal accreditation results in over-procurement of capacity since:**
  - ✓ Capacity credit of some resources is lower under a marginal approach.
  - ✓ Total supply relative to demand is reduced under marginal, leading to a need for extra procurement of other resources and/or higher prices.

Marginal Accreditation Does Not Cause Over-procurement

- The ICAP Requirements are determined independently of the capacity accreditation methodology.
- Supply and demand side of the capacity market are both converted to UCAP using the same average derating factor
- As a result, for a given resource mix, the supply/demand balance is not affected by the capacity accreditation method.
  - ✓ In the long term, when the resource mix is not fixed, inaccurate accreditation could lead to over-procurement by encouraging inefficient entry.

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Marginal Accreditation Does Not Cause Over-procurement

Simplified example

(light green)	Not affected by choice of accreditation method in near term
(yellow)	Affected by choice of accreditation method in near term

Accreditation Method		Marginal	Average
Peak Load	(a)	100	100
IRM	(b)	115%	115%
ICAP Requirement	(c) = (a)*(b)	115	115
ICAP Supply	(d)	120	120
Average Derating Factor	(e)	20%	10%
UCAP Supply	(f) = (d)*[1-(e)]	96	108
UCAP Requirement	(g) = (c)*[1-(e)]	92	104
Reference Point ($/kW UCAP)[1]	(h)	75	75
UCAP Demand Curve Slope	(i) = -(h)/[.12*(g)]	-6.8	-6.0
Capacity Surplus (%)	(j) = (f) / (g) - 1	4.35%	4.35%
Price ($/kW UCAP)	(k) = (h) + (i)*[(f) - (g)]	47.83	47.83

[1] assumes Net CONE is translated using derating factor of reference unit, see SOM Recommendation 2019-5.

Misconception #2

- **Misconception #2: Marginal accreditation will excessively discount intermittent resources and storage because:**
  - ✓ Due to correlated effects, these resources have diminishing marginal value as their penetration rises.
  - ✓ As state goals are achieved, marginal credit of policy resources will necessarily be very low or zero.
  - ✓ Marginal approaches examine resources in isolation and not as part of a larger portfolio.

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Marginal Accreditation Does Not Excessively Discount Resources

- Marginal capacity credit is affected by both diminishing returns *and* synergies with complementary resources.
  - ✓ For example, rising solar penetration is expected to support marginal capacity value of storage and vice versa.
- Marginal accreditation will help *avoid* situations where the marginal value of resources falls to zero.
  - ✓ Provides signal to reduce investment in saturated resource types and invest in complementary resources instead.
  - ✓ A scenario in which marginal capacity value of a resource falls to zero is one in which (a) unproductive overinvestment has occurred or (b) the resource has very large non-capacity benefits.

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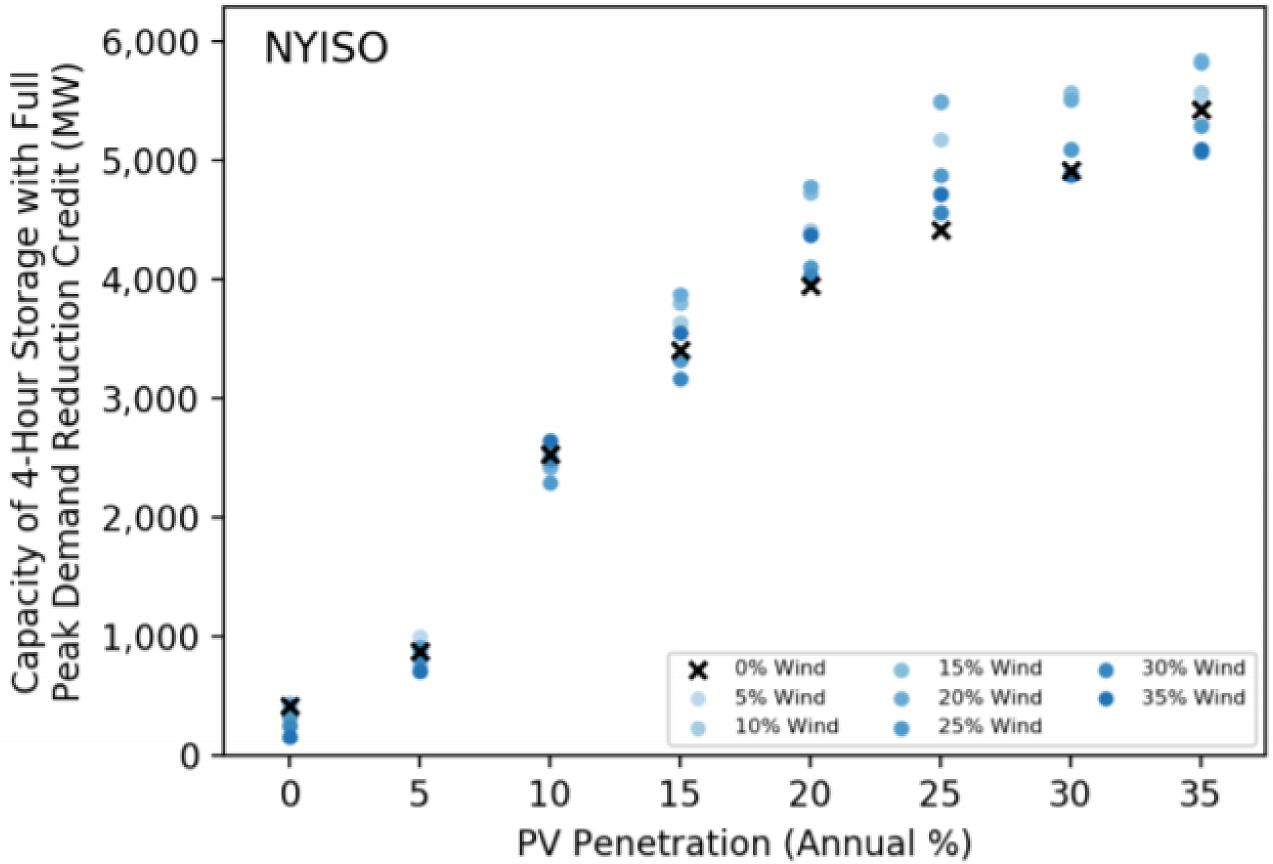
Example of Synergies under Marginal Accreditation

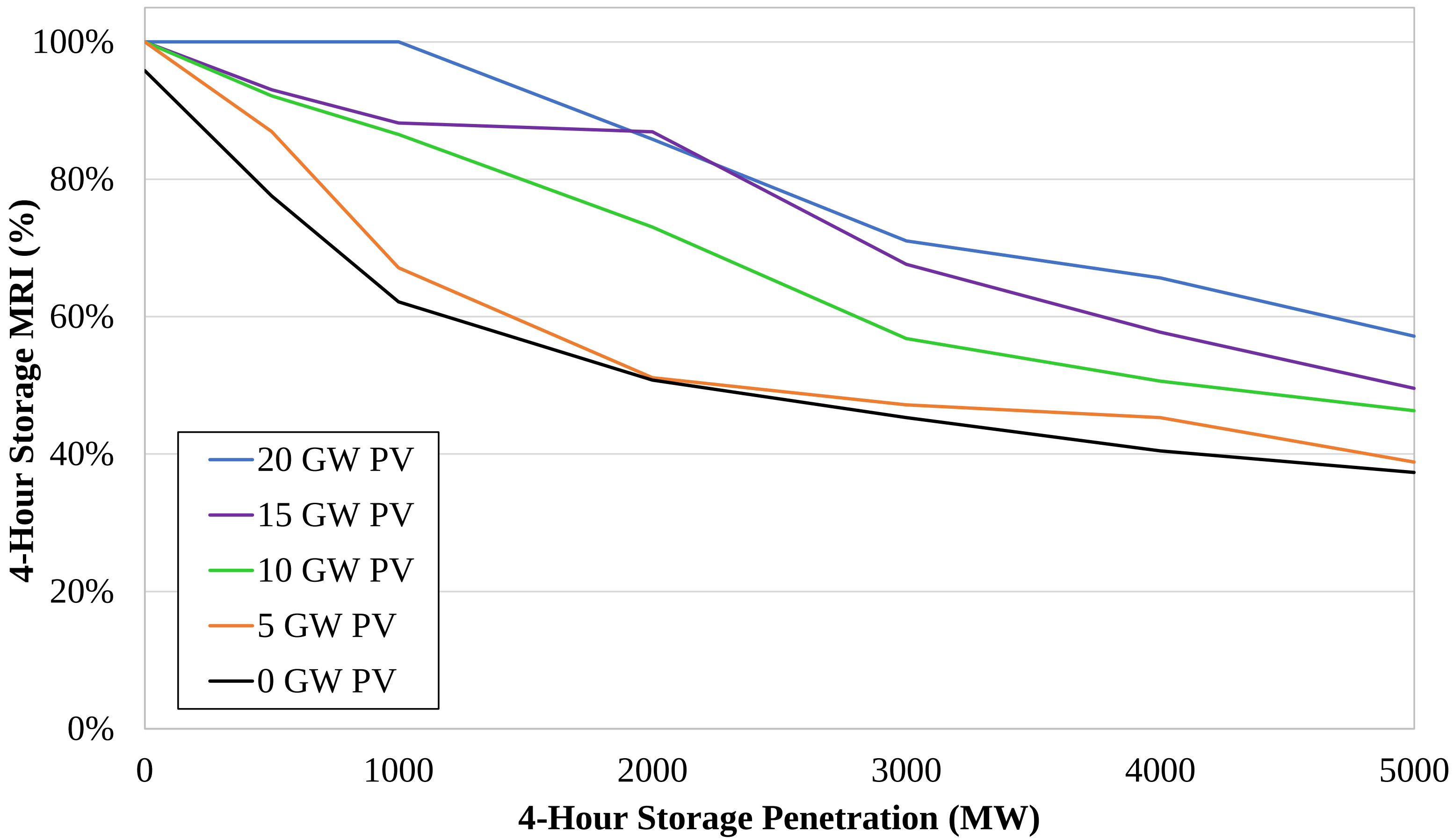


Source: Denholm, Paul, Jacob Nunemaker, Pieter Gagnon, and Wesley Cole. 2019. The Potential for Battery Energy Storage to Provide Peaking Capacity in the United States. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-74184. https://www.nrel.gov/docs/fy19osti/74184.pdf

Illustrative MRI Values
Impact of Synergies and Correlation

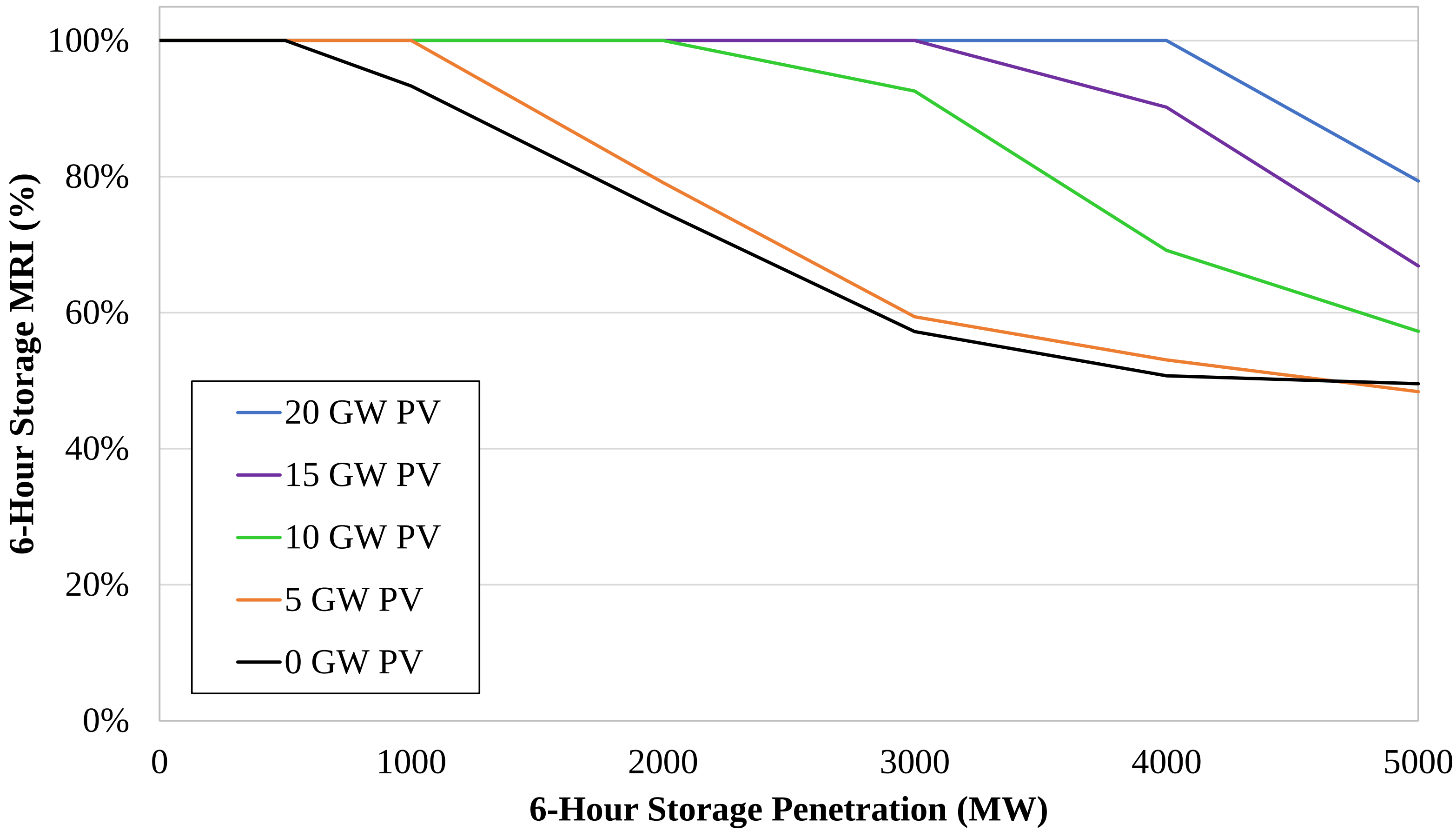
- The following two slides show MRI calculated for storage as penetration grows, at varying levels of solar penetration.
- **These results are based on a desktop analysis lacking the detail and stochastic features of MARS, and should not be interpreted as predictions of actual MRI values.**
- Rather, they are intended to illustrate how MRI is affected by the presence of correlated or synergistic resources, all else equal
- Details of methodology can be found in the Appendix.

Illustrative MRI
4-Hour Storage with Varying Solar Penetration



Results are illustrative and are not predictions of MRI values.

Illustrative MRI
6-Hour Storage with Varying Solar Penetration



Results are illustrative and are not predictions of MRI values.

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Misconception #3

- **Misconception #3: Marginal accreditation is not aligned with achieving state policies because:**
  - ✓ Accurate investment signals are not important, because projects will be driven by non-NYISO market revenue sources such as RECs.
  - ✓ Marginal accreditation is likely to reduce capacity credit of some policy resources, so it is unsupportive of state policy.

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Relationship of Marginal Accreditation to Policy-Driven Investment

- What are *efficient* capacity market incentives?
  - ✓ Guide investment and retirement decisions towards meeting resource adequacy criteria at the lowest cost…
  - ✓ …*subject to* environmental and policy criteria that restrict what kinds of investments are needed/permissible.
- Efficient capacity prices are no less important when investment is largely policy-driven, and likely even more important.
  - ✓ Many possible combinations of resources and locations can meet state policy targets – high cost of inefficient decisions.
- Accreditation based on marginal value encourages investment in resources that meet *both* environmental and reliability targets at lowest total cost.

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Relationship of Marginal Accreditation to Policy-Driven Investment

- State REC procurements use competition between policy resources.
  - ✓ The most competitive projects have the lowest {cost minus wholesale market revenue}
  - ✓ Wind, solar and other technologies compete in Tier 1 program
  - ✓ Storage-paired and standalone renewables compete in Tier 1
  - ✓ Storage projects could be 4-hour, 2-hour, 8-hour, etc
  - ✓ Policy resources in different locations compete with each other
- Marginal accreditation supports cost-effective achievement of state goals by accurately signaling value of competing policy resources
  - ✓ Average accreditation will increase the cost of achieving state goals by distorting capacity market incentives, leading to an inefficient mix of policy resources.

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Marginal Accreditation Supports Policy Goals
Stylized Example

- Solicitation for RECs with two bidders offering same REC quantity.
- Under marginal accreditation the more efficient resource is selected.
  - ✓ This results in lower total consumer cost (energy + capacity + REC)

All in $/MWh terms		**Resource X**	**Resource Y**
Levelized Cost	(a)	50	60
Energy Revenue	(b)	25	25
Capacity + REC Revenue Needed	(c) = (a) - (b)	25	35
Capacity Revenue (Marginal Approach)	(d)	2	5
Capacity Revenue (Average Approach)	(e)	3	15
REC Offer (Marginal Approach)	(f) = (c) - (d)	23	30
REC Offer (Average Approach)	(g) = (c) - (e)	22	20

Method	Winner	REC	Capacity Payment	Incremental Capacity Value	Energy Revenue	Resource Cost	**Total Payment less Energy and Capacity Value**
Marginal Approach	Resource X	23	2	2	25	50	**23**
Average Approach	Resource Y	20	15	5	25	60	**30**

Problems with Average Accreditation

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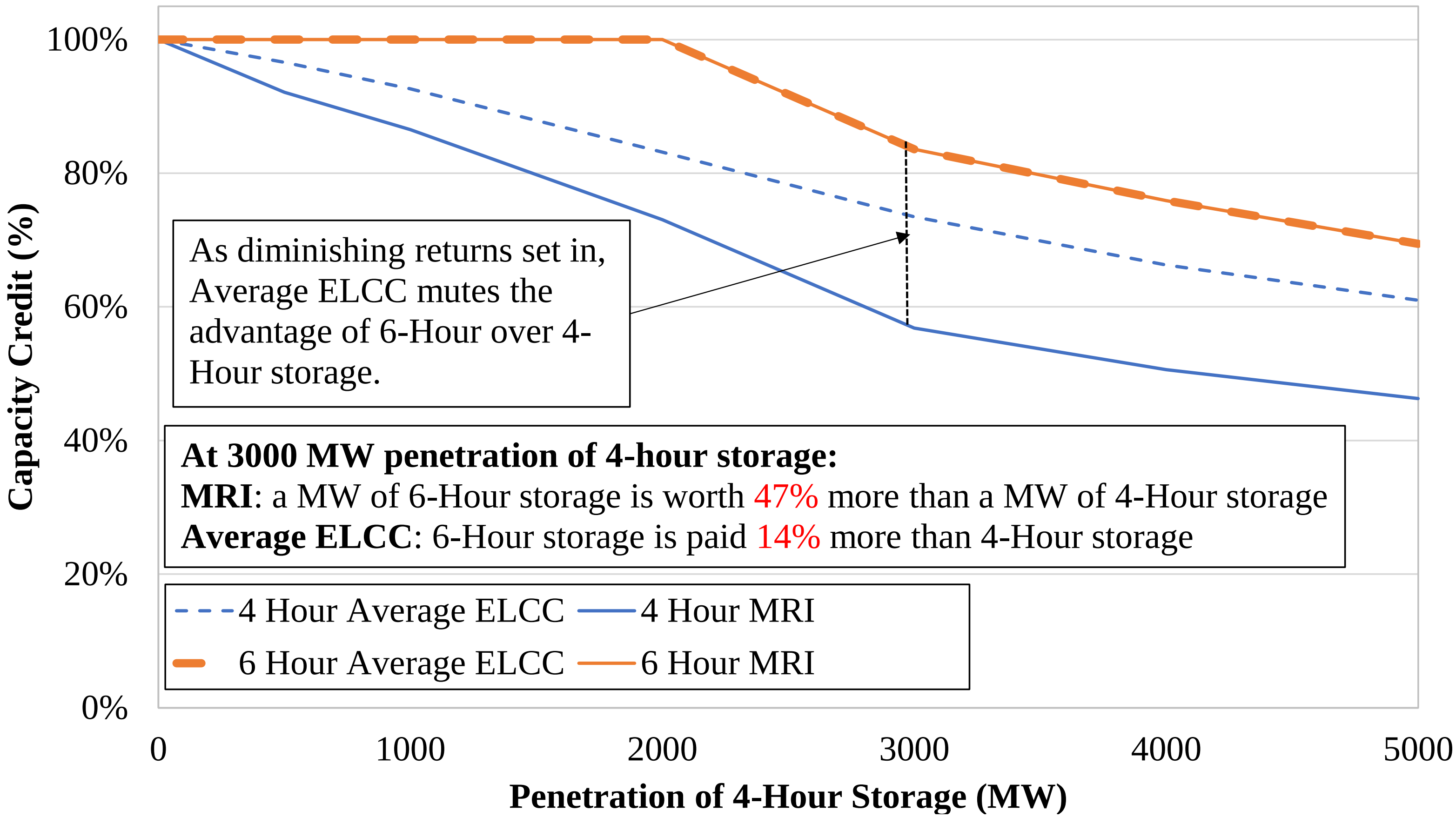
Inefficient Incentives under Average Accreditation

- **Problem #1: Inefficient Incentives for Investment**
- Under average accreditation, compensation does not align with a resource’s impact on improving reliability.
  - ✓ Suppose Resource X has average ELCC of 20% and MRI of 4%.
  - ✓ A new unit of Resource X is 4% as effective as perfect capacity at reducing load shedding…but gets paid 5 times its value.
- Likely consequences of average ELCC approach:
  - ✓ Underinvestment in resources with greater reliability benefits (including storage-paired renewables, longer duration storage)
  - ✓ Overinvestment in resources with diminishing reliability benefits (undiversified intermittent type, shorter duration storage, retention of gas-only thermal generation)

Illustrative MRI vs. Average ELCC
Assuming 10 GW Solar, 0 MW 6-hour Storage



Results are illustrative and are not predictions of MRI or ELCC values. See slide 13 and Appendix.

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Overpayment by Consumers under Average Accreditation

- **Problem #2: Excess payments under average accreditation lead to inflated consumer costs.**
- Efficient capacity payments reflect what is needed to attract or retain capacity at the current level of reliability.
  - ✓ At the tariff-prescribed level of excess…
    - the DCR technology should earn the Net CONE, and
    - a unit that provides half as much reliability benefit as the DCR technology should earn half the Net CONE.
- Under average accreditation, capacity payments to some resources exceed what is needed to attract or retain capacity.
  - ✓ <u>Consumer surplus</u> (difference between total benefit and marginal price) is artificially allocated to some producers instead of consumers.

Overpayment under Average Accreditation
Analogy to Locational Value

- Suppose the following surplus and capacity price values:
  - ✓ NYCA: 4 GW surplus capacity, price of $0/kW-year.
  - ✓ NYC: 0 GW surplus capacity, price of $150/kW-year (Net CONE).
  - ✓ A large surplus of bottlenecked capacity upstate limits the benefit of adding more capacity there.
- Suppose that the 4 GW surplus upstate could be replaced by an additional 2 GW in NYC, while holding systemwide LOLE constant.
  - ✓ The average value of surplus upstate capacity is higher than $0.
- Marginal approach: pay each unit $0 in rest-of-state and $150 in NYC, based on the value the next unit would provide.
- Average approach: pay ROS capacity 50 percent of Net CONE even though the next unit provides no value, because its total load carrying capacity is large.

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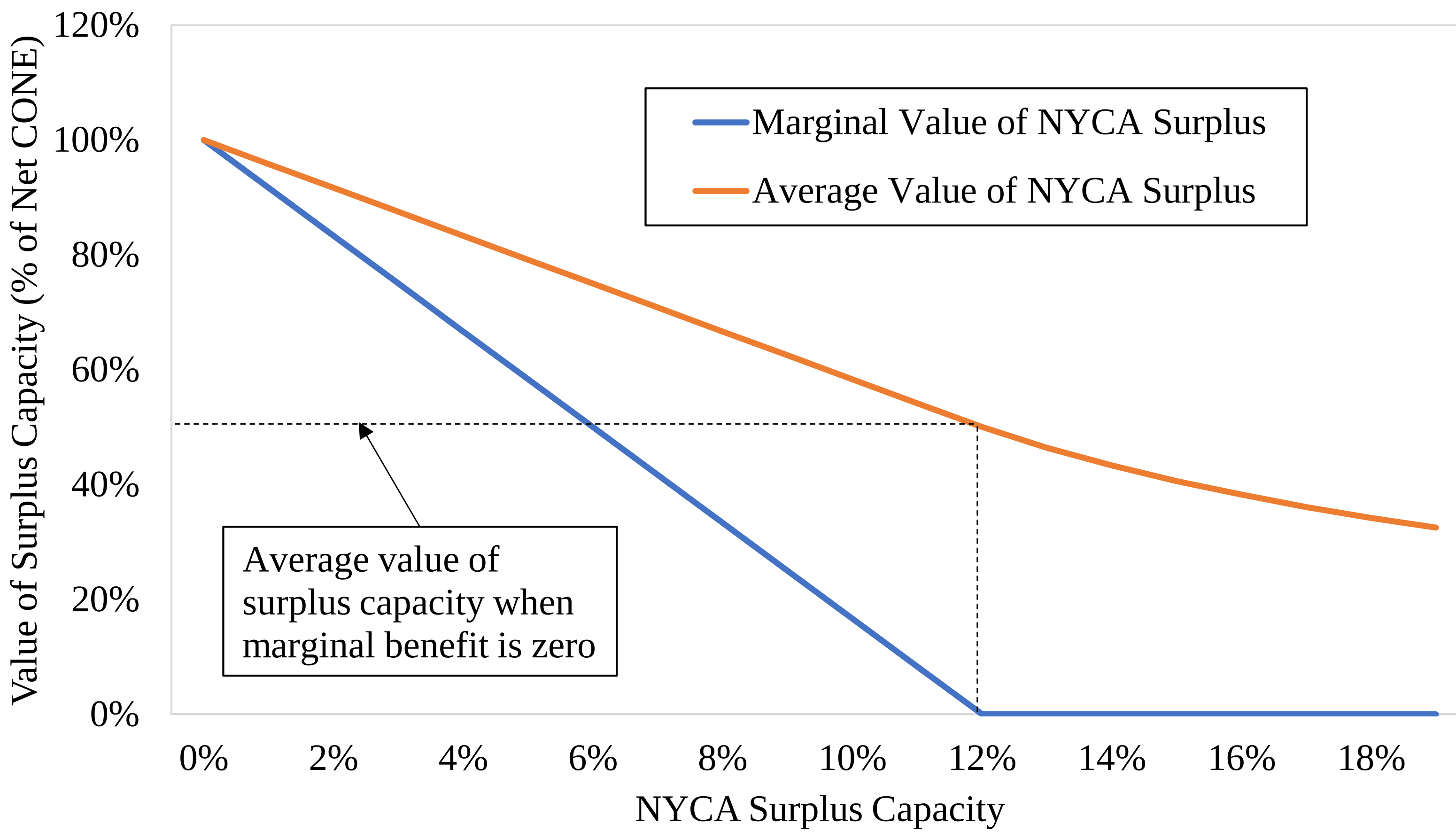
Overpayment under Average Accreditation
Analogy to Locational Value



Subjectivity of Average Accreditation Approach

- **Problem #3: Average ELCC values are subjective**
- Choice of what to include in resource portfolios for Average ELCC is likely to affect the outcome.
  - ✓ The sum of average ELCC values performed for each resource class individually may exceed the aggregate portfolio ELCC.
- *Consequence*: capacity credit under Average ELCC requires use of subjective portfolio groupings or allocation methods.
  - ✓ Example: solar is more valuable when some amount of storage is included in the base case, and vice versa.
    - – Solar and storage may be incentivized to enter separately instead of as hybrid resources to get higher total capacity payment, even if economics favor hybrids.
- Marginal methods do not have this problem because the entire resource mix is always included in the base case.

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Subjectivity of Average Accreditation Approach

- Example – if hybrid solar + storage is considered a separate resource class, it is undervalued under Average ELCC relative to standalone.
  - ✓ "Portfolio benefit" is allocated to whatever resources are chosen to be considered members of a larger portfolio.

Resource Type	Existing MW	MRI	Average ELCC	Portfolio Average ELCC
Standalone Solar	5,000	15%	30%	
Standalone Storage	2,000	60%	90%	49%
Hybrid S+ES	500	70%	73%	

This example is illustrative and uses hypothetical values.

- Similar arbitrary classifications could occur with:
  - ✓ Resources of same type at different locations
  - ✓ Resources that are different but partly correlated (storage resources of different durations, land-based vs. offshore wind)

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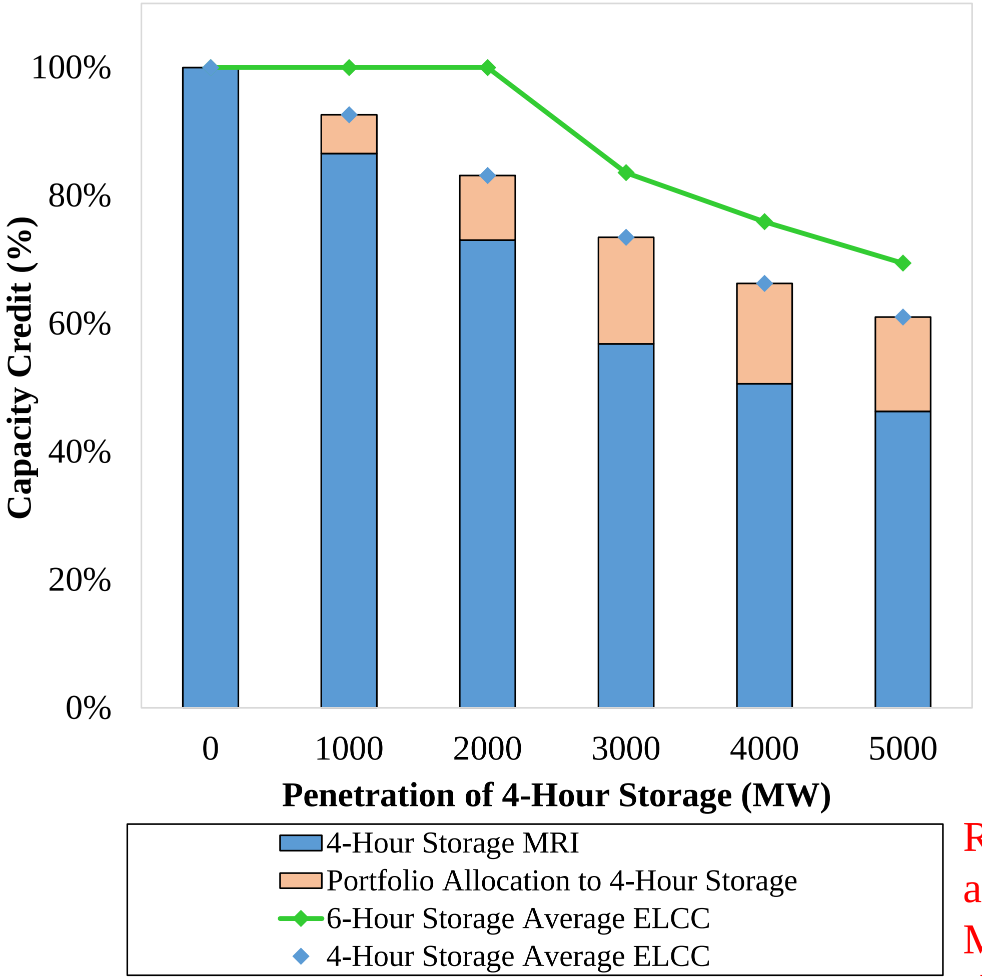
Subjectivity of Average Accreditation Approach
Illustrative Values – 10 GW Solar, 0 MW 6-Hour ES



- 'Portfolio effect' is allocated to existing resource type – 4-hour storage in this case.
- ELCC of 6-hour storage is affected by 4-hour penetration, but it is not allocated portfolio effect because its penetration is low/zero.
- This results in unequal treatment of 4-hour and 6-hour resources.

Results are illustrative and are not predictions of MRI or ELCC values. See slide 13 and Appendix.

Appendix

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Appendix – Desktop Analysis of MRI and ELCC

- Compare generation and storage availability to load in each hour to calculate unserved energy (UE) in a deterministic model (*not* a Monte Carlo model).
  - ✓ Results show average of runs using 2002, 2006 and 2007 NYCA load shapes.
  - ✓ Solar ICAP is multiplied by hourly profile shape for NY from NREL.
  - ✓ Storage is dispatched to relieve UE if load exceeds other available generation capacity, beginning in first hour each day that UE would occur, until energy reserve is depleted.
  - ✓ All other capacity is modeled as always available.
- Methodology to calculate MRI and ELCC:
  - ✓ Vary 'other capacity' until system is at target UE (0.002% of annual load).
  - ✓ Calculate MRI as change in UE from adding 1 MW of resource at criteria, relative to adding 1 MW of always-available capacity.
  - ✓ Calculate Average ELCC of portfolio as total perfect capacity needed to replace all solar and storage holding UE constant. Allocate to solar and storage similarly to 'Delta Method' proposed by PJM.