NYISO Capacity Accreditation: Consumer Impact Analysis

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Background

- NYISO has proposed tariff changes related to capacity accreditation as part of its Comprehensive Mitigation Review proposal.
- The MMU conducted an analysis of the long-term impacts of capacity accreditation on consumer costs and the NYISO markets.
  - ✓ The analysis considers the dynamic impact of accreditation on resource investment decisions.
  - ✓ This analysis can be used to address many of the questions being raised by stakeholders ahead of the November BIC and MC meetings.

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Overview of Approach

- **Purpose**: Model how the resource mix, capacity market outcomes, and consumer payments by 2030 are affected by alternative accreditation methods.
- Two primary components:
  - ✓ **Simplified capacity accreditation model** – calculate capacity credit under Marginal, Average (Delta Method), and Status Quo for each resource type for a given resource mix.
  - ✓ **Simplified capacity expansion model** – calculate profit-maximizing investment decisions with given capacity credit ratings.
  - ✓ These two models are iterated to arrive at an optimal set of investment decisions by 2030 under each accreditation method.

Overview of Presentation

- This presentation is organized as follows:
  - ✓ Methodology: Capacity Accreditation Model (slides 5-10)
  - ✓ Methodology: Capacity Expansion Model (slides 11-15)
  - ✓ Summary of Results (slides 16-31)
  - ✓ Conclusions (slides 32-33)
  - ✓ Appendix (slides 34-43)
- Marginal Accreditation is projected to be significantly more efficient than the two alternative methods, saving consumers:
  - ✓ $176 to $350 million per year by 2030 compared to the Status Quo rules (depending on the amount of fossil retirement and load growth), and
  - ✓ $93 to $226 million per year by 2030 compared to Average Accreditation.
  - ✓ Marginal accreditation performs better by encouraging:
    - A more efficient balance of solar and wind generation, and
    - Increased investment in longer duration battery storage.

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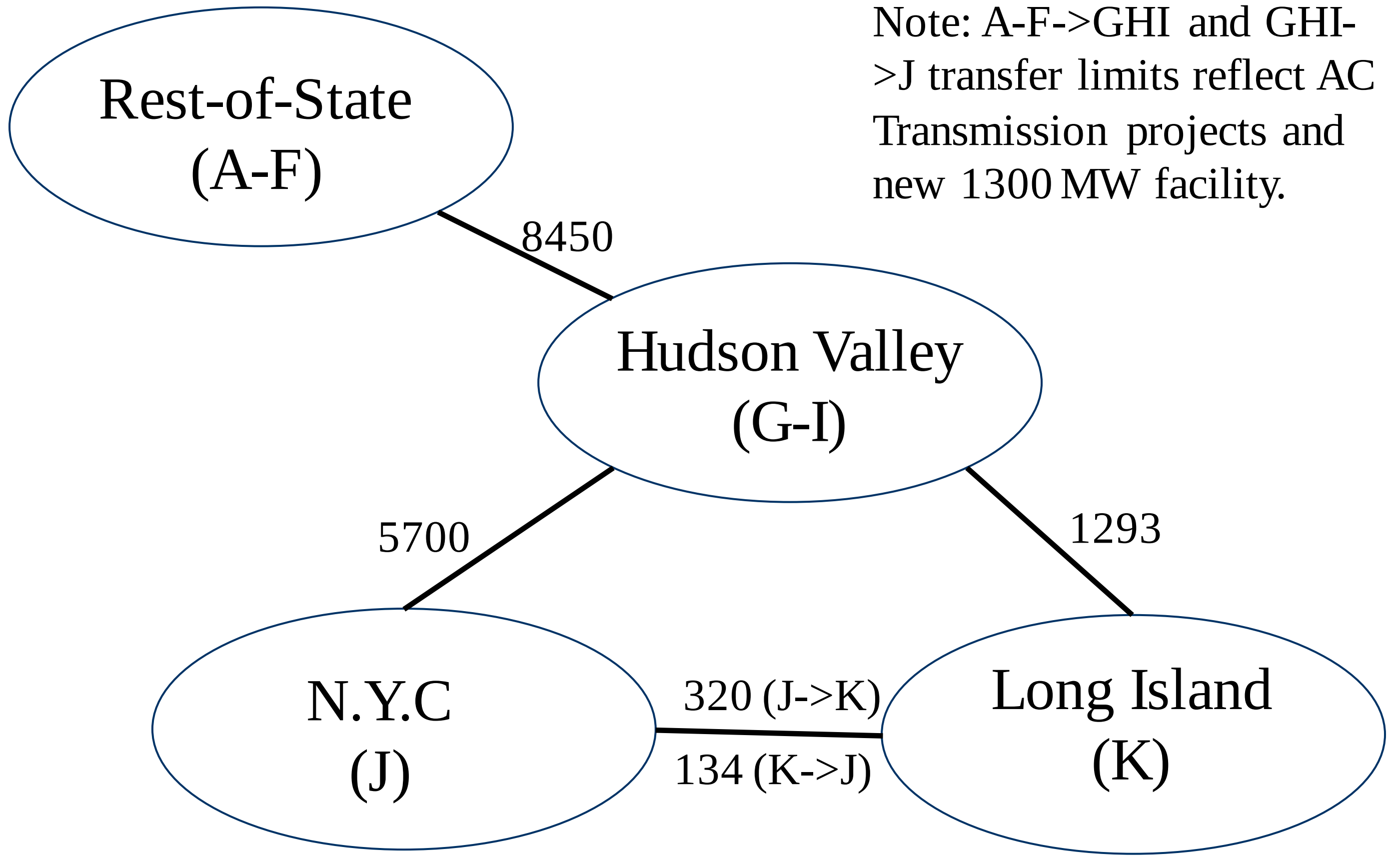
Methodology
Capacity Accreditation Model

Unserved Energy Model

- Deterministic chronological hourly loss of load model
  - ✓ Inputs a resource mix, outputs total unserved energy
- Calculate unserved energy (UE) in each hour, considering the following:
  - ✓ Hourly load shapes
  - ✓ Hourly intermittent resource output
  - ✓ Available capacity from conventional suppliers (assumed equal to UCAP)
  - ✓ Duration-limited resources (dispatched to minimize unserved energy until total energy is depleted)
- Simplified four-zone topology
  - ✓ Surplus capacity is transferred between zones to minimize unserved energy subject to zonal transfer limits

UE Model Topology

Note: A-F->GHI and GHI->J transfer limits reflect AC Transmission projects and new 1300 MW facility.



Determination of ICAP Requirements

- Capacity requirements (IRM and LCRs) are determined using the UE model.
  - ✓ Installed capacity is scaled such that the target level of reliability is met.
  - ✓ The sum of scaled capacity in each capacity zone sets its IRM/LCR.
- **Key takeaway – capacity requirements are determined prior to capacity credit. Each case will establish requirements that result in a reliable system.**

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Capacity Credit Methodology

- **Marginal Method (MRI)**
  - ✓ Determined for each resource type and zone
  - ✓ Calculated as change in UE from an incremental unit of capacity compared to a unit of perfect capacity in the same zone
- **Status Quo**
  - ✓ Based on Tailored Availability Metric (TAM) and Expanding Capacity Eligibility (ECE) rules
  - ✓ Intermittent resources – capacity credit is weighted average availability in seasonal 8-hour peak load window. PLW is determined as highest net load window.
  - ✓ Energy storage – ratings for 2-, 4-, 6- and 8-hour resources extrapolated based on results of initial ECE study.

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Capacity Credit Methodology

- Average ELCC – based on Delta Method approach[1]
  - ✓ Portfolio ELCC: perfect capacity that could replace all capacity of intermittent and storage resources at criteria.
  - ✓ Last-In ELCC: MRI at criteria
  - ✓ First In ELCC: MRI in a system at criteria with no intermittent or storage resources
- Allocate portfolio interactive effect (difference between portfolio ELCC and sum of last-in ELCCs) in proportion to individual interactive effects (difference between first-in and last-in ELCC of individual resource class)
- Portfolio ELCC = last-in ELCC plus allocated interactive effect
- Each resource/location combination is treated as a class

[1] See Slide 12 of presentation by E3 at 9/27/2021 ICAPWG.

Methodology
Capacity Expansion Model

Capacity Expansion Model

- Iterative model to choose the most economic investment and retirement decisions under each capacity accreditation method.
- Calculate capacity prices and revenues of each resource type and location
  - ✓ Build new resources if their total revenue (including RECs) exceeds cost of new entry
  - ✓ Retire existing capacity if revenue is below its going-forward cost.
    - – When there is a capacity surplus, prices tend to reflect the going-forward cost of existing resources.
- Models and provides results for a single year (2030), but results represent cumulative investment decisions up to that year
- New resource options: solar, land-based wind, offshore wind, energy storage (2, 4, 6, and 8 hour)

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Capacity Expansion Model
RECs and Storage Incentives

- State targets of 70 percent renewable energy and 3 GW storage are required to be met by 2030
- We assume that the State provides incentives at levels needed to attract investment in these resource types
  - ✓ Uniform REC price paid to new wind and solar resources
  - ✓ Uniform energy storage incentive per kWh of capacity
- Resources currently under contract with NYSERDA (including transmission lines) are automatically included
- Additional resources to meet policy targets are built by model based on minimum REC/incentive offer (cost minus market revenues)
  - ✓ Includes remaining renewables to meet 70x30 goal and storage
- **Key takeaway: capacity credit method affects mix of policy resources by changing relative economics of different types/locations of policy resources**

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Capacity Expansion Model Process

1. Determine capacity market demand curves and prices using ICAP requirements and derating factors from UE model
2. Calculate revenues of each resource using capacity price and UCAP ratings derived from UE model
3. Calculate uniform REC and storage incentive prices as minimum needed to incentivize investment in policy resources
4. Adjust entry and retirement decisions based on total revenue minus cost of each resource type
5. Recalculate ICAP requirements and capacity credit ratings

- Iterate this process until CLCPA targets are met and all resources earn revenue (including RECs) sufficient to cover cost-of-entry or going-forward costs

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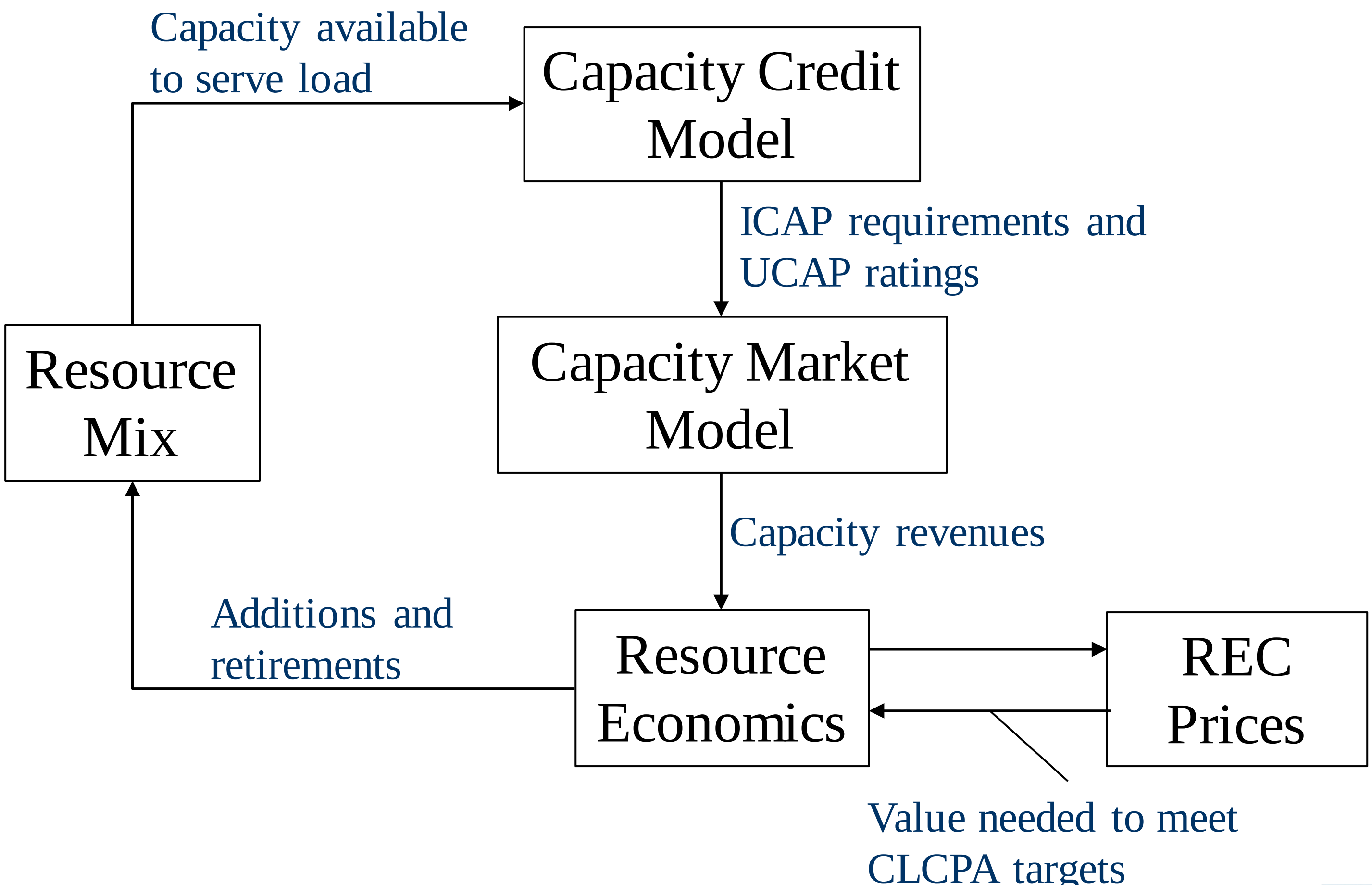
Summary of Model



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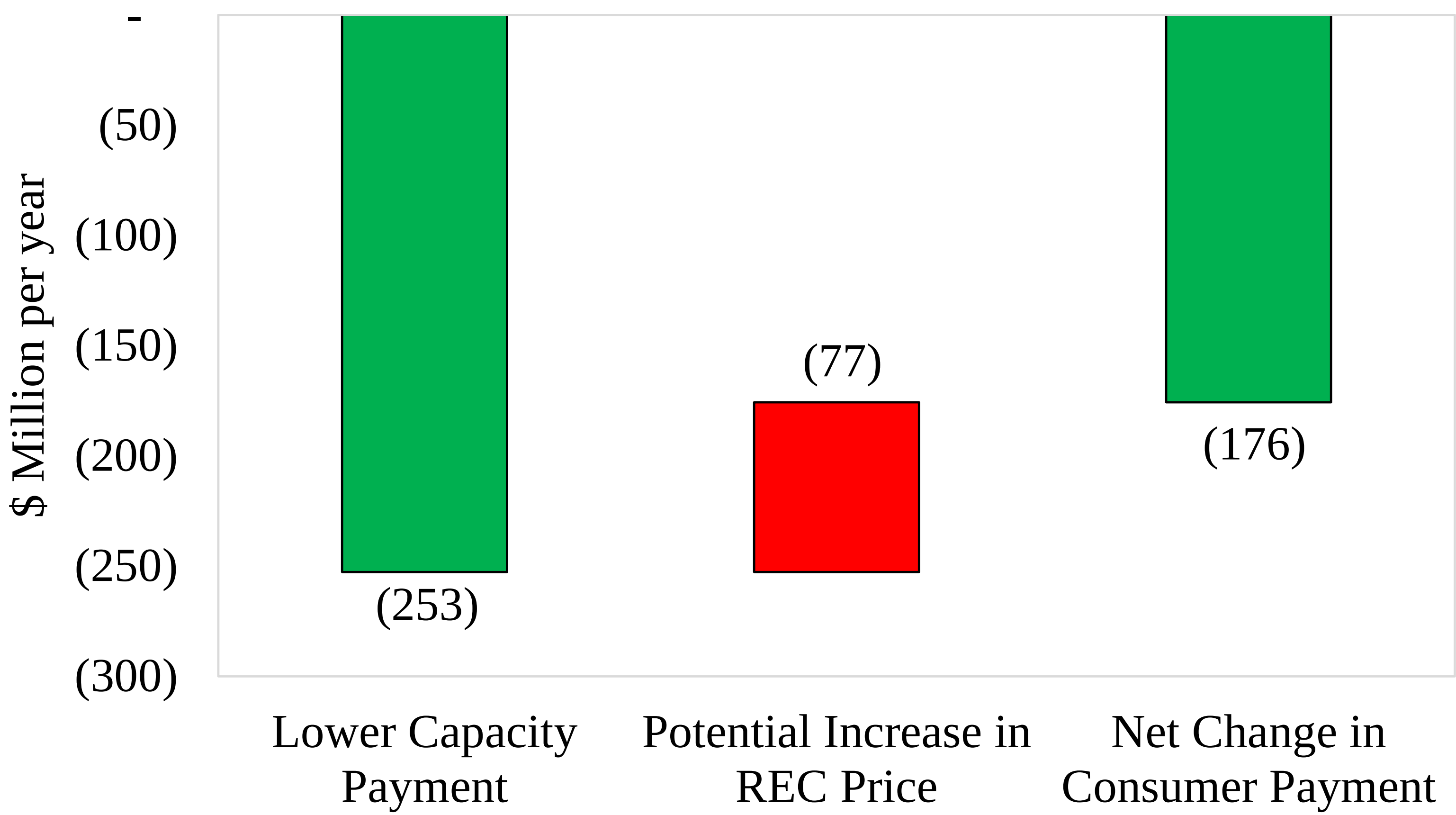
Summary of Results

Results – Introduction

- In each case:
  - ✓ The system satisfies the requirements determined using the unserved energy model – total procured capacity meets or exceeds the expected IRM/LCRs
  - ✓ State targets are achieved, including 70% renewable energy and 3 GW energy storage
- Cases differ because:
  - ✓ Capacity payments (based on accredited UCAP) vary across cases
  - ✓ Reliability and policy requirements are met with a different combination of resources in each case
    - – A less efficient combination of resources will increase the total cost (including RECs) of the system

Change in Consumer Payment (2030) Marginal vs. Status Quo



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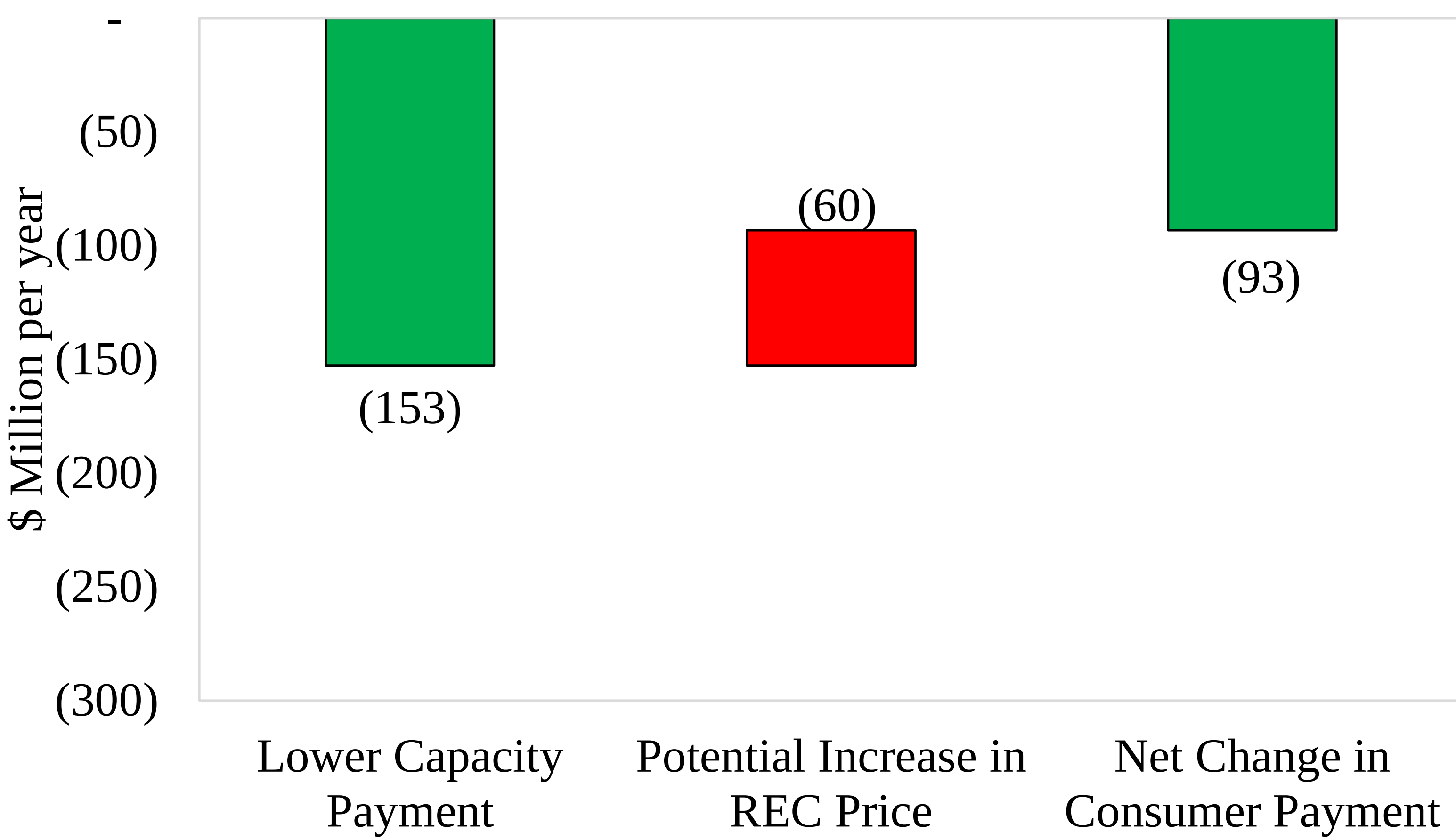
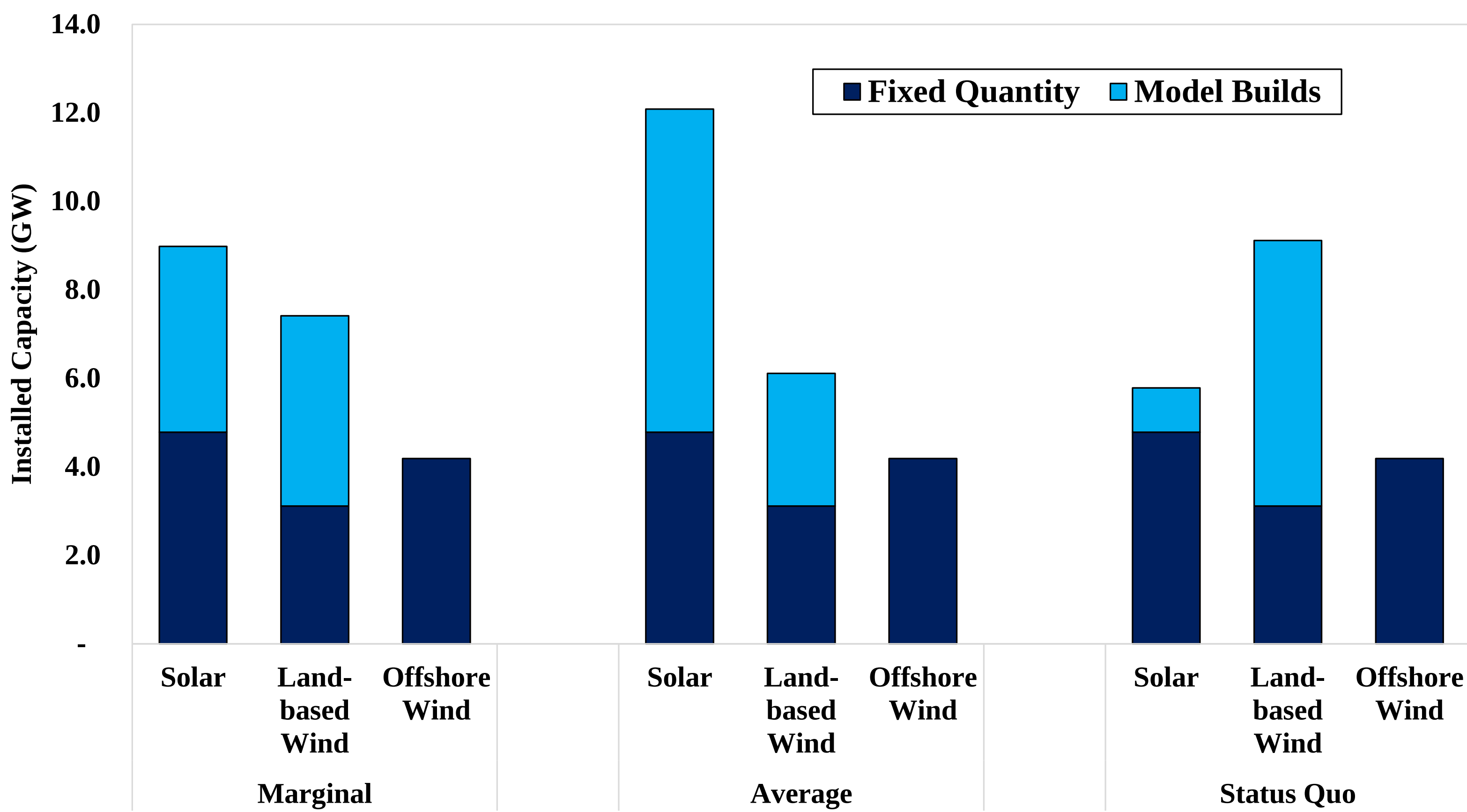
Change in Consumer Payment (2030)
Marginal vs. Average



Intermittent Renewable Capacity



- Marginal accreditation encourages a balanced mix of intermittent renewables compared to other approaches

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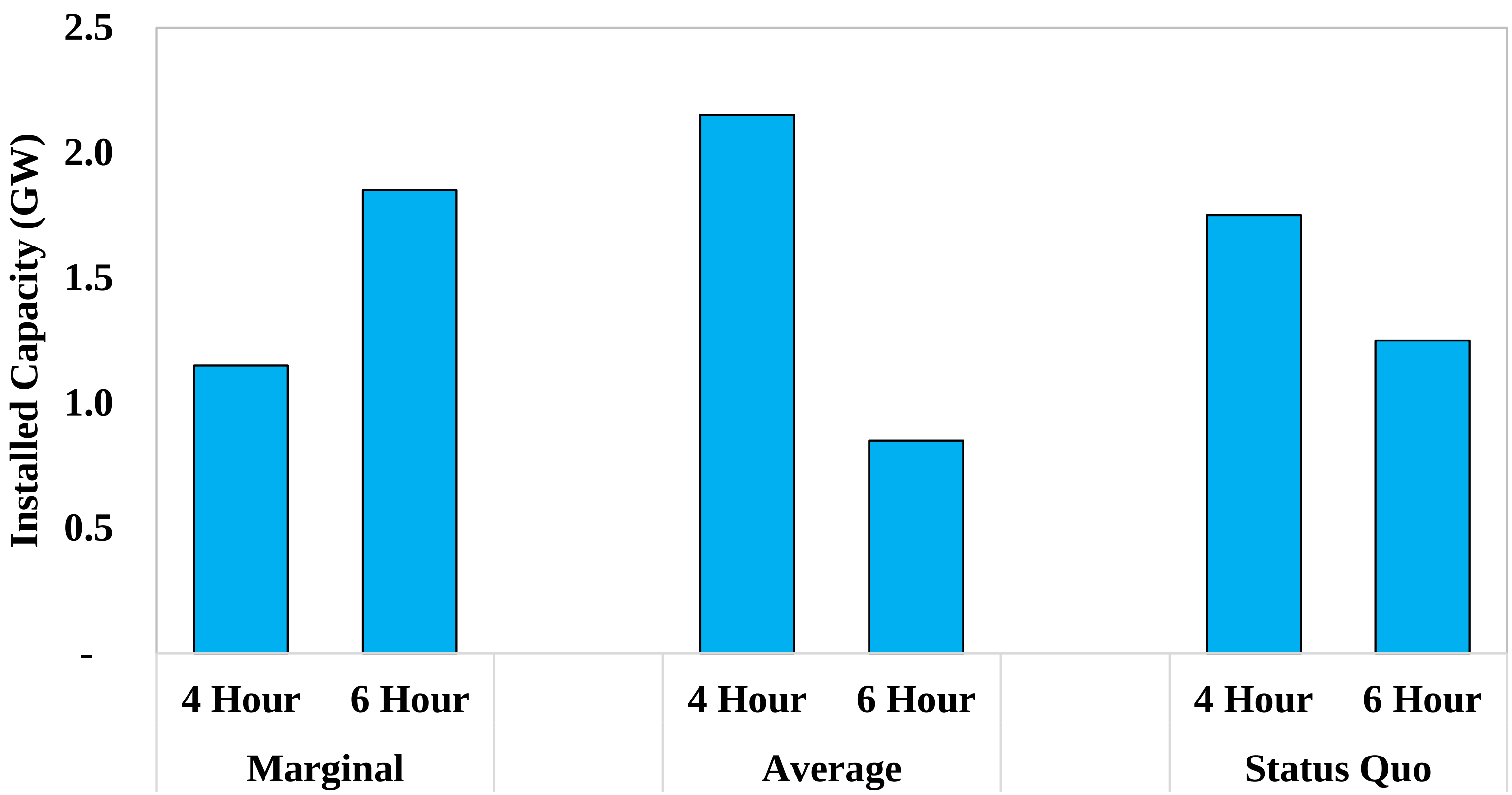
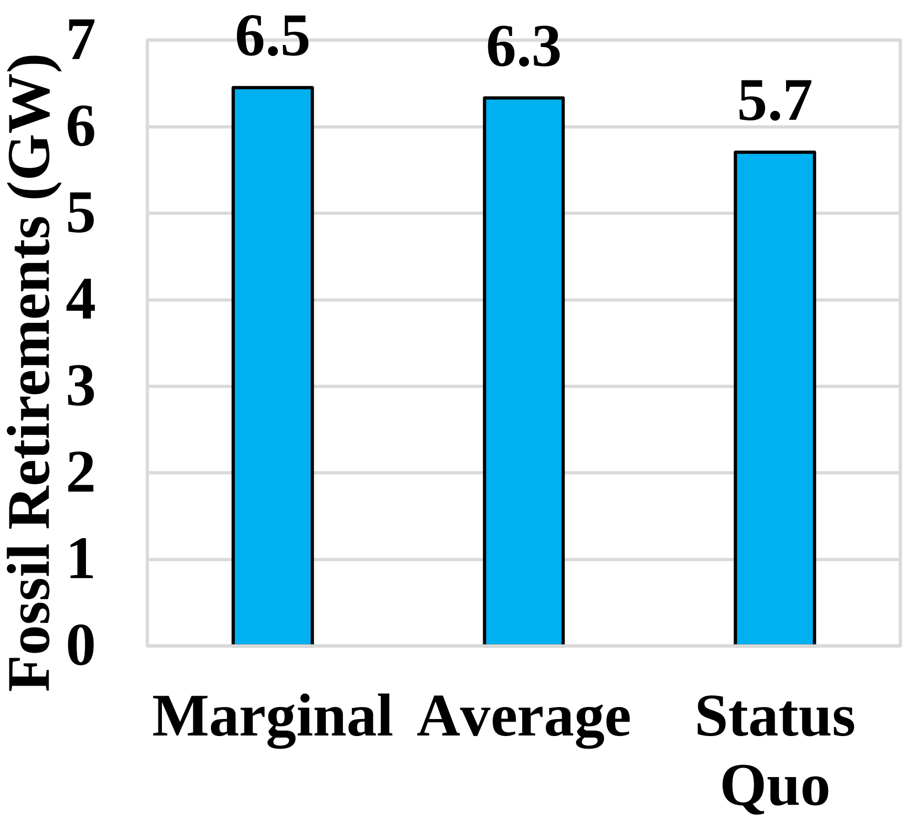
Energy Storage Capacity



- Marginal accreditation encourages investment in longer duration storage resources compared to other approaches

Retirements



- More accurate accreditation methods select policy resources with greater aggregate reliability value, allowing more existing capacity to be displaced.

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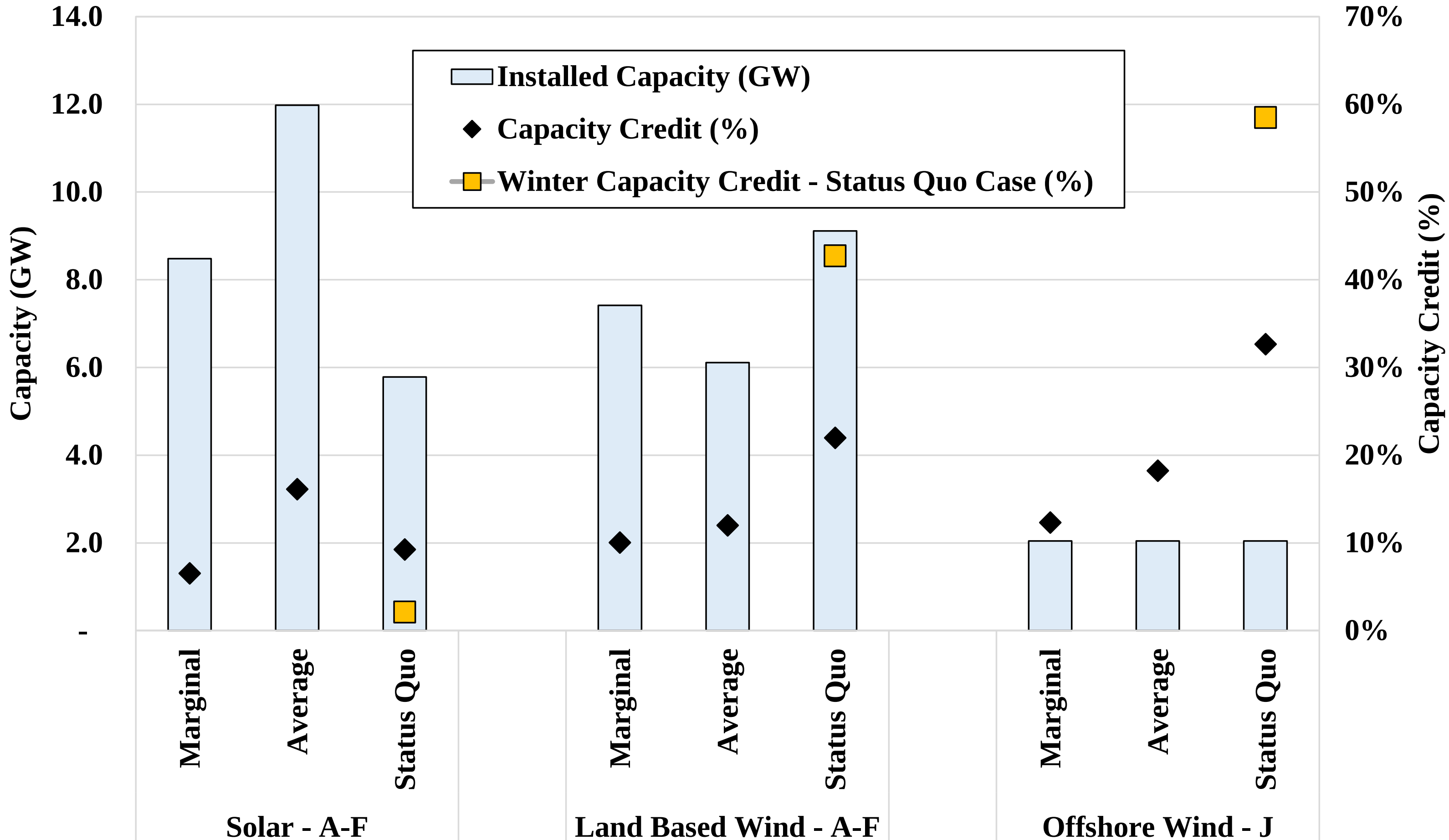
Capacity Requirements

Case	IRM	ICAP Requirement (GW)	Total ICAP (GW)	UCAP Requirement (GW)	Total UCAP (GW)	Capacity Surplus
Marginal	182%	59.1	62.4	32.5	34.3	5.6%
Average	187%	61.0	64.4	34.6	36.5	5.5%
Status Quo	180%	58.5	61.7	34.6	36.5	5.5%

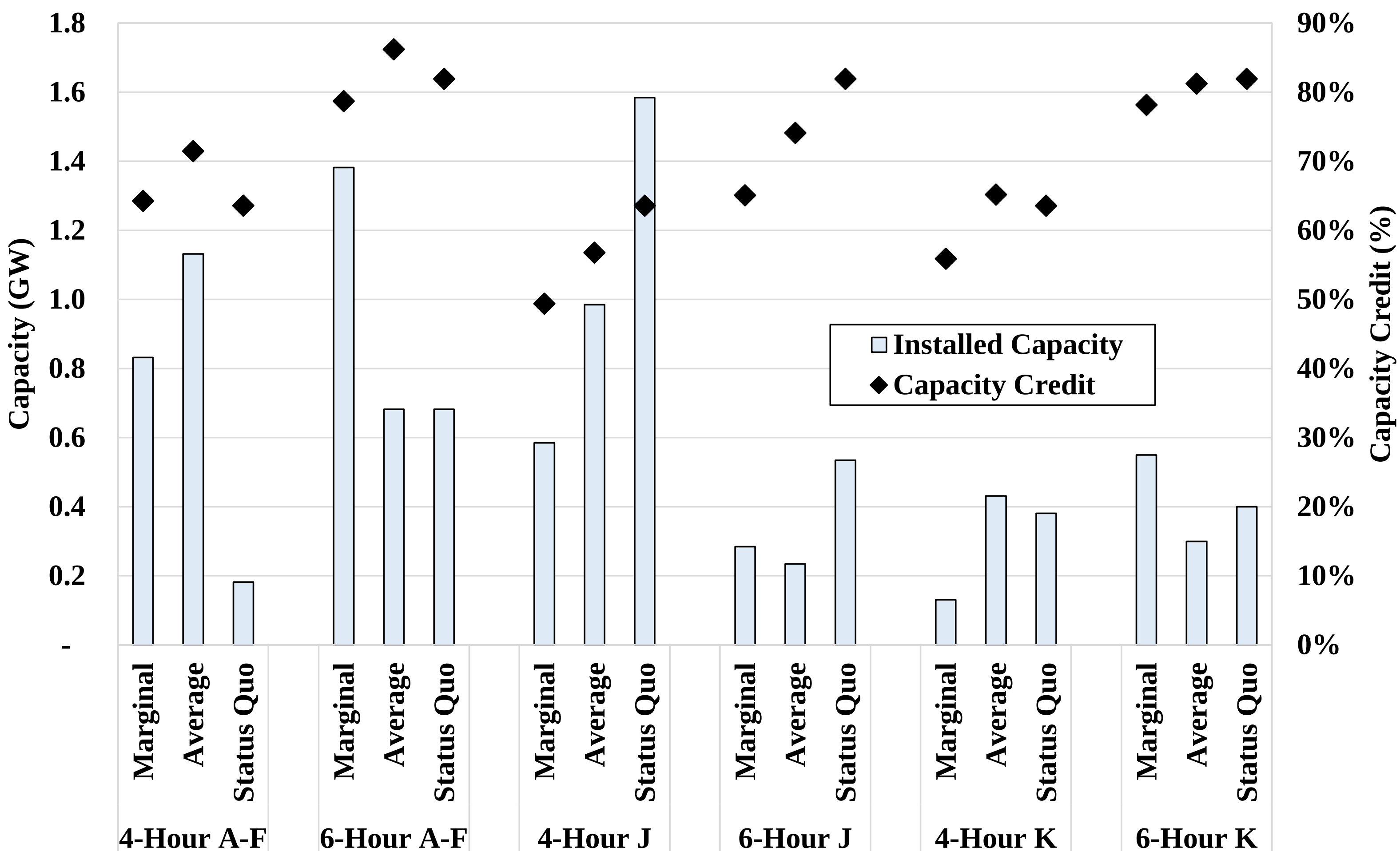
- Compared to the Marginal Case, the Average and Status Quo cases establish higher UCAP requirements and have higher total accredited UCAP supply
- Increased UCAP supply results in higher total capacity payment
  - ✓ It does NOT result in superior reliability – all three cases have similar levels of capacity surplus and unserved energy

Capacity Credit – Intermittent Renewables



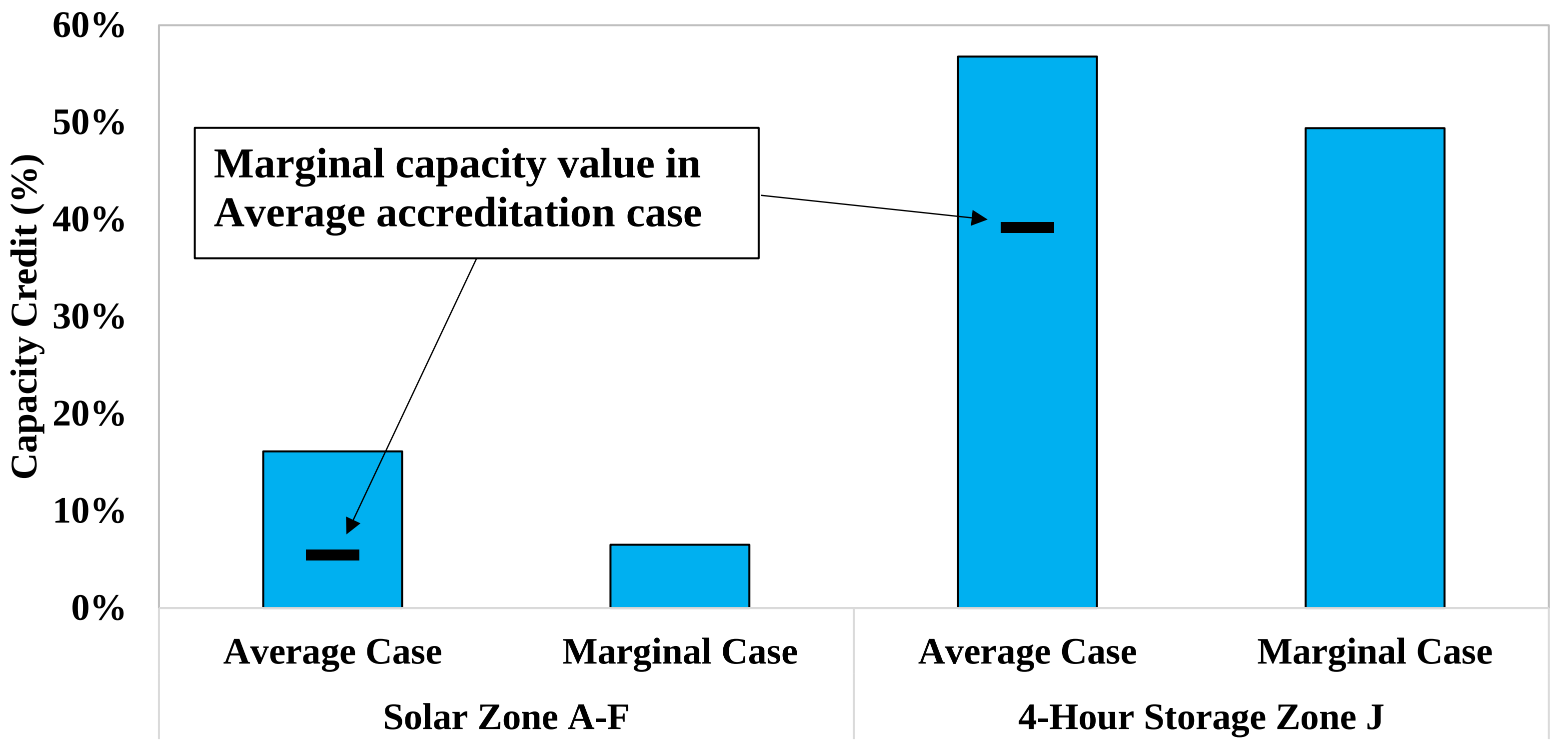
Results for all technologies and locations shown in Appendix

Capacity Credit – Energy Storage



Results for all technologies and locations shown in Appendix

Over-investment in Average Case



- Under average accreditation, investment in a resource type continues after its marginal value has dropped below its cost (net of REC value)

Results Summary

- Reliability and policy targets are satisfied in all three cases
- Consumer costs are lower in the Marginal case
  - ✓ by $176 million (vs. Status Quo case) and $93 million (vs. Average case), net of REC payments
- Marginal accreditation favors a balanced mix of intermittent resources, while Average and Status Quo accreditation heavily favor one resource type
- Marginal accreditation incentivizes longer-duration storage more than Average and Status Quo accreditation

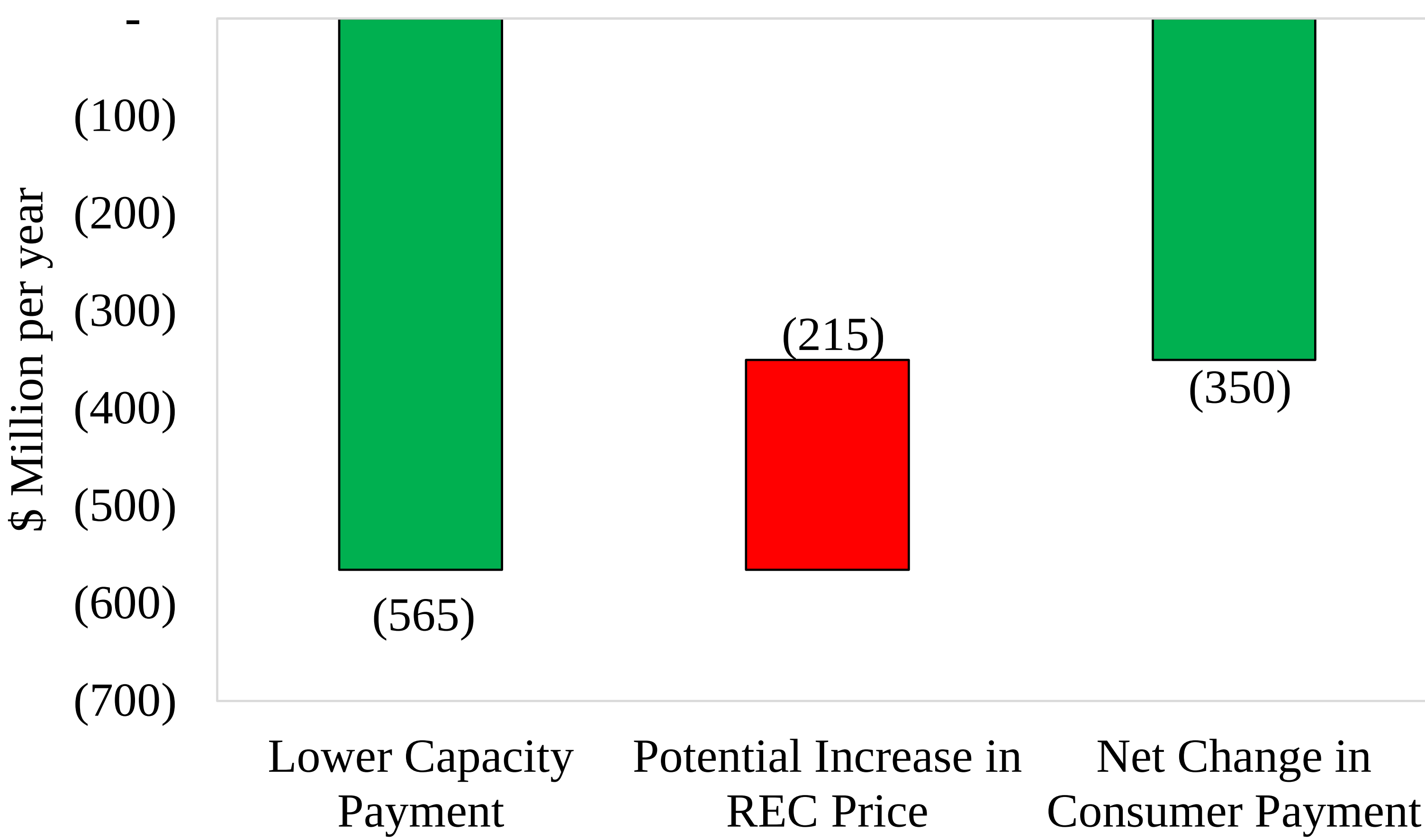
Factors Affecting Result

- The following factors would tend to increase the divergence between different accreditation methods in terms of market outcomes and consumer costs:
  - ✓ Larger renewable and storage targets
  - ✓ Greater diversity of potential choices among policy resources
  - ✓ Retirement or restriction of fossil resources, required replacement of peaking resources
  - ✓ Higher capacity prices
  - ✓ Load growth and/or changes in load pattern
  - ✓ Application of enhanced accreditation to other technologies (such as gas-only units and inflexible units)
- **For these reasons, the advantage of marginal accreditation over other methods is likely to increase beyond 2030**

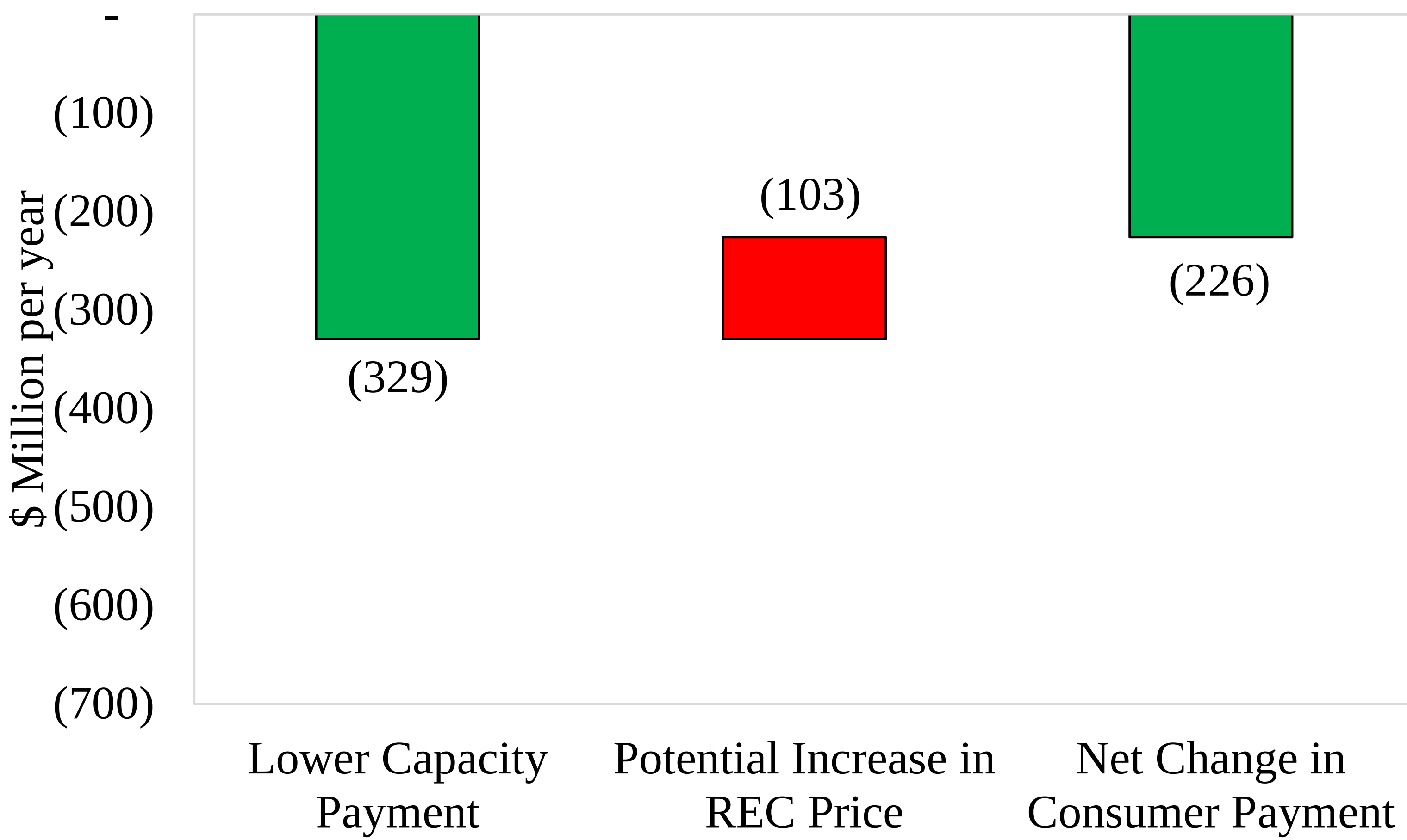
Sensitivity – High Capacity Prices

- The following two slides show consumer cost differences for a scenario with higher capacity prices in all three cases.
- This sensitivity case assumes that retirements occur until prices are at Net CONE levels in each zone.
  - ✓ This could represent a high-end scenario in which existing capacity retires on an accelerated schedule or there is rapid load growth.

Sensitivity – High Capacity Prices Marginal vs. Status Quo



Sensitivity – High Capacity Prices
Marginal vs. Average



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Conclusion

Conclusion

- A marginal accreditation approach results in more efficient signals for investment and lower consumer costs than the status quo or an average approach.
- Capacity market signals can help guide investment in policy resources at the lowest cost to consumers when RECs supplement wholesale market revenues.
- Efficient accreditation will become more impactful as the CLCPA requires larger quantities of investment.
- We support NYISO’s proposal to apply a marginal accreditation approach to all resources.

Appendix

Adjustment to Criteria

- Capacity requirements and capacity credit ratings are determined at the targeted (criteria) level of unserved energy
  - ✓ We use a target based on UE instead of LOLE, as UE is better suited for a deterministic model
- The UE model is adjusted to criteria by scaling the as-found resource mix until total UE is equal to the target level
  - ✓ A UE criteria of 0.003% of annual load is used in each case
  - ✓ Capacity is scaled on a zonal level so that the cost of improving reliability at criteria is approximately equal across zones
- Capacity requirements (IRM and LCRs) are determined as the sum of scaled capacity at criteria in each region

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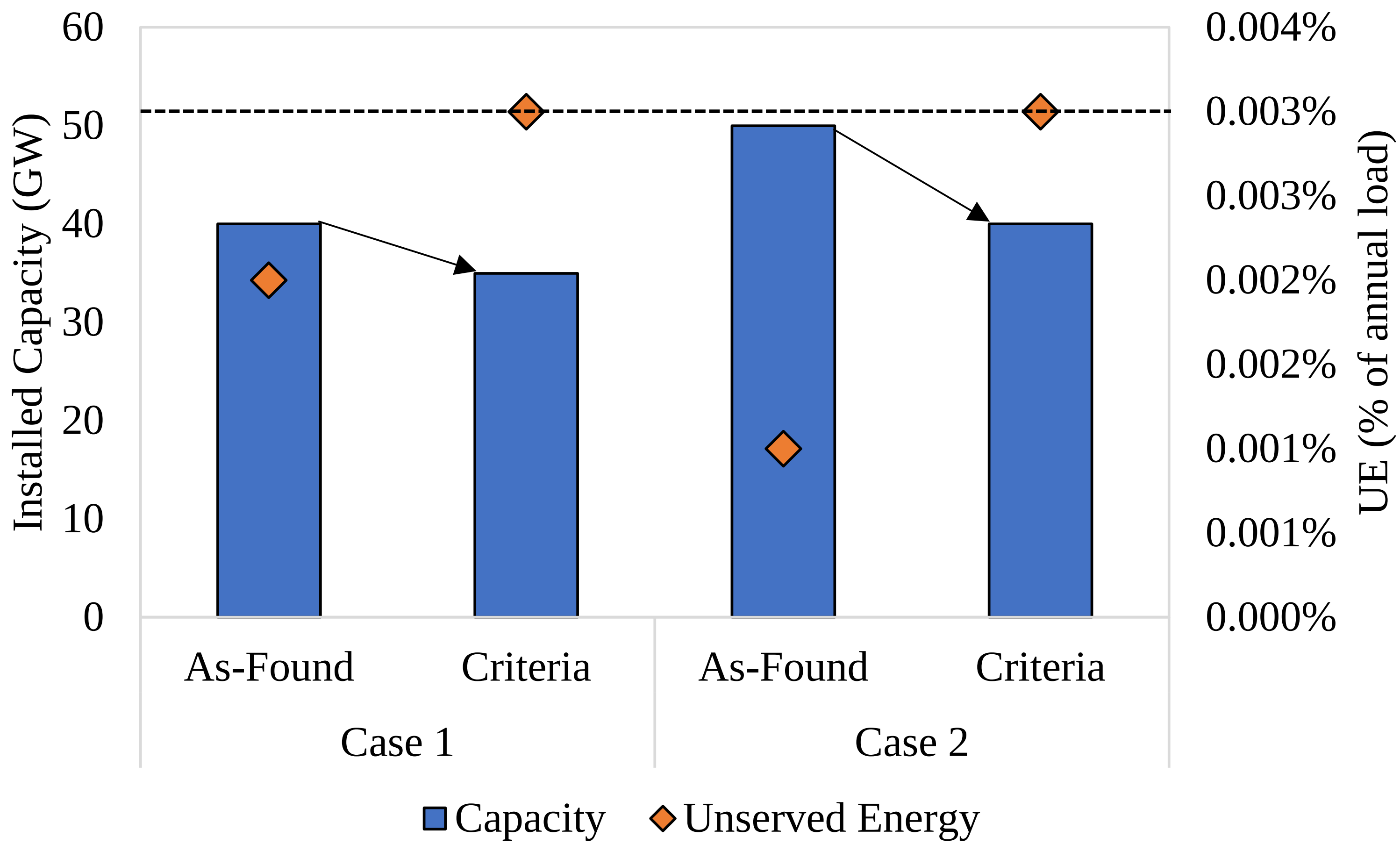
Adjustment to Criteria Conceptual Illustration



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Key Assumptions

Assumption	Source
Peak load forecast	2021 Gold Book forecast
BTM Solar penetration	2021 Gold Book forecast
Hourly gross load shape	2002, 2006 and 2007 IRM load shapes
Load Forecast Uncertainty	8.0% increase applied to load in UE model to reflect high-end draw
Existing Capacity	2021 Gold Book, less Indian Point 3 and units affected by DEC Peaker Rule that plan to retire or cease summer operations Latest summer/winter SCR and UDRs
Firm Renewable Capacity	6.1 GW solar and wind awarded REC contracts in 2017-2020 NYSERDA Solicitations for Large Scale Renewables and 4.2 GW offshore wind awarded OREC contracts in 2018 and 2020 solicitations
Capacity Imports	Based on recent historical levels, 1.0 GW summer and 0.4 GW winter

Key Assumptions

Assumption	Source
Transmission Transfer Limits	Post-2024 transfer limits from Draft 2021-2030 Comprehensive Reliability Plan, increased to reflect new 1300 MW transmission line into Zone J. CHPE Line included as firm capacity in Zone J.
Capacity Market Net CONE	2021 Demand Curve Reset gross CONE values, inflated to 2030. Net E&AS offset estimated using prices from NYISO 2019 CARIS 70x30 Case.
Policy resource cost of new entry	Average 2025-2030 costs derived from NREL 2021 ATB.
Policy resource E&AS revenues	Estimated using prices and net load from NYISO 2019 CARIS 70x30 Case.
Fossil resource going-forward costs	Steam turbine going-forward costs assumed as \$110/kW-yr in NYC, \$65/kW-yr in Long Island, and \$55/kW-yr in zones A-G. See 2019 State of the Market Report, p. A-236.

Detailed Results – Requirements and Prices

Marginal	NYCA	G-J	J	K
ICAP Requirement (MW)	59,091	13,126	9,390	7,424
IRM/LCR (%)	182%	83%	81%	150%
Average Derating Factor (%)	45.1%	31.8%	30.2%	40.2%
UCAP Requirement (MW)	32,470	8,948	6,557	4,440
Annualized Price ($/kW-yr)	57.4	58.4	116.9	69.3

Average	NYCA	G-J	J	K
ICAP Requirement (MW)	61,022	13,071	9,659	7,526
IRM/LCR (%)	187%	83%	83%	152%
Average Derating Factor (%)	43.4%	29.2%	29.5%	36.9%
UCAP Requirement (MW)	34,567	9,260	6,809	4,747
Annualized Price ($/kW-yr)	58.2	58.2	116.9	69.3

Status Quo	NYCA	G-J	J	K
ICAP Requirement (MW)	58,497	12,960	10,135	7,747
IRM/LCR (%)	180%	82%	87%	157%
Average Derating Factor (%)	40.9%	27.3%	27.7%	35.0%
UCAP Requirement (MW)	34,580	9,421	7,327	5,035
Annualized Price ($/kW-yr)	58.3	58.3	116.9	69.2

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Detailed Results – Installed Capacity

		Installed Capacity (MW)		
Zone	Technology	Marginal	Average	Status Quo
A-F	Existing Conventional	16,973	17,046	17,046
A-F	BTM Solar	4,538	4,538	4,538
A-F	SCR	546	546	546
A-F	Solar	8,482	11,982	5,782
A-F	Land Based Wind	7,414	6,114	9,114
A-F	2-Hour Storage	-	-	-
A-F	4-Hour Storage	650	950	-
A-F	6-Hour Storage	1,200	500	500
A-F	8-Hour Storage	-	-	-
G-I	Existing Conventional	2,643	2,763	3,602
G-I	BTM Solar	1,037	1,037	1,037
G-I	SCR	68	68	68
G-I	Solar	500	100	-
G-I	2-Hour Storage	-	-	-
G-I	4-Hour Storage	-	-	-
G-I	6-Hour Storage	-	-	-
G-I	8-Hour Storage	-	-	-

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Detailed Results – Installed Capacity

Zone	Technology	Installed Capacity (MW) Marginal	Average	Status Quo
J	Existing Conventional	6,628	6,566	6,175
J	BTM Solar	627	627	627
J	SCR	369	369	369
J	Offshore Wind	2,046	2,046	2,046
J	2-Hour Storage	-	-	-
J	4-Hour Storage	400	800	1,400
J	6-Hour Storage	100	50	350
J	8-Hour Storage	-	-	-
K	Existing Conventional	4,271	4,335	4,512
K	BTM Solar	1,079	1,079	1,079
K	SCR	31	31	31
K	Offshore Wind	2,140	2,140	2,140
K	2-Hour Storage	-	-	-
K	4-Hour Storage	100	400	350
K	6-Hour Storage	550	300	400
K	8-Hour Storage	-	-	-

Detailed Results – Capacity Credit

		Capacity Credit by Case (%)			
Zone	Technology	Marginal	Average	Status Quo - Summer	Status Quo - Winter
A-F	Solar	7%	16%	9%	2%
A-F	Land Based Wind	10%	12%	22%	43%
A-F	2-Hour Storage	42%	43%	32%	32%
A-F	4-Hour Storage	64%	71%	64%	64%
A-F	6-Hour Storage	79%	86%	82%	82%
A-F	8-Hour Storage	87%	92%	100%	100%
G-I	Solar	14%	24%	9%	2%
G-I	2-Hour Storage	22%	31%	32%	32%
G-I	4-Hour Storage	52%	57%	64%	64%
G-I	6-Hour Storage	75%	80%	82%	82%
G-I	8-Hour Storage	90%	94%	100%	100%

Note: results are **not** a full replication of NYISO GE-MARS and capacity credit is sensitive to underlying resource mix. Use caution applying capacity credit values outside context of specific case from which they were derived.

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Detailed Results – Capacity Credit

		Capacity Credit by Case (%)			
Zone	Technology	Marginal	Average	Status Quo - Summer	Status Quo - Winter
J	Offshore Wind	12%	18%	33%	58%
J	2-Hour Storage	28%	30%	32%	32%
J	4-Hour Storage	49%	57%	64%	64%
J	6-Hour Storage	65%	74%	82%	82%
J	8-Hour Storage	83%	88%	100%	100%
K	Offshore Wind	9%	18%	33%	58%
K	2-Hour Storage	37%	36%	32%	32%
K	4-Hour Storage	56%	65%	64%	64%
K	6-Hour Storage	78%	81%	82%	82%
K	8-Hour Storage	87%	92%	100%	100%

Note: results are **not** a full replication of NYISO GE-MARS and capacity credit is sensitive to underlying resource mix. Use caution applying capacity credit values outside context of specific case from which they were derived.

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