BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Oversee the Resource Adequacy Program, Consider Program Refinements, and Establish Forward Resource Adequacy Procurement Obligations.	Rulemaking 19-11-009 (Filed November 7, 2019)

HYBRID COUNTING WORKING GROUP PROGRESS REPORT SUBMITTED BY SAN DIEGO GAS & ELECTRIC COMPANY (U 902 E) AND THE CALIFORNIA ENERGY STORAGE ALLIANCE

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February 14, 2020

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Pursuant to the Rules of Practice and Procedure of the California Public Utilities Commission (the "Commission") and in accordance with the direction set forth in the *Assigned Commissioner's Scoping Memo and Ruling* ("Scoping Memo") issued in the above-captioned proceeding on January 22, 2020, San Diego Gas & Electric Company ("SDG&E") and the California Energy Storage Alliance ("CESA") jointly submit the attached progress report concerning the working group focused on development of a hybrid resource counting convention methodology ("Hybrid Counting Working Group").[1/]

Respectfully submitted this 14th day of February 2020.

/s/ Aimee M. Smith
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1/ Pursuant to Rule 1.8(d), counsel for SDG&E confirms that CESA has authorized SDG&E to file this progress report on its behalf.

Progress Report

Rulemaking 19-11-009 (Track 2)
Resource Adequacy

Hybrid Counting Working Group

February 14, 2020

I. INTRODUCTION AND BACKGROUND

On November 13, 2019, the California Public Utilities Commission (the "Commission") opened the instant Rulemaking (R.19-11-009) to continue to address the 2021 – 2022 Resource Adequacy ("RA") compliance years and to consider necessary refinements to the RA program. The January 22, 2020 Scoping Memo and Ruling ("Scoping Memo") directed parties to establish a working group process to address questions regarding RA counting conventions, dividing the working groups into four topical areas: (i) Hybrid Resources; (ii) Hydro Resources; (iii) Demand Response Resources; and (iv) Effective Load Carrying Capacity.

San Diego Gas & Electric Company ("SDG&E") and the California Energy Storage Alliance ("CESA") (together, the "Co-Chairs") volunteered to co-chair the Hybrid Resources Working Group, which is tasked with addressing the question of whether the Commission should adopt a permanent methodology for counting of hybrid resources. The Scoping Memo anticipates a Proposed Decision on all working group topics in the second quarter of 2020.

II. SUMMARY OF CO-CHAIR ACTIVITIES

The Hybrid Resources Working Group Co-Chairs, led by Nuo Tang (SDG&E), and Jin Noh (CESA), have held several meetings for the purpose of sharing proposals and determining the agenda for the Hybrid Resources Working Group in-person meeting on February 12, 2020. Meetings have been collaborative in nature, with each party bringing forth proposals and concepts vetted by their respective constituents. The collaboration process began with a call agreeing to the steps necessary to prepare for the in-person meeting, followed by additional calls dedicated to proposal review and agenda planning.

Co-Chair Meeting Dates:

- Initial Discussion: January 31 – telephonic
- Working Session #1: February 4 – telephonic
- Working Session #2: February 6 – telephonic
- Working Session #3: February 7 – telephonic
- Working Session #4: February 10 – telephonic

III. SUMMARY OF WORKING GROUP ACTIVITIES

A. Scheduling and Meeting Notification

The Scoping Memo directed that the working groups convene in early February 2020.[2] SDG&E provided notice to the R.19-11-009 service list on February 3, 2020, regarding its willingness to co-chair the Hybrid Resources Working Group with CESA and requested that all interested parties notify SDG&E and CESA in order to develop a targeted email distribution list for the Hybrid Resources Working Group. Pacific Gas and Electric Company ("PG&E") reached out to Energy Division Staff on behalf of all parties to determine meeting space availability; working group meetings for all topics were scheduled for February 12-13. Southern California Edison ("SCE") provided notice to the R.19-11-009 service list on February 4, 2020, of all co-chairs and the meeting schedule. A subsequent notice sent by SCE on February 10, 2020, included a web conference option for parties unable to attend the working group meetings in person. The materials to be reviewed at the Hybrid Resources Working Group meeting were sent to SDG&E's targeted distribution list on February 11, 2020.

[2] Scoping Memo, p. 9.

B. Meeting Description

The Hybrid Resources Working Group workshop meeting took place on February 12, 2020 from 2:00 PM to 5:00 PM in the Hearing Room A at the Commission's San Francisco location. The following organizations announced their attendance: Silicon Valley Clean Energy, California Independent System Operator ("CAISO"), SCE, PG&E, Middle River Power, Sunrun, Solar Energy Industries Association ("SEIA"), Large Scale Solar Association ("LSA"), Avangrid, Center for Energy Efficiency & Renewable Technologies ("CEERT"), and Union of Concerned Scientists ("UCS"). A web conference option was provided for parties attending remotely.

The workshop discussion focused on the following question identified in the Scoping Memo:

- Should the Commission adopt a permanent methodology for counting of hybrid resources?

Nuo Tang (SDG&E) and Jin Noh (CESA) led the discussion. At the conclusion of the workshop meeting, parties were invited to submit informal written comments by February 18.

IV. HYBRID RESOURCES COUNTING CONVENTIONS

A. Overview

The meeting began with a presentation by Mr. Tang and Mr. Noh, which included the current definition and background of hybrid resources, the Hybrid Resources Working Group scope, questions for informal comments, and next steps. The presentation is attached to this report as Appendix A. Following the presentation by Mr. Tang and Mr. Noh, five parties presented proposals: (i) SDG&E; (ii) CESA; (iii) Sunrun; (iv) SEIA/LSA; and (v) SCE. These

proposals are described in more detail below, and are attached hereto as Appendix B. The presentations were then followed by additional party discussion and clarification of proposals.

B. SDG&E Proposed Hybrid Counting Methodology

SDG&E believes that the Commission should adopt a permanent methodology for the counting of hybrid resources using the results of the Effective Load Carrying Capacity ("ELCC") study currently being performed by Astrape Consulting under the Renewable Portfolio Standard ("RPS") proceeding (Rulemaking 18-07-003).[3] SDG&E recommends that the Commission continue the current interim method for determining qualifying capacity, and once the RPS ELCC study is complete in Q4 of 2020, utilize the results to create a permanent methodology.

C. CESA Proposed Hybrid Counting Methodology

CESA proposes a holistic approach to determine the capacity value of hybrid resources. CESA considers that any permanent qualifying capacity ("QC") methodology must take into account: (1) the market participation pathway of the hybrid resource (generator vs. non-generating resource ("NGR")); (2) Investment Tax Credit ("ITC") -related charging; and (3) the storage to generation ratio. CESA proposes a framework that captures the nuances related to charging, market participation, and operational tradeoffs in order to inform the development of a permanent QC methodology for hybrid resources. CESA proposes distinct methodologies for assets operated under: (a) the generator model; (b) the NGR model with a low storage to generation ratio; and (c) the NGR model with a high storage to generation ratio. For some of these scenarios CESA proposes the creation of derating formulae and the application of an additive approach for the resulting underlying capacity values. For model (a), CESA proposes a derating of the capacity value of on-site generation (*i.e.*, ELCC) and the use of an additive

[3] The Investor Owned Utilities ("IOUs") were directed to perform this study and use the results to update the least-cost best-fit ("LCBF") RPS project valuation methodology.

approach, capped at the point of interconnection ("POI"). For model (b), CESA proposes the application of an additive methodology, capped at the POI. For case (c), CESA proposes a derating of the storage's net qualifying capacity ("NQC") and the use of an additive approach, capped at the POI.

D. Sunrun Proposed Hybrid Counting Methodology

Sunrun proposes that hybrid (solar plus storage) resources behind the customer meter ("BTM") have a QC value, to be the same as for in front of the meter ("IFM") hybrid resources initially, based on full resource output. This methodology would apply only to hybrid resources under contract or other obligation to provide capacity to an LSE.

E. SEIA/LSA Proposed Hybrid Counting Methodology

SEIA and LSA propose that the permanent RA counting method for hybrid solar resources should move to the use of the Additive Method originally proposed by SCE, where the RA value is the sum of the NQCs of the individual co-located solar and storage units. SEIA and LSA presented analysis exploring whether any constraints on the Additive Method might be needed as a result of resource configuration, ratio of storage to renewable capacity, or storage duration. Their analysis finds that the Additive Method may need to be limited only: (1) by the size of the single inverter in DC-coupled configurations; or (2) in winter months for systems where the discharge capacity for 4-hour storage is greater than 75% of the solar nameplate. Finally, SEIA and LSA note that hybrid resource owners have the ability to use up to 25% grid power to fill storage (with some loss of the ITC), so the hybrid owner can make an economic decision whether to supply RA up to the full Additive Method in winter months.

F. SCE Proposed Hybrid Counting Methodology

SCE presented a proposal that would account for the RA value from the combination of a renewable resource combined with a battery where the ability to charge the battery was restricted to the output of the paired renewable resource. The proposal attempts to account for the portion of output from the renewable resource necessary to fully charge the battery to account for the expected remaining capacity available to the grid for RA, and adds to that the QC value of the battery based upon the amount it can be expected to charge from the renewable device.

G. Next Steps

Parties will provide informal comments to SDG&E and CESA by February 18, 2020. The co-chairs proposed a list of guiding questions to support informal comments development, though comments are not limited to responses to these questions. SDG&E and CESA will then review and summarize these comments, as well as workshop discussion points, to identify and summarize consensus and non-consensus items. The Co-Chairs will circulate a draft Working Group Report for participant review prior to filing the final Working Group Report with the Commission on March 2, 2020.

Appendix A

Co-Chair Presentation

HYBRID RESOURCE QUALIFYING CAPACITY ("QC") METHODOLOGY WORKING GROUP

FEBRUARY 12, 2020

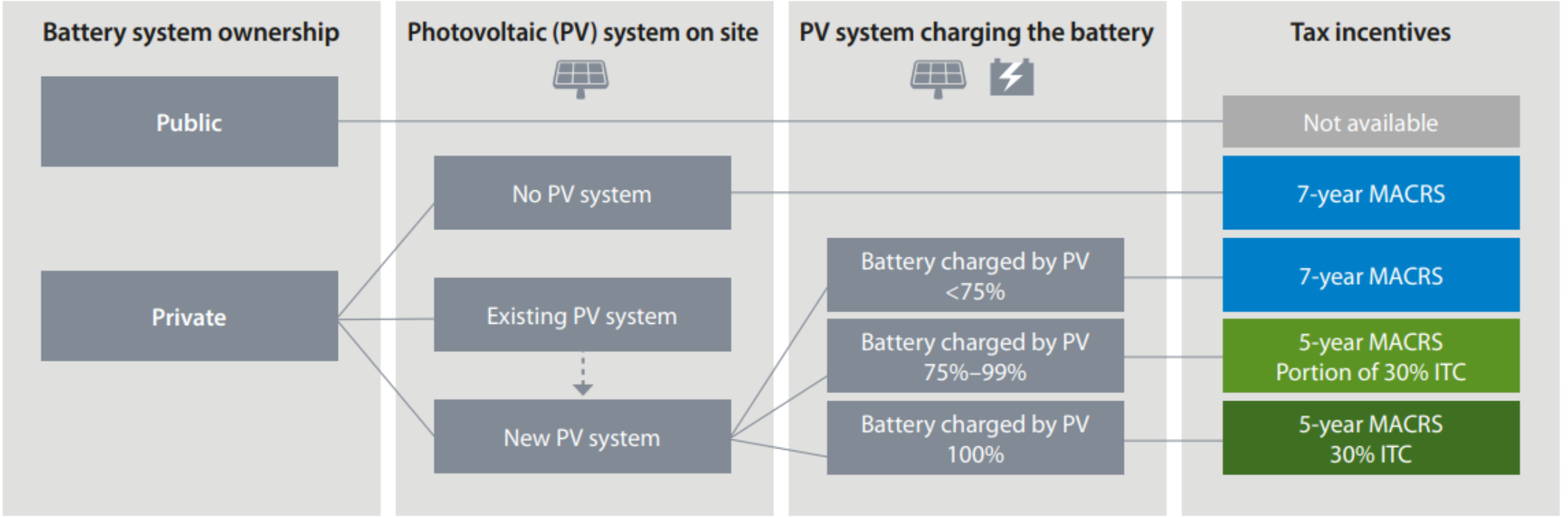
AGENDA

- Current Definition and Background
- Working Group Scope
- Parties' Presentations
- Questions for Informal Comments
- Next Steps

DEFINITIONS OF HYBRID RESOURCES

- "A generating resource co-located with a storage project and with a single point of interconnection" (Decision ('D.') 20-01-004, OP 2)
  - QC methodology limited to hybrid resources with Investment Tax Credit-related charging restrictions (Id.)
- "Any combination of multiple resource technologies combined into a single generating facility, with a single point of interconnection, represented by a single market resource ID." (CAISO – Hybrid Resources – Revised Straw Proposal, p 5)
  - "Intentionally excludes co-located projects at a point of interconnection, with two or more market resource IDs" (Id.)
- Difference caused by uncertainty of how the QC of co-located resource that charges the battery at any level would impact reliability

INVESTMENT TAX CREDITS AND ENERGY STORAGE



Source: National Renewable Energy Laboratory ("NREL") https://www.nrel.gov/docs/fy18osti/70384.pdf

- Battery systems that are charged by a renewable energy system more than 75% of the time are eligible for the ITC, currently 30% for systems charged by PV and declining to 10% from 2022+
- Battery systems that are charged by a renewable energy system >75% of the time are eligible for that portion of the value of the ITC. i.e. 80% charging * 30% ITC = 24% ITC

CPUC INTERIM QUALIFYING CAPACITY ("QC") METHODOLOGY

- QC value shall be based on the greater of either:
  - The effective load carrying capacity-based qualifying capacity (QC) of the intermittent resource or the QC of the dispatchable resource, whichever applies or
  - A modified QC of the co-located storage device capped at the maximum amount of expected energy available to charge the storage device

INTERIM QC AND DEFINITIONAL COMPLEXITIES

- CPUC's definition encompasses *all* resources that are co-located but restricts QC methodology to hybrids with ITC charging restrictions
  - Uncertain how QC will be allocated over the two resource IDs on the NQC list
    - Different charging restrictions affect the QC values of each resource ID
    - Assumes charging restrictions are known *a priori*
  - Hybrid resources without ITC charging restrictions receive individual QC values
- CAISO's definition is limited to single interconnection and single resource ID resources
  - Single interconnection, 2 resource ID resources are not hybrids
  - Each resource would receive its own QC because the CAISO is able to dispatch each resource distinctly
    - QC of co-located resource would not be impacted
  - CAISO assumes that ITCs would only apply to single resource ID resources or confident that co-located resource would charge the battery primarily even if battery is grid connected

WORKING GROUP SCOPE

- Definition of Hybrid and Co-located
- Multiple resource combinations
  - Dispatchable
  - Variable Energy Resources (“VER”)
- Different market participation pathways
- Size of storage component relative to co-located resource
- Duration of storage component

DEFINITION OF HYBRID VS CO-LOCATED

Hybrid

- A generating resource co-located with a storage component with a single point of interconnection represented by a single market resource ID

Co-Located

- A combination of multiple resources with a storage component, with a single point of interconnection represented by more than one market resource ID

- *If co-located resource charges storage component at any level, does that impact QC counting of the co-located resource for reliability?*

MULTIPLE RESOURCE COMBINATIONS

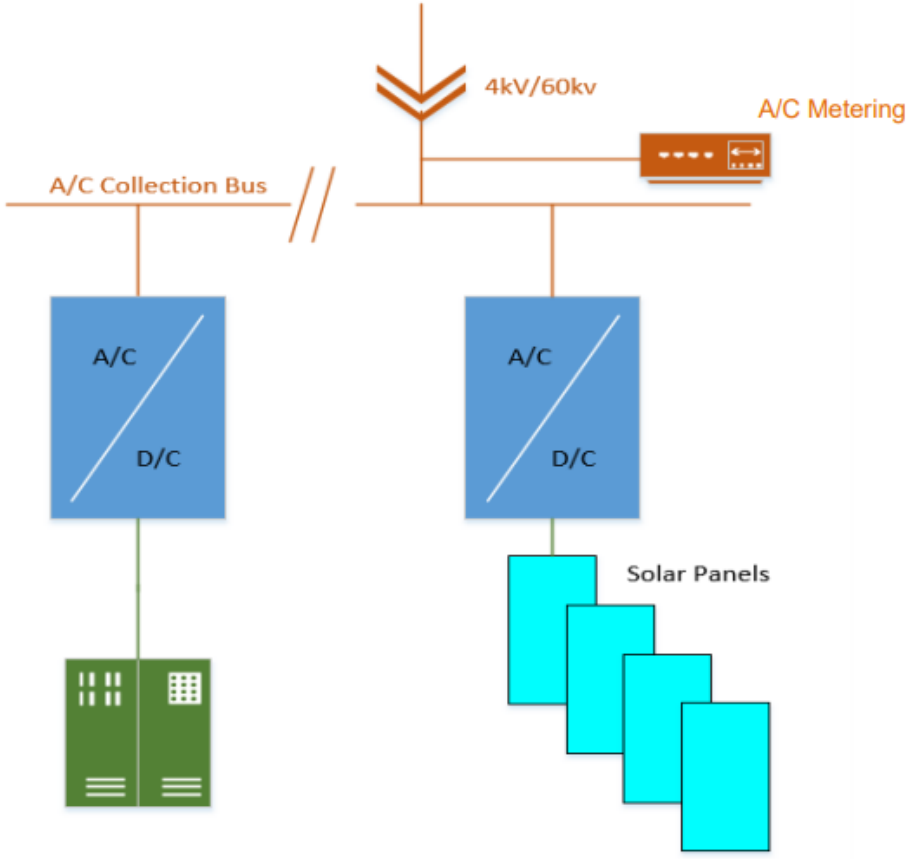
- Dispatchable plus storage component
- VER plus storage component
  - AC-coupled VER plus storage component
  - DC-coupled VER plus storage component (VER or Grid charging)
  - DC-coupled VER plus storage component (VER-only charging)

MARKET PARTICIPATION PATHWAYS

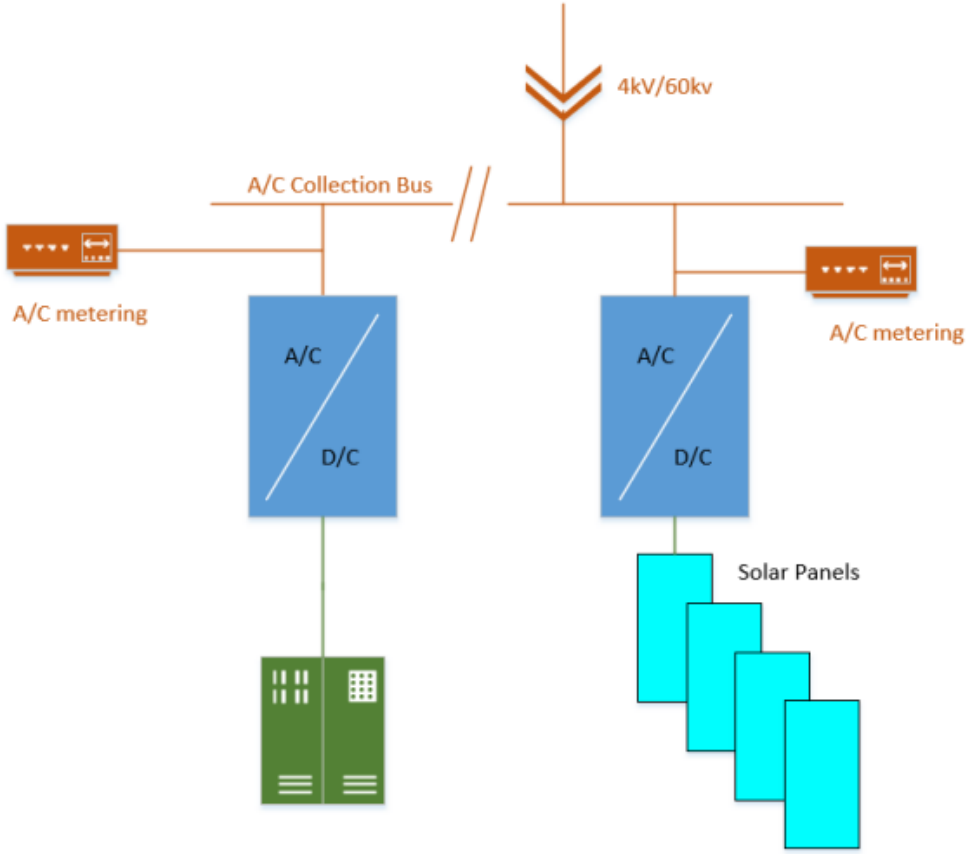
- According to the CAISO, both hybrid and co-located resources can participate via two models
  - Generator
  - Non-Generating Resource (“NGR”)
- This distinction is up to the asset’s owner and is derived from the way the storage component will behave
- Storage components can charge:
  - Only from on-site generation – Either Generator or NGR model
  - Only from the grid – Only NGR model
  - From both on-site generation, and the grid – Only NGR model
- These distinctions are crucial, as they reflect the hybrid’s capability to provide capacity beyond what is available on-site, as well as charging flexibility available for the system under the NGR models

AC COUPLED PV PLUS STORAGE COMPONENT

Single Resource ID

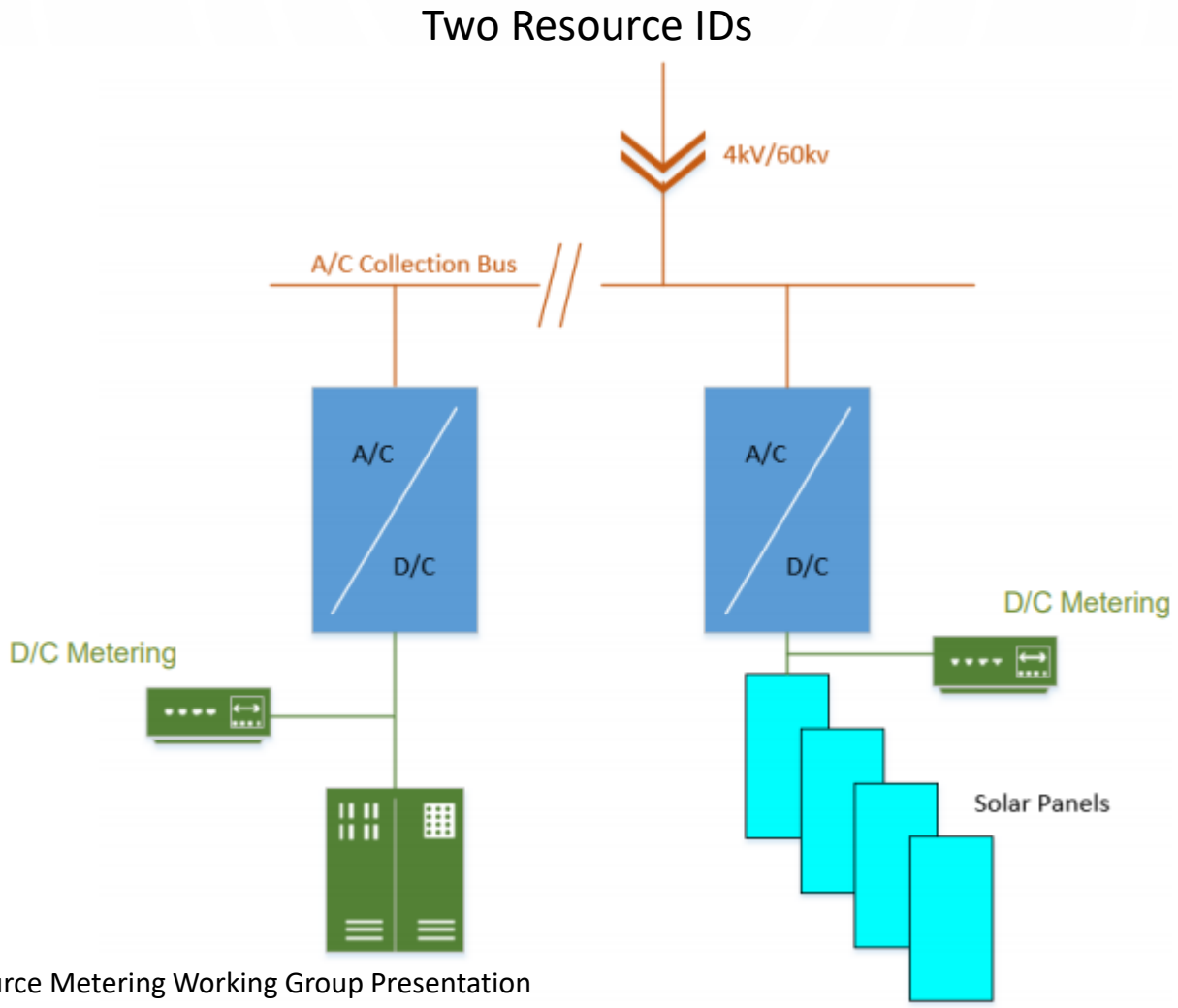


Two Resource IDs



Source: CAISO Hybrid Resource Metering Working Group Presentation

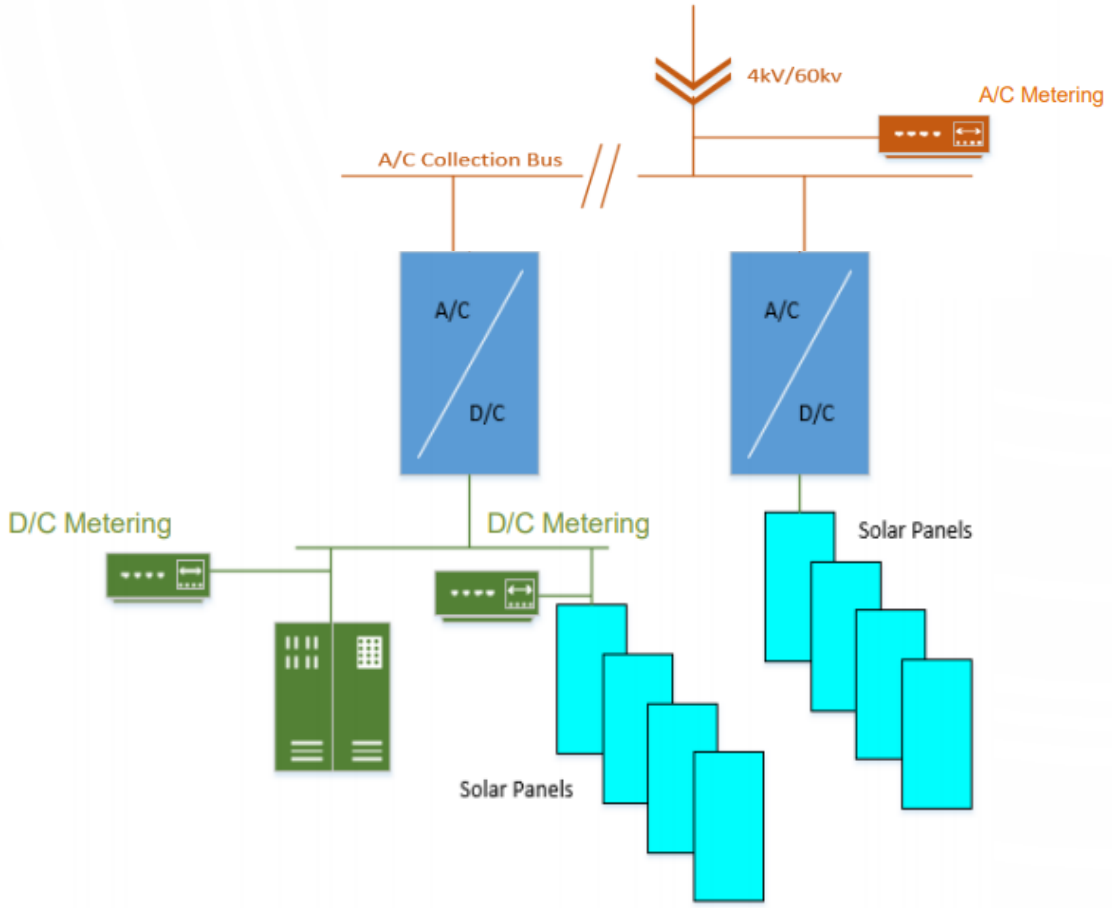
DC-COUPLED PV PLUS STORAGE COMPONENT (PV OR GRID CHARGING)



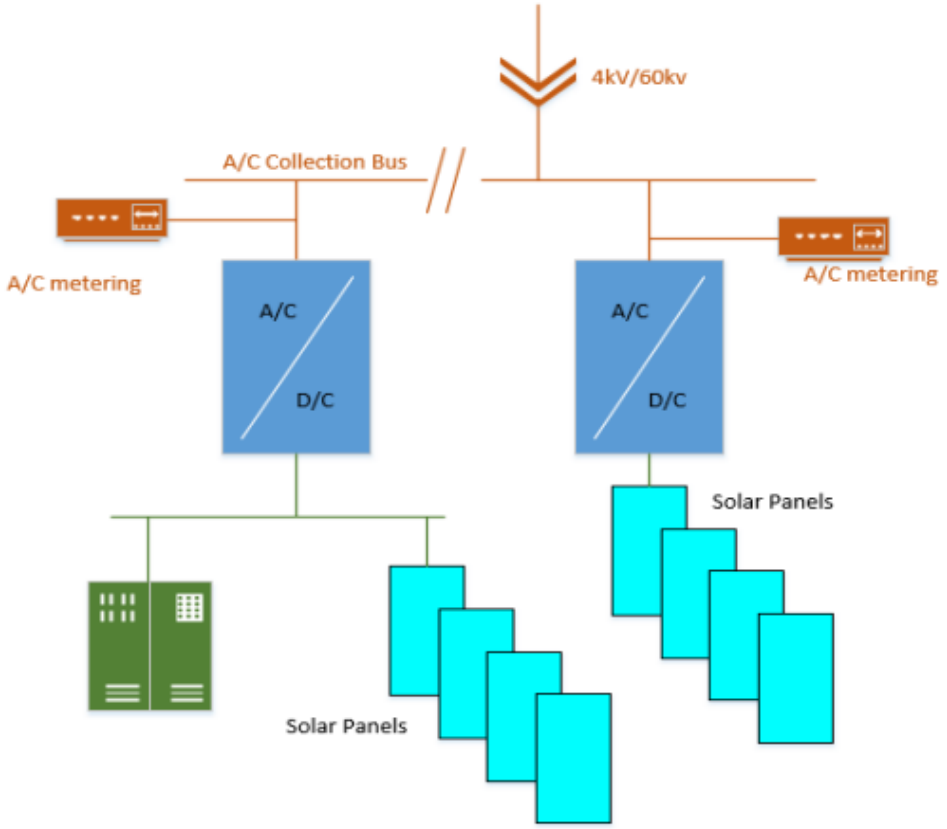
Source: CAISO Hybrid Resource Metering Working Group Presentation

DC-COUPLED PV PLUS STORAGE COMPONENT (PV-ONLY CHARGING)

Single Resource ID



Two Resource IDs



Source: CAISO Hybrid Resource Metering Working Group Presentation

OTHER CONSIDERATIONS

- Size of renewable resource relative to battery
  - “if renewable resource were to only charge the battery, then reliability benefit of the combined resource would only be that of the battery” D.19-06-026, p 38
- Duration of storage component
  - Should duration of less than 4 hours be considered?
  - Is it consistent with reliability needs of RA program?

PARTIES’ PRESENTATIONS

PRESENTATIONS

- San Diego Gas & Electric
- California Energy Storage Alliance
- Sunrun
- Southern California Edison
- Large Solar Association & Solar Energy Industries Association

QUESTIONS FOR INFORMAL COMMENTS

QUESTIONS FOR INFORMAL COMMENTS

1. Are the definitions of Hybrid and Co-located resources appropriate? Please explain any modifications.
2. Are the QC methodologies different for Hybrid and Co-located resources?
3. Should there be additional methodologies for single resource ID and those that operate under two or more different resource IDs? How would each resource attain its own unique resource QC?
4. Do ITC charging incentives impact the QC of hybrid or Co-located resources under your definition? If so, how?
5. Are discounts or derate of any component's QC value necessary for multiple resource ID hybrid or co-located resources (ELCC in the case of VERs, NQC in the case of conventional generation and storage)? In what cases should such discounts or derates apply?
6. Is a storage component's duration an essential variable when determining the QC of a hybrid resource? If so, explain this relationship.

QUESTIONS FOR INFORMAL COMMENTS

7. Is the storage to generation ratio an essential variable when determining the QC of a hybrid resource? If so, explain this relationship.
8. Could the any proposed QC methodologies apply to BTM hybrids? If so, how? If not, please explain why.
9. Among the parties' proposals at the February 12, 2019 working group meeting, which do you favor? Please explain why.
10. Are there key improvement areas to any of the parties' proposals from the February 12, 2019 working group meeting?
11. Are there other variables or considerations not covered in the parties' proposals from the February 12, 2019 working group meeting?
12. Please provide any other general comments.

NEXT STEPS

- Progress Report – February 14, 2020
- Informal Comments from Parties – provide via email to Tina Chase (CChase@sdge.com) and Jin Noh (jnoh@storagealliance.org) by COB Tuesday, February 18
- Additional Co-chair discussions – TBD
- Working Group Report – March 2, 2020

Appendix B

Hybrid Counting Methodology Proposals

- SDG&E
- CESA
- Sunrun
- SEIA/LSA
- SCE

HYBRID RESOURCES QUALIFYING CAPACITY

Ben Montoya , PE
Principal Resource Planner

February 12, 2020

SDGE
A Sempra Energy utility®

Topics

- Where are we today?
- SDG&E Recommendations
- Joint IOU ELCC Working Group Timeline
- Modeling Considerations

Where are we today?

There have been two CPUC decisions regarding the determination of Qualifying Capacity (QC) for “hybrid resources” (defined as a generating resource co-located with a storage project and with a single point of interconnection).

- Per CPUC Resource Adequacy (RA) D.20-01-004:
  - The QC value of hybrid resources that do not have charging restrictions is the sum of the QC values of each element of the hybrid resource.
  - The interim QC value for in front of the meter (IFOM) hybrid resources that have charging restrictions related to the Investment Tax Credit (ITC) is the greater of either:
    - (i) the ELCC-based QC of the intermittent resource or the QC of the dispatchable resource, whichever applies; or
    - (ii) a modified QC of the co-located storage device capped at the maximum amount of expected energy available to charge the storage device.

Where are we today? (Cont.)

- Per CPUC Renewable Portfolio Standard (RPS) D.19-09-043:
  - The California Investor Owned Utilities (IOUs) were ordered to conduct an ELCC study for renewable resources, including hybrid resources.
  - The Joint IOU ELCC study will update the ELCC values used in the IOUs' least-cost best-fit (LCBF) valuation methodology (part of the RPS program bid ranking and selection process).

SDG&E's Recommendations

- The CPUC should adopt a permanent counting methodology for hybrid resources using the results of the Joint IOU ELCC study, which will be completed by October 1, 2020.

- Using the results from the Joint IOU ELCC study will promote consistency between proceedings and yield results that are more accurate than other methods, for example:
  - Exceedance – doesn't fully capture resource's contribution to system reliability
  - Additive – overestimates the capacity value of the hybrid solar

- Until a permanent methodology can be adopted, the Commission should direct parties to continue to utilize the interim qualified capacity methodology adopted in D.20-01-004.

Joint IOU Working Group Timeline (currently proposed)

Item	Description	Due Date
Report #1	Provides the annual, marginal ELCC values for the resource classes and class subtype locations including hybrid resources using 4 hour duration storage	Draft: 4/15/2020 Final: 5/1/2020
Report #2	Provides the annual, marginal ELCC values for hybrid resources using 1 and 2 hour duration storage	Draft: 9/15/2020 Final: 10/1/2020
Report #3	Provides the annual, average ELCC values for the resource types: solar PV; wind; storage (4, 6, and 8 hour); and hybrid resources.	Draft: 9/15/2020 Final: 10/1/2020

Modeling Considerations

Current hybrid resource modeling challenges included in the RPS study effort:

- AC versus DC coupling
- Ratio of storage to renewable capacity
- Storage duration
- Grid charging limitation related to the Investment Tax Credit (ITC)

Questions?

CESA's Proposals for Hybrid QC

Hybrid Resource QC Methodology Working Group

February 12, 2020

CESA
CALIFORNIA ENERGY STORAGE ALLIANCE

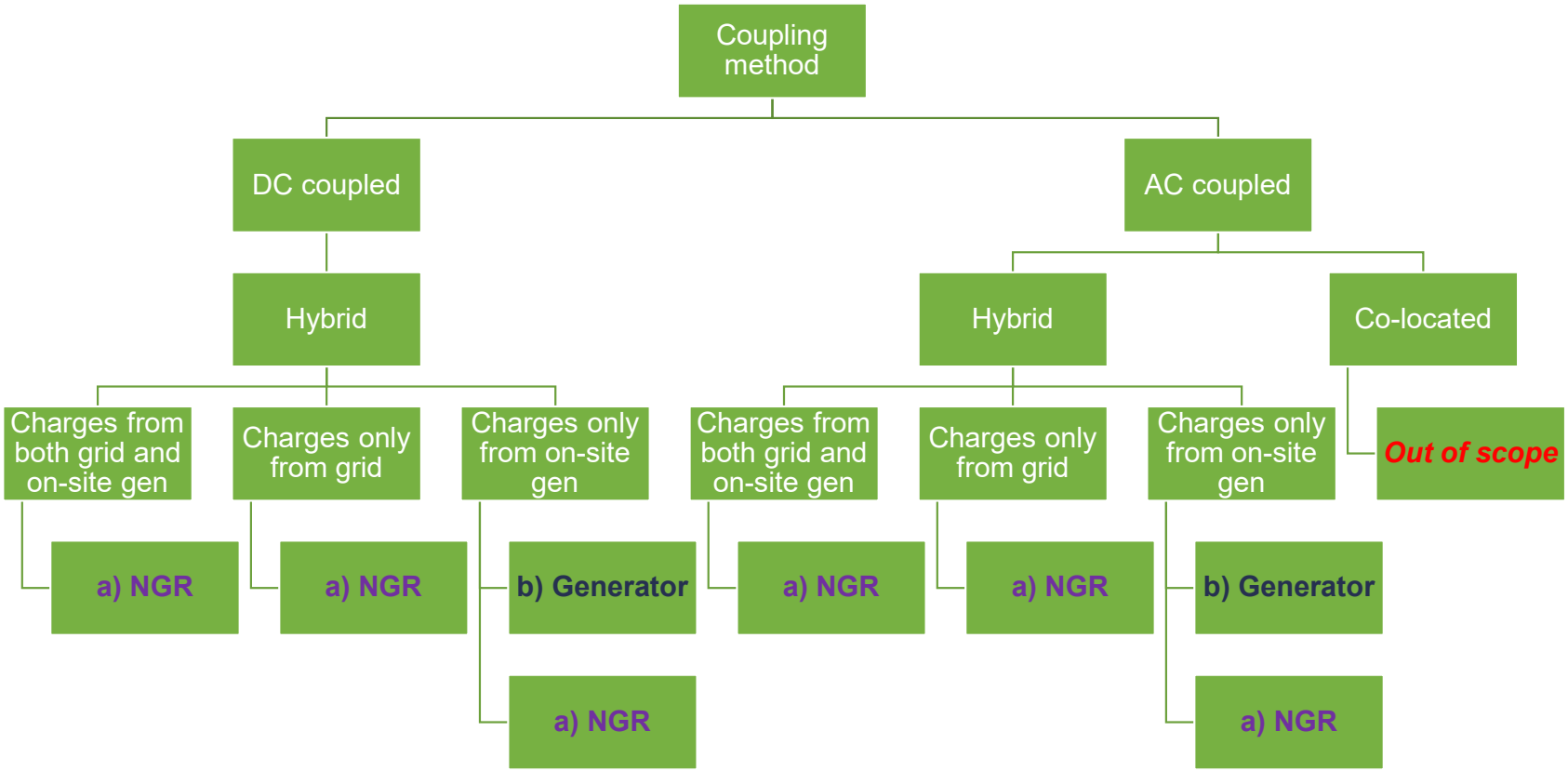
Key Factors

- **Hybrid resources can be compromised of any number of generation assets paired with onsite energy storage at a single point of interconnection (POI) under a single resource ID**
- **For CESA, the following factors are most relevant when assessing the operation of a hybrid resource:**
  - AC or DC coupling
  - Market participation pathway (generator vs. non-generator resource [NGR])
  - Relative storage sizing (storage-to-generation ratio, duration)
  - ITC-related incentives
  - Inverter size at point of interconnection (POI) (*i.e.*, approved interconnection capacity)

Market Participation Pathway

- **Hybrid resources can participate via two CAISO market participation models**
  - Generator
  - NGR
- **This distinction is up to the asset's owner and is derived from the way the storage component will behave**
- **Storage components can charge either:**
  1) Only from on-site generation (Generator or NGR)
  2) Only from the grid (NGR)
  3) From both on-site generation, and the grid (NGR)

Options Available



Relative Sizing

- **The ratio of storage to generation informs how much additional capacity can be stored and later delivered and is given by the result of**

$$\frac{Storage\ nameplate\ capacity}{Onsite\ generation\ nameplate\ capacity}$$

- **For hybrids with a "low" ratio *(e.g.*, 0.1 to 0.5) it is reasonable to assume, regardless of charging decisions, that onsite generation is capable of charging the storage component since these assets are generally oversized relative to the POI and designed to minimize clipping during daylight hours**
- **For hybrids with "higher" ratios, there is a direct relationship between the sizing of a storage component relative to onsite generation, and the difficulty of maintaining a high state of charge**
  - This is true *only* for resources with onsite charging restrictions
- **Storage duration also plays a factor, which can be accounted through existing 4-hour NQC rules for storage at this time**

ITC-Related Incentives

- **ITC-related charging is not enforced during operation of the assets; instead, the charging behavior of the storage component is analyzed and settled *ex post***
  - After operation of the hybrid, metering data will reveal the level of compliance and thus award ITC as pertinent
- **CESA believes this is <u>not</u> a physical restriction, and asset owners and operators can manage this risk relative to all other market responsibilities**
- **However, ITC-related charging constraints may inform capacity values attributed before operation per D.20-01-004**
  - **<u>Proposal:</u>** Since the level of on-site charging is not known *ex ante,* resource operators could provide a constraint range with some level of accuracy (*e.g.*, ±5%) to determine impact of restrictions (*e.g.*, 0.75, 0.80. 0.85, etc.)

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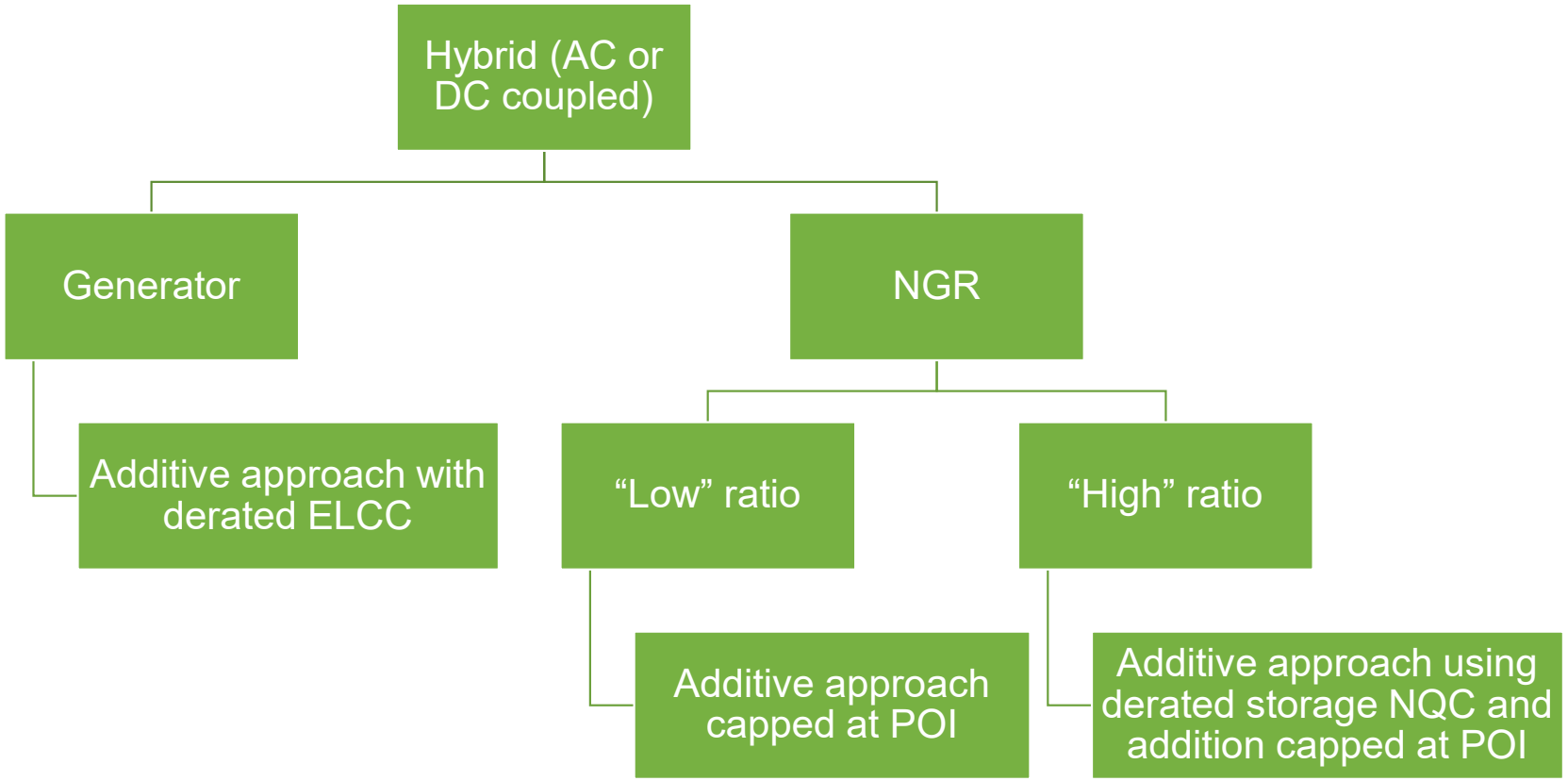
Proposals for Different Alternatives

- **As it has been shown, there are essentially three factors that could determine the operation of hybrids in the CAISO system:**
  - Generator or NGR
  - ITC-related charging
  - "Low" or "high" ratio (*e.g.*, above or below 0.5)
- **CESA considers AC-coupled co-located resources to be out of scope; thus, the determination of their NQC value shall be done by attributing ELCC or NQC to each component**
- **AC- and DC-coupled hybrids are operationally similar; thus, their NQC values shall be determined by their market participation pathways**

Proposals for Different Alternatives



Proposal for Generators

- **CESA considers that hybrids that: (1) charge *only* from on-site generation; *AND* (2) decide to participate under the *generator* model shall receive a QC equal to the NQC of the on-site storage asset plus a derated ELCC of the on-site generation**
- **Hybrids under the generator model will be limited to energy available onsite but may shift energy towards most crucial hours**
  - Renewable ELCC is determined based on 8,760 LOLE study, so storage charging from renewable would reduce the energy available and attributable to the renewable generator at all times of the day – thus some derate to the renewable ELCC could apply
  - Full storage NQC value can still apply due to the ability to deliver stored capacity when needed

Proposals for NGRs

- **NGR resources are able to bid to charge, but they are not limited to charge solely from onsite generation**
- **Nevertheless, the relative size of the storage component has a direct relationship with the difficulty to charge it, particularly during months of low solar irradiance**
- **Thus, CESA proposes establishing a ratio "cut-off" where:**
  - For NGR-participating resources with a "low" ratio: the additive methodology shall apply
  - For NGR-participating resources with a "high" ratio: the storage component shall have a reduction of its NQC equal to some derated NQC ($NQCd_i$) for the given month i
  - $NQCd_i$ shall then be added to the generator's ELCC
- **All these additive results must be capped at the size of the inverter in the POI**

Proposals for NGRs

- **The determination of $NQCd_i$ shall be subject to:**
  - Expected level of onsite charging (*i.e.*, ITC-related charging restriction)

- **For illustrative purposes, an $NQCd_i$ formula could look like this:**

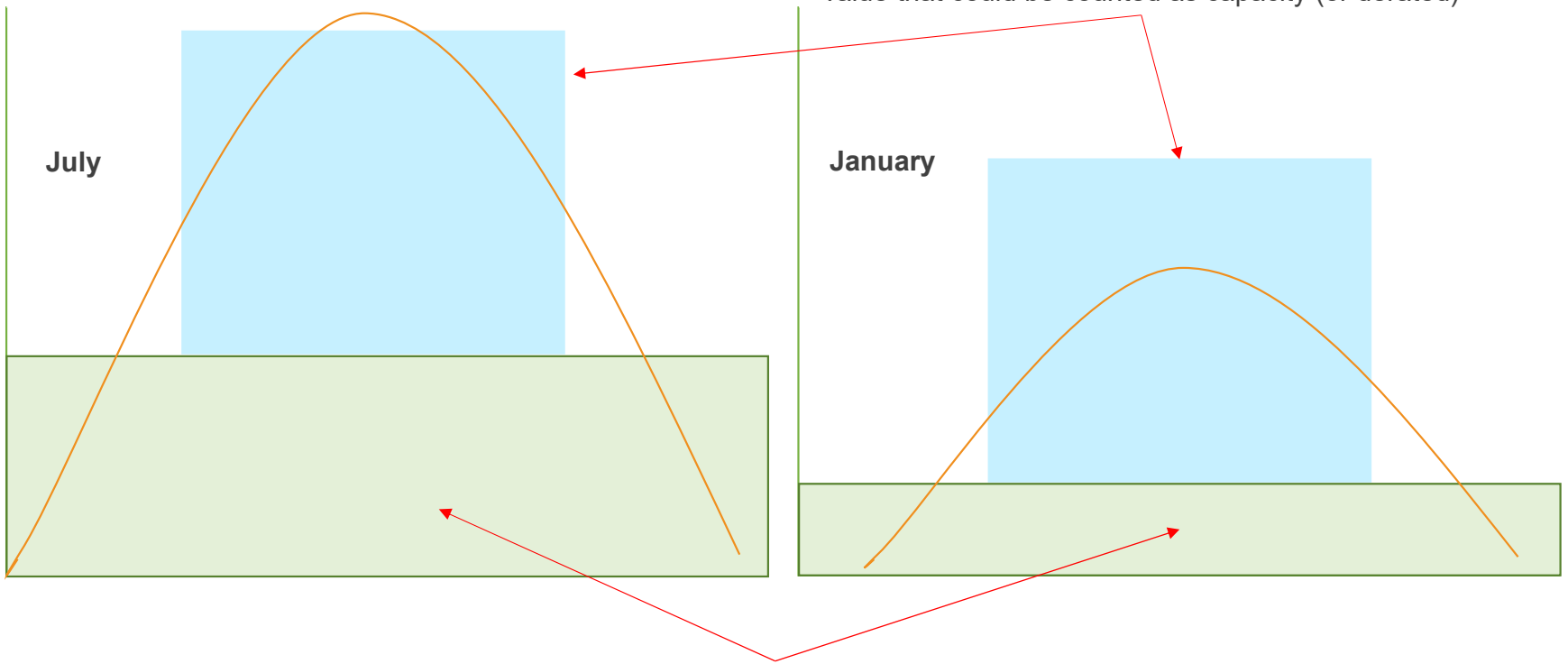
$$NQCd_i = NQC(CR * x) + NQC(1 - CR)$$

Full credit for grid charging since this can be deliverable capacity

- **CR refers to the ITC-related charging restriction (0.75, 0.8, etc.)**
  - CESA notes this is just an approximation provided by owners; real restriction can only be known *ex post*
- **X refers to the discount or de-rate factor**
  - This is a function of solar generation above $ELCC_i$ and the Pmax of storage

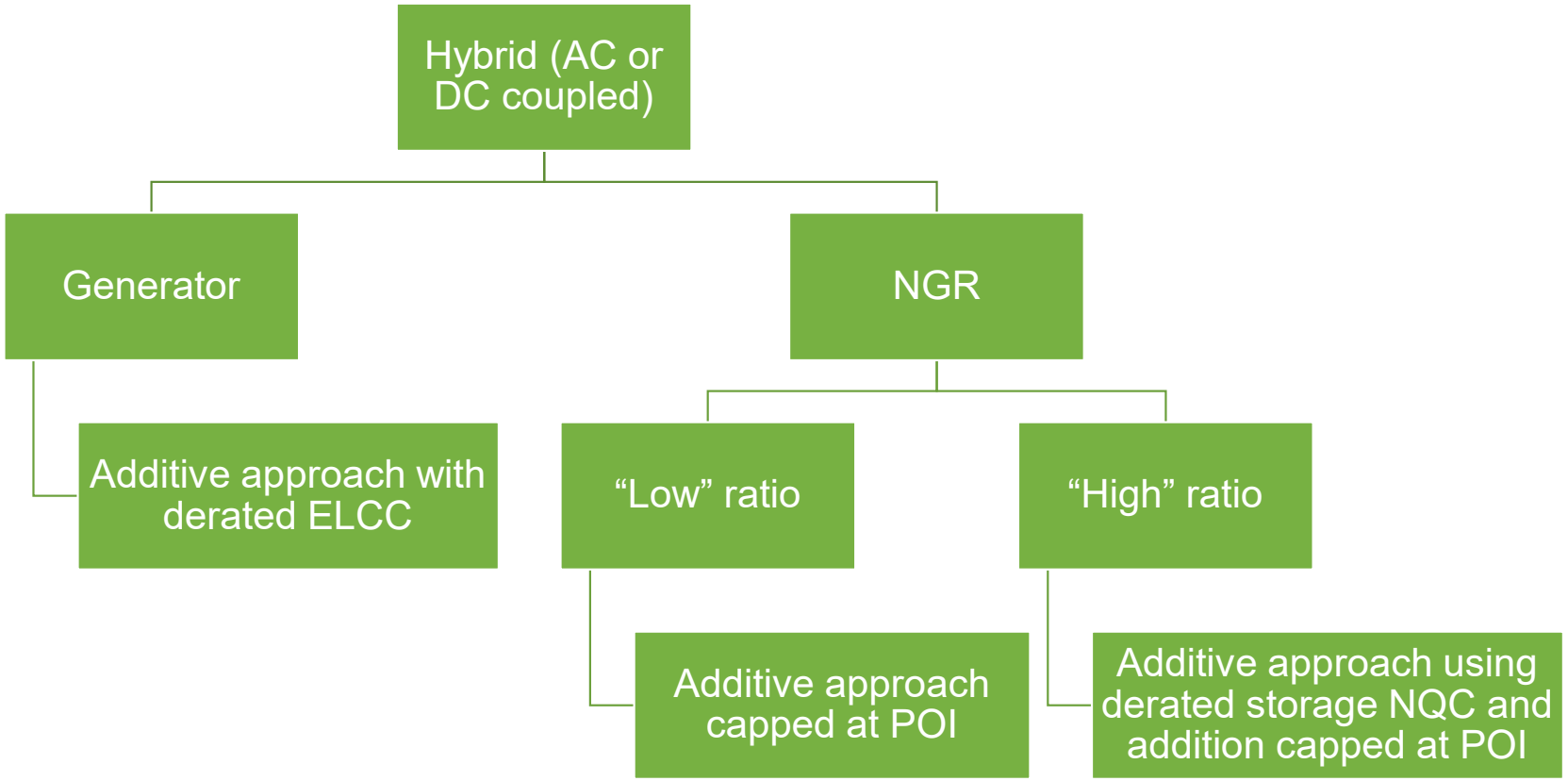
Proposals for NGRs

Storage onsite charging capacity: Determines whether there is sufficient energy from solar generation above ELCC value that could be counted as capacity (or derated)



ELCC based capacity value: Determines how much charging energy is unavailable under additive approach

Proposals for Different Alternatives



Next Steps

- **Determine viable "cut-off" points based on empirical data**
  - Industry stakeholders could support this
- **Revise modeled/projected operations to inform $NQCd_i$ formulae**
  - Must take into account available energy for charging above monthly ELCC-based capacity values; as well as based on other factors (*e.g.*, location, tech), level of onsite charging, among others, to determine appropriate derate factor
  - Follow-up activity needed to assess monthly solar generation

Appendices

CESA
CALIFORNIA ENERGY STORAGE ALLIANCE

Coupling

- **The components that compromise a hybrid resource can be coupled in two ways: AC and DC**
- **AC coupling is the most standard form of connection; nevertheless, DC coupling provides a series of cost and operational benefits:**
  - Increased round-trip efficiency
  - Ability to capture otherwise “clipped” energy
  - Shared facility costs (*e.g.*, inverter)
- **AC coupling might be used under single- or multiple-resource ID configurations**
- **In contrast, DC coupling would only be used under single resource ID configurations**

Co-located Resources

- **CESA considers co-located resources to be out of scope as there is a current framework for the determination of their QC values**
  - Each component shall receive an independent ELCC or NQC, as applicable
  - Each resource counts with its own market resource ID, dispatch responsibilities, and operational guidelines
- **Even if co-located components are physically capable of sharing energy (*e.g.*, the on-site generation can charge on-site storage), each resource is seen and operated by CAISO as independent, so separate treatment for capacity counting is justified**

Co-located Resources

Co-located asset

Co-located case: All energy produced by the onsite VER makes it to the grid, with some immediately delivered to grid or stored and later delivered to grid

Load

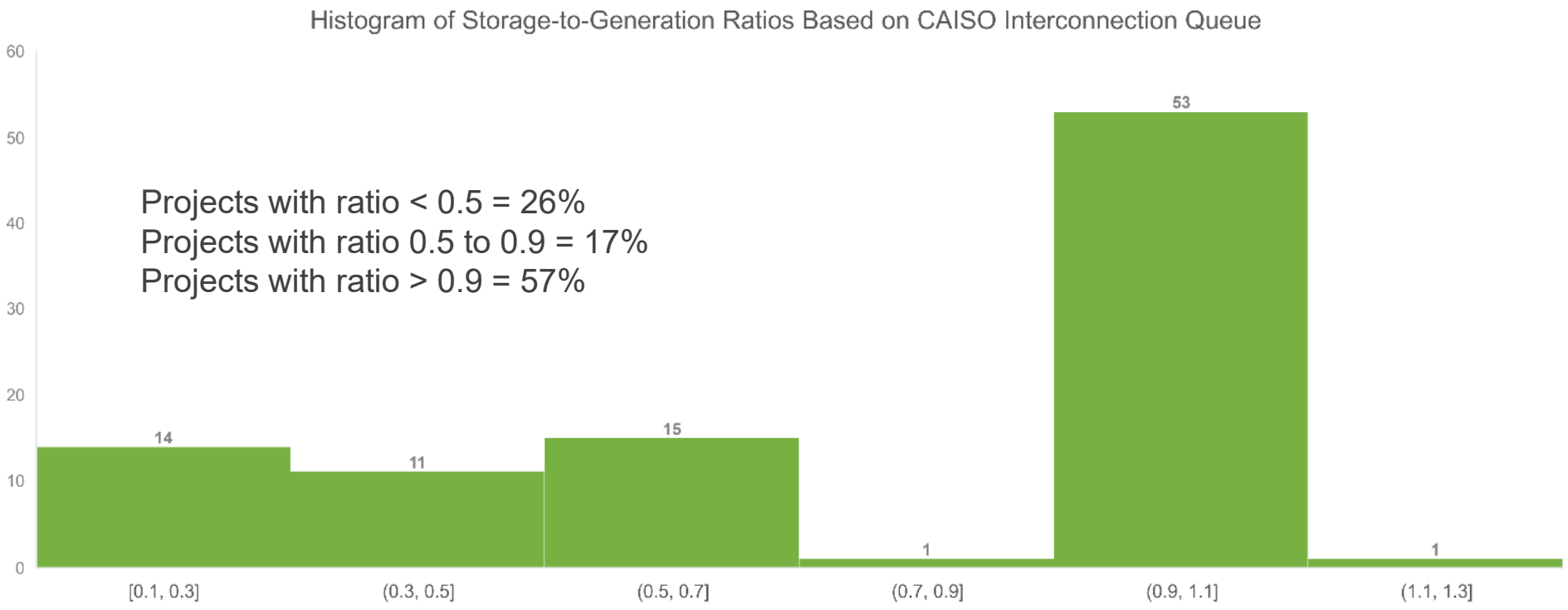
Standalone case: All energy produced by VERs is injected to the grid, while a storage asset charges with energy produced from unspecified VERs

VER

Load

Since there are no differences in the net effect of operation between co-located assets and standalone assets, there is no need to determine a QC methodology for co-located assets

Relative Sizing



Projects with ratio < 0.5 = 26%
Projects with ratio 0.5 to 0.9 = 17%
Projects with ratio > 0.9 = 57%

Note: In order to show the distribution of ratios, this histogram excludes one project with a ratio of 16.

Differences between ELCC and NQC

- **When evaluating the QC of a hybrid resource composed of a VER and an energy storage asset, it is relevant to understand the differences between ELCC and NQC values**
- **ELCC values are obtained through a loss-of-load expectation analysis that takes into account all hours of the year**
  - Thus, ELCC is a measure of coincidence (*i.e.*, overlap) between an asset's ability to provide capacity and system load
- **NQC is obtained using the "four-hour rule" which notes the level of capacity an asset can provide over 4 continuous hours**
  - NQC is based on capacity needs given system load peak times
- **Thus, ELCC and NQC are effectively measuring reliability contributions in different ways**
- **ELCC focuses on coincidence with load, while NQC underlines ability to shave or contribute to system load peak**

sunrun

Capacity Value for Customer Sited Hybrid Resources

FEBRUARY 12, 2020 | MICHAEL NORBECK

Proposal

METHODOLOGY

- Same qualifying capacity methodology as for IFM hybrids, initially. Current methodology dictates counting storage QC.
- Full output of resource including any exports.
- Reconcile assumption in load forecast for existing resources; treat new resources as new.

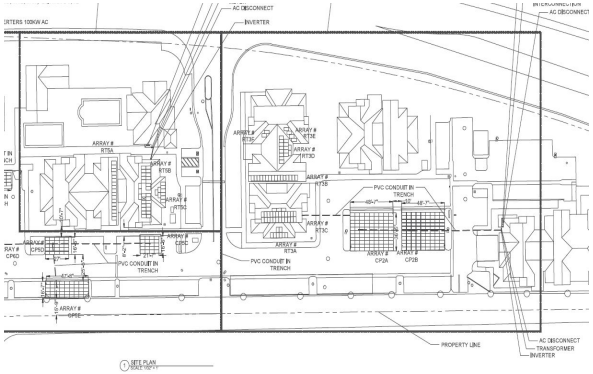
APPLICATION

- Apply only to BTM hybrid resources under obligation to deliver capacity.
- LSE procurement of Flexible, System and Local capacity to meet RA and IRP procurement obligations.

Use Case – Virtual Power Plant

Example - Oakland Clean Energy Project

- Sunrun will install solar PV and energy storage at affordable multifamily housing sites in West Oakland.
- Solar will deliver bill savings to residents via Virtual Net Energy Metering tariff.
- Storage will provide backup power for critical common-area loads (e.g., lighting, HVAC) in each building.
- Sunrun will aggregate storage assets into a Virtual Power Plant, to deliver RA to EBCE.
- Capacity delivered from VPP will facilitate retirement of legacy RMR gas plant while maintaining grid reliability in Oakland.
- IDD Q1 2022.

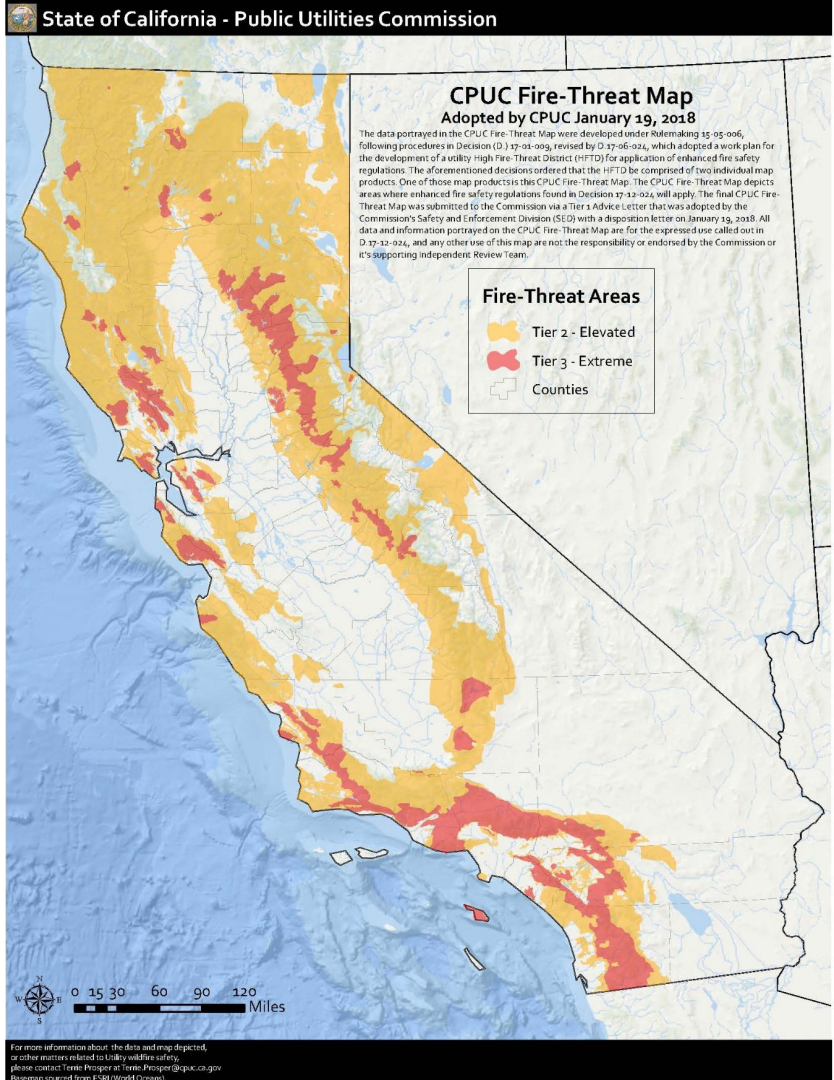


Win-win-win:

↓ Bill savings, ↑ Resiliency , ↓ Pollution in environmental justice community

Use Case – Microgrid

- Increase in wildfire season intensity has led to regular Public Safety Power Shutoff (PSPS) events.
- SB 1339 (2018) required the CPUC to open a proceeding to develop microgrids. Rulemaking 19-09-011 is focused on both implementing SB 1339 and deploying solutions to address PSPS events.
- BTM hybrid resources in a microgrid configuration can provide System, Local and Flexible RA capacity when not needed for islanding critical loads during PSPS events, which is the majority of the time.
- Value stacking rules for storage resources allow for provision of islanding and capacity services, which lowers overall cost to ratepayers.



Issues to Address

VALUE STACKING

Multiple Use Application rules adopted in D.18-01-003 dictate that customer services, including TOU, demand charge management and back-up power, are unconstrained in an MUA scenario.

Transparent and final incrementality rules are needed for BTM hybrids providing RA and other services.

QC VALUE FOR BTM SOLAR

D.19-06-026 adopted an ELCC value for IFM solar resources only.

It may or may not be necessary to revisit the issue of ELCC for BTM solar in establishing a QC value for BTM hybrids.

INCREMENTALITY RULES FOR RA AND IRP

Transparent rules for provision of services (*not technology-based incentives*) beyond customer-level MUA services and RA.

Application of current IDER pilot incrementality framework to capacity procurement (either through RA or IRP) should be thoroughly examined. Is it the best option to use going forward? If so, consistent, transparent guidance on its application is needed.

Thank You.

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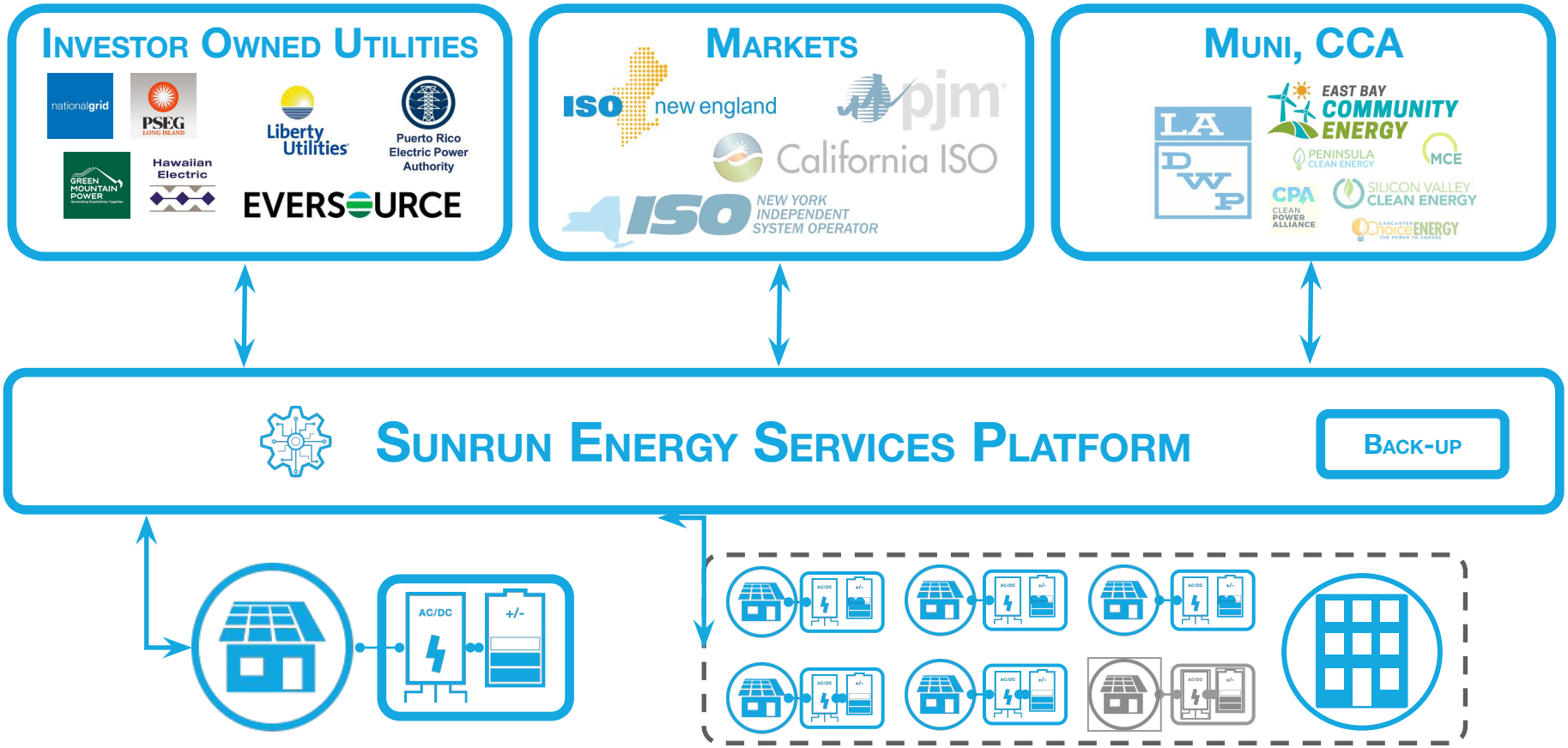
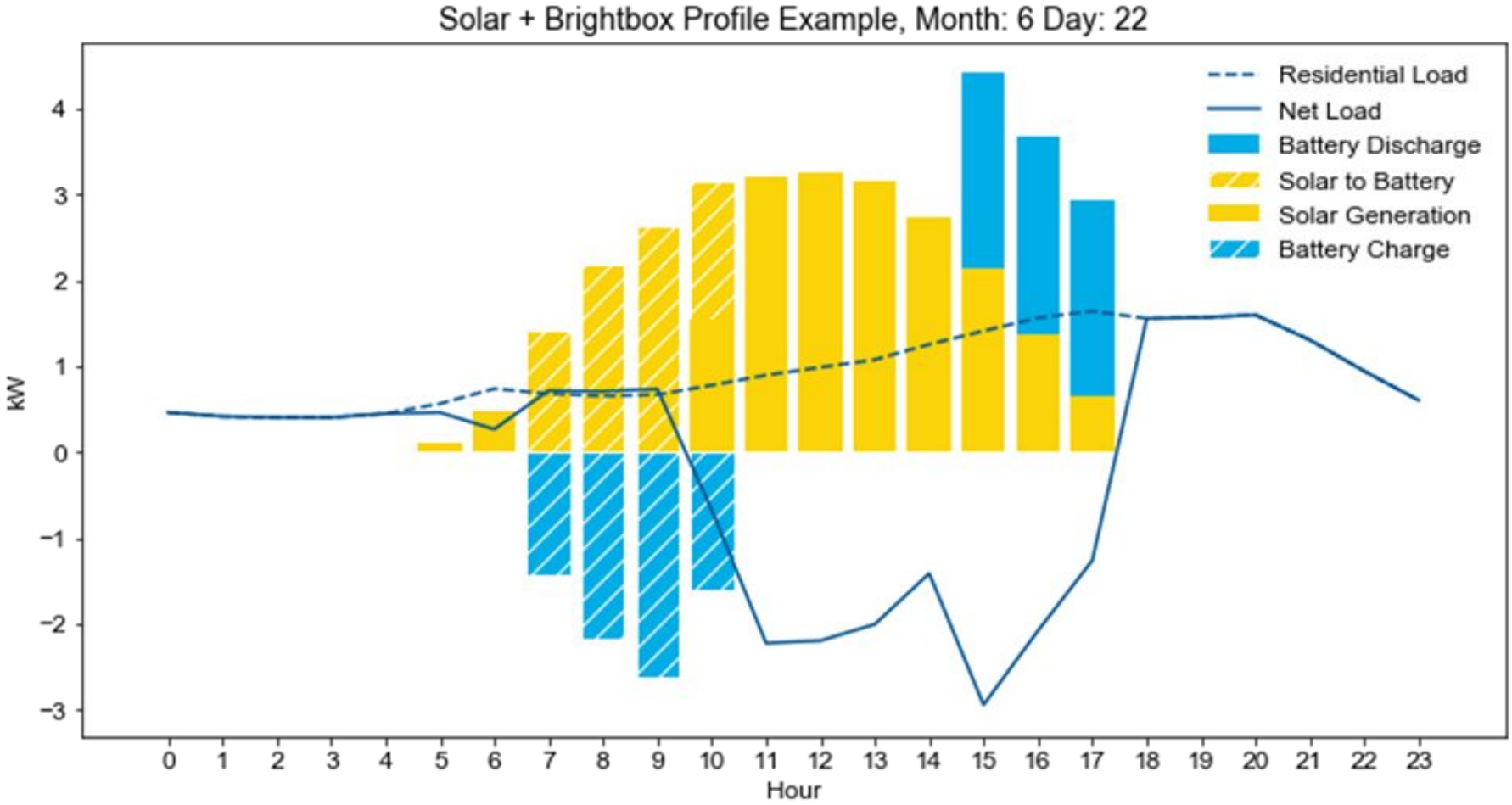
sunrun

BACK-UP SLIDES

Sunrun strategy to scale: Eliminating Power Plants




Solar + Brightbox Profile Example, Month: 6 Day: 22
Residential Load
Net Load
Battery Discharge
Solar to Battery
Solar Generation
Battery Charge
kW
4
3
2
1
0
−1
−2
−3
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour

A Permanent Resource Adequacy Counting Method for Hybrid Resources

Presentation to RA Working Group on behalf of SEIA / LSA

R. 19-11-009

Tom Beach
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February 12, 2020

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- Can provide significant, needed firm resource adequacy (RA) capacity
  - D. 19-11-016 found a need for and directed procurement of 3,300 MW of new system RA capacity from 2021-2023.
- Substantial hybrid capacity in the CAISO interconnection queue
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- Locations of hybrid resources – top 5 counties
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	2021	1	0	4	2	2	4	1	0	0	2	7	1	1
	2022	0	1	3	1	4	2	0	0	1	4	12	0	0
	2023	1	2	1	1	3	3	0	0	1	7	9	0	0
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- Four-hour storage addresses the evening peak.
- Draft IRP modeling shows hybrid resources are the least-cost scenario.

	Incremental Cost ($MM/yr)			Change from Reference ($MM/yr)		
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ITC Extension	-$250	$164	$925	-$250	-$309	-$317
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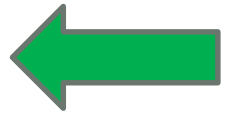
Paired Battery Cost	-$475	-$73	$626	-$475	-$546	-$616
Low RA Imports	$259	$728	$1,436	+$259	+$255	+$195
High RA Imports	-$389	$168	$970	-$389	-$305	-$271
High Load Baseline	$745	$1,306	$2,212	+$745	+$834	+$971
OTC Extension	-$173	$299	$1,068	-$173	-$173	-$173
Partial OTC Extension	-$132	$341	$1,109	-$132	-$132	-$132
Early Shed DR Availability	-$18	$465	$1,234	-$18	-$8	-$7

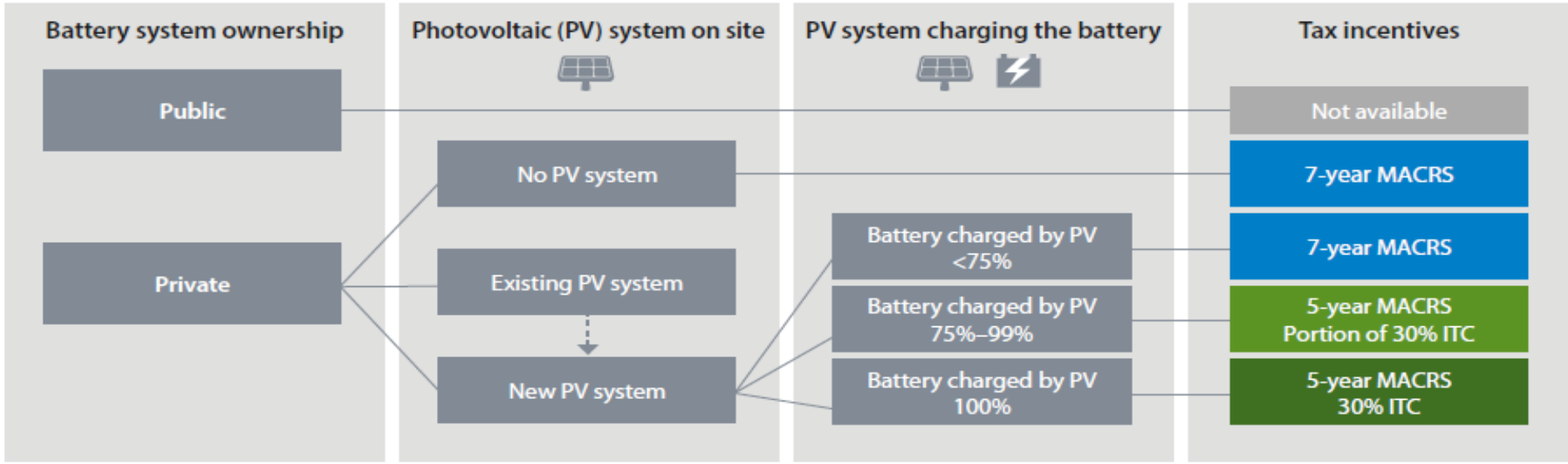


D. 20-01-004 Adopts an Interim Methodology

- Two approaches on the table
  - "Additive" method proposed by petitioners, based on an SCE proposal
    - Sum of NQCs of the individual Co-located Generation and Storage Units
  - "Maximum" method proposed by SDG&E
    - Maximum of the separate NQCs of the Co-located Generation and Storage Units
- D. 20-01-004 adopted the Maximum approach, as interim method
  - Concern with "operational restrictions"
  - Little data presented on how to reflect this constraint.
  - CPUC adopts the "conservative" Maximum approach.
  - Recognizes that this may undervalue hybrid resources
- Also caps the monthly QC of the battery "at the amount of energy that can reasonably be expected to be available to charge the storage device on a daily basis" (p. 9).

"Operational restrictions" of Hybrid Resources

- D. 20-01-004 clarifies that these are the qualification rules for the ITC:



- DC-coupled hybrids may have physical restrictions.
  - Tightly-coupled DC-DC hybrids cannot use grid power,
  - But recover "clipped" solar output, and avoid a second inverter.
  - Inverter size can limit maximum output of solar + storage to the grid.

Hybrid Resource Configurations

- AC-coupled
  - Two inverters
  - Can operate solar and storage separately
- DC-coupled
  - Single inverter, bi-directional
  - Can fill storage from the grid
- DC-coupled (tight)
  - Single inverter, export only
  - Can charge storage only from on-site solar, cannot use grid power
- See NREL, *Evaluating the Technical and Economic Performance of PV Plus Storage Power Plants* (August 2017).

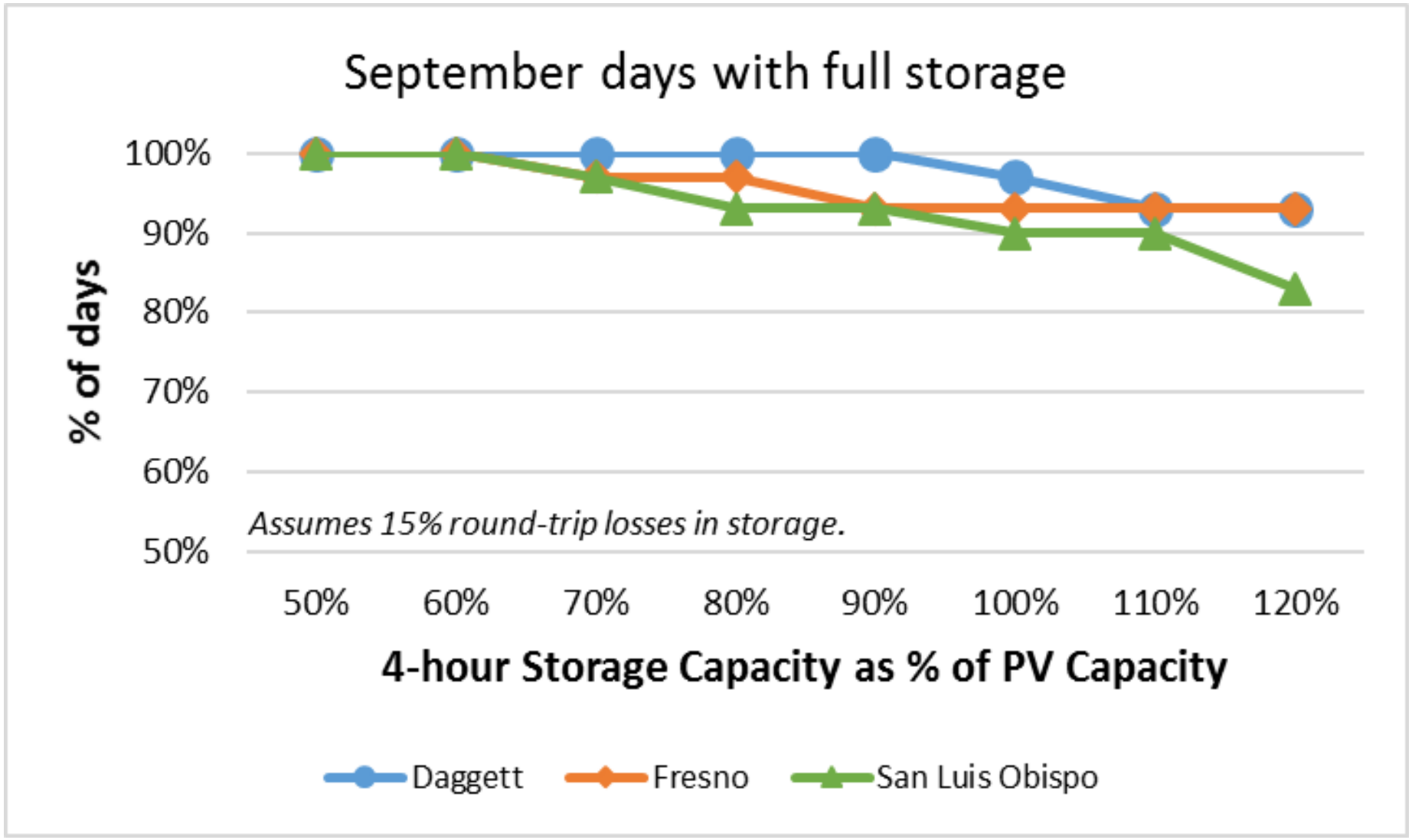
Issues for an RA Counting Method for Hybrid Solar

- Can solar fill the paired storage on all days?
  - If not, how much grid power is needed to fill storage?
  - Should the QC of the battery be de-rated to account for unfilled storage on some days? Or should the storage owner bear the risk of using grid power to fill storage, thus losing ITC?
  - Key metrics:
    - Relative sizes of the solar nameplate and the storage discharge capacities
    - Storage duration (i.e. MWh stored / MW discharge capacity)
- After filling storage, is the RA value of the remaining solar output to the grid the same?
  - When paired with storage, is the solar output to the grid reduced during the peak hours?
  - Is the simultaneous export of solar + stored power limited by the inverter size of DC-coupled systems?

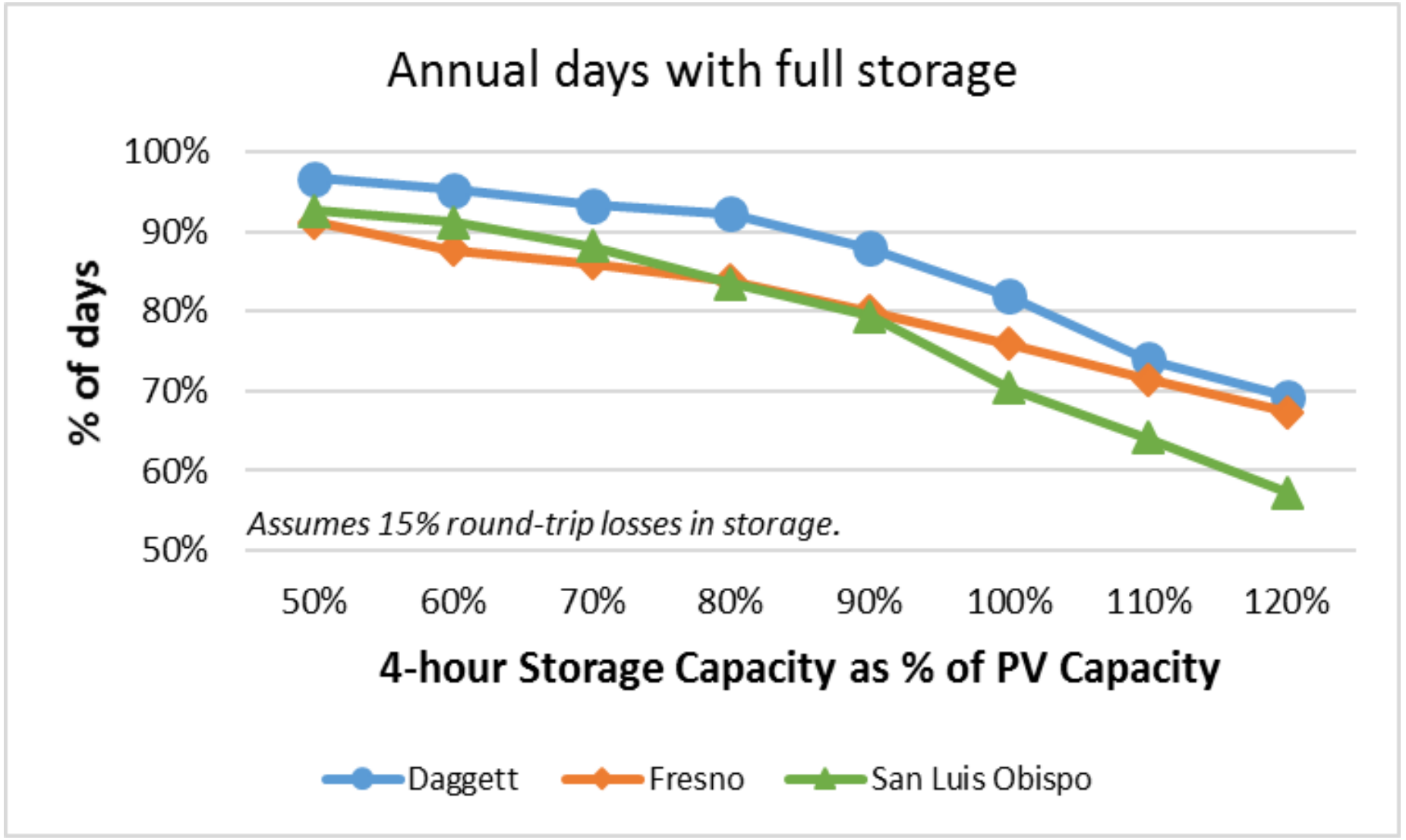
Analysis of RA Impacts of "Operational Restrictions"

- Three locations:
  - Daggett (western Mojave)
  - Fresno (southern San Joaquin Valley)
  - San Luis Obispo (Central Coast)
- Single-axis tracking solar, using PVWATTS
- 4-hour storage sized from 50% to 120% of solar nameplate
- AC-coupled, no POI limitations on output to the grid
- 15% round-trip storage losses
- Full daily cycling (100% of stored energy discharged 4p to 9p)
- All on-peak (4p to 9p) solar output is exported; none is stored.

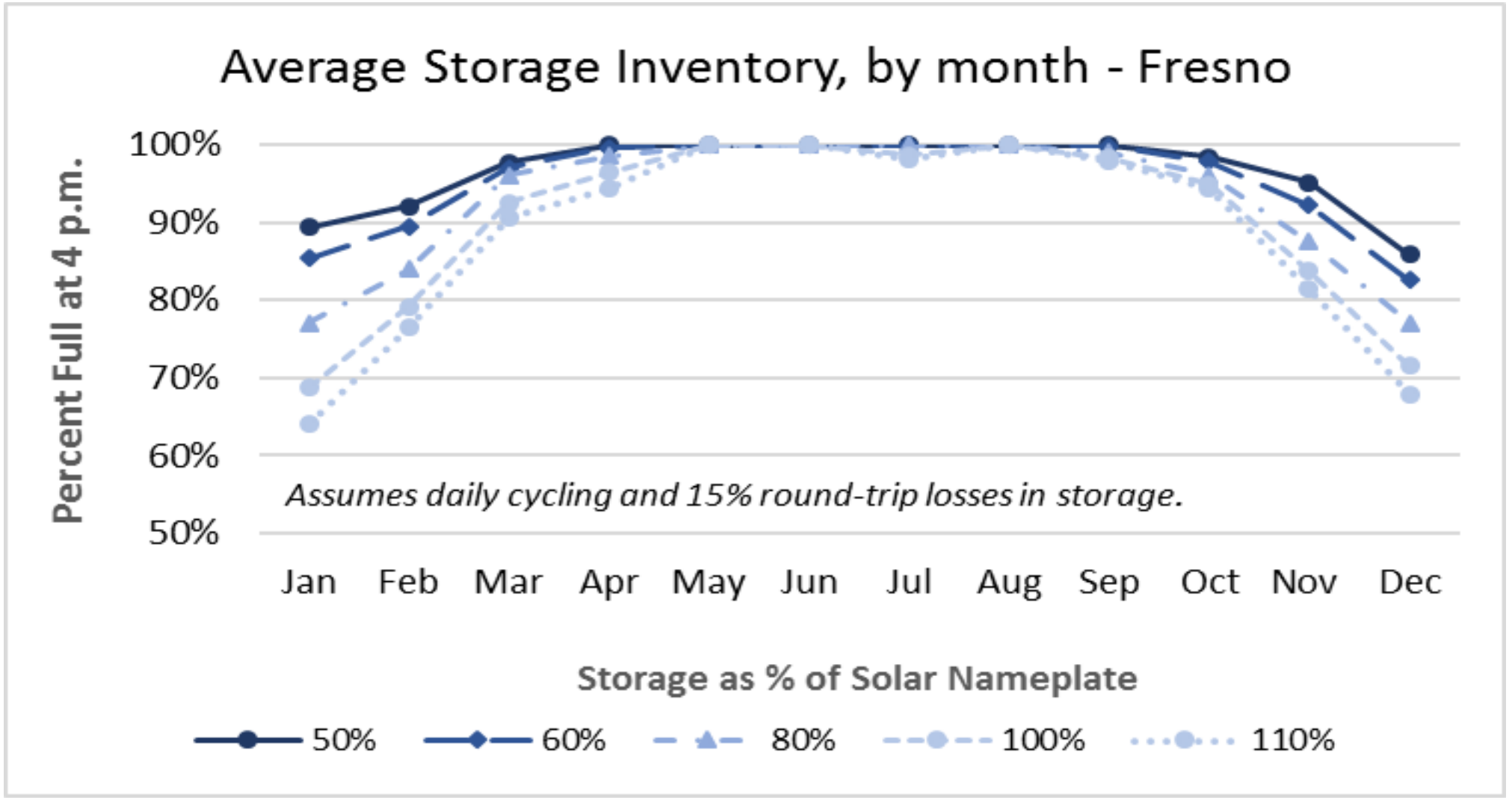
Results – Peak Month (September)



Results – Annual



Winter Months Are Most Challenging



On-Peak Solar Output Is Unchanged, After Filling Storage

- Storage can be filled off-peak, leaving on-peak solar output unchanged.
- On-peak (4p-9p) solar capacity factor typically exceeds solar ELCC.

Solar PV and Solar Thermal		On-peak 4p-9p Capacity Factor		
Month	CY 2020 Solar ELCC	Daggett	Fresno	SLO
1	4%	2%	5%	3%
2	3%	5%	8%	6%
3	18%	23%	22%	21%
4	15%	31%	28%	32%
5	16%	37%	36%	38%
6	31%	44%	42%	47%
7	39%	35%	39%	48%
8	27%	31%	38%	42%
9	14%	24%	29%	29%
10	2%	16%	19%	17%
11	2%	2%	3%	3%
12	0%	0%	2%	1%

Recommendation

- RA counting for hybrid solar resources can move to Additive method
  - Use Sum of QCs of the Co-located Solar and Storage Units
  - Subject to a cap of the inverter capacity for DC-coupled systems
  - No restrictions if 4-hour storage capacity < 75% of solar nameplate capacity.
- Possible conditions on use of the Additive method if 4-hour storage capacity > 75% of solar nameplate capacity.
  1. De-rate monthly storage QC in months where:
     - Storage is too large to fill on every day, and
     - Hybrid resource is not configured to use grid power, or chooses not to use grid power to fill storage. Hybrid resource owner can decide if added RA revenues from storing grid power offset loss of the ITC.
     - De-rate monthly storage QC by the daily average shortfall.
  2. Solar component of a hybrid project should retain its full RA QC, provided that off-peak solar is used to fill storage.

SOUTHERN CALIFORNIA EDISON®
Energy for What's Ahead℠

Renewable & Energy Storage Hybrid RA QC Proposal

Eric Little

2/12/2020

Background

- SCE proposed in the 2019 OIR a method to account for hybrid resources
  - It was not adopted at that time
- D.20-01-004 adopted an interim methodology to assign RA value to hybrid resources and co-located resources where the battery was restricted in its ability to charge due to ITC
  - The decision also recognized that a more permanent solution would be addressed in the 2020 RA OIR
- SCE has evolved its proposal to account for the combined value in meeting grid reliability of a resource combining a renewable facility and a battery storage device to meet grid reliability needs for RA

Renewable Hybrid QC Framework

Existing QC Rules		
Solar and Wind	**Solar or Wind + ES Hybrid**	**Dispatchable Resources**
QC = ELCC[1] (%) * Solar Capacity	***Interim method*** Max (ELCC (%) * Solar Capacity, Pmax of storage)	QC = Pmax or maximum continuous deliverable power over 4 hours

SCE's Proposal using solar as the example

QC for solar + energy storage hybrid resources (charging from **renewables only**) considers the *effective* contributions from both the renewable facility and the energy storage facility on a monthly basis

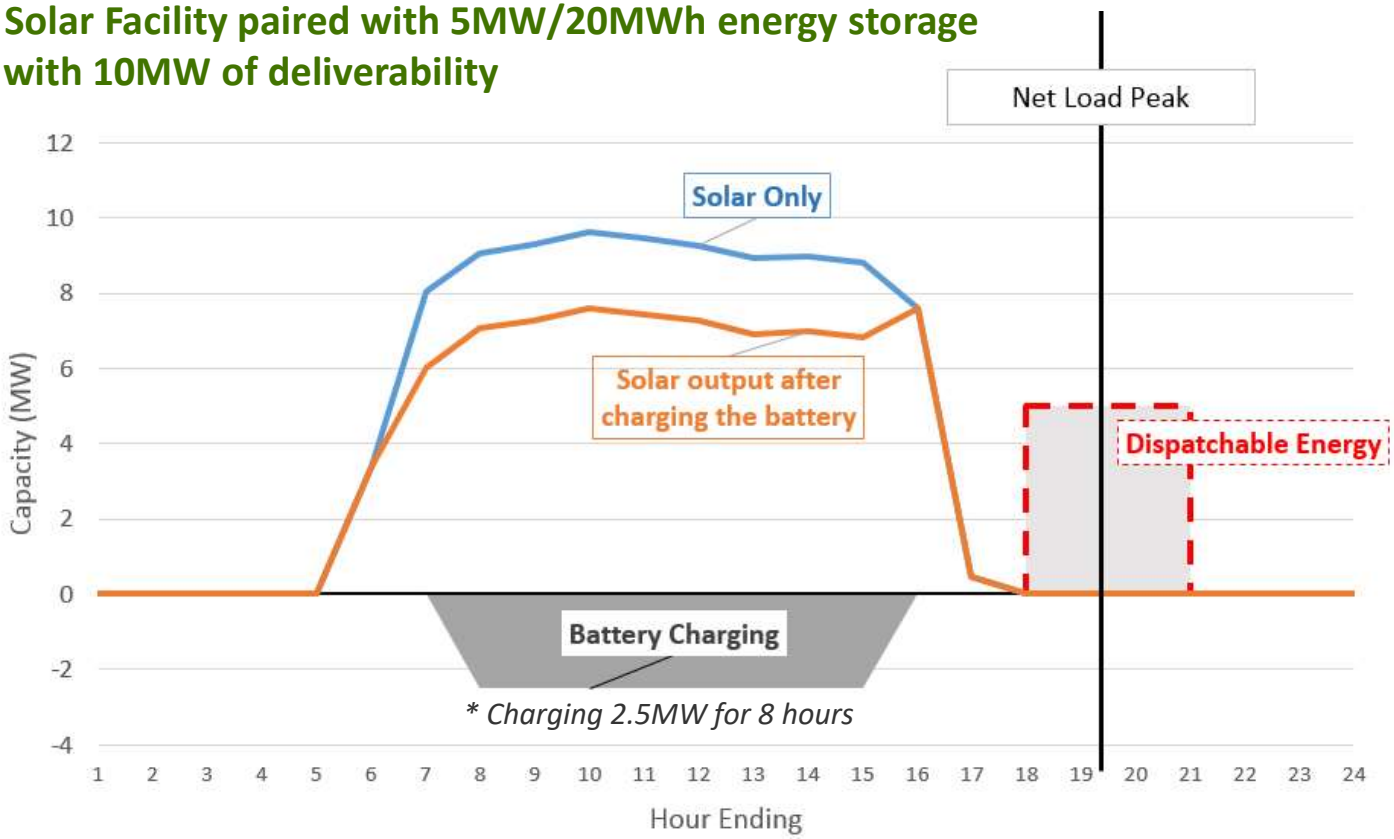
Renewable Hybrid QC = ***Effective ES QC*** *+ Effective Solar QC*

1. **Effective ES QC** = The minimum of:
   - The energy (MWh) production from the renewable resource until 2 hours before the net peak load assuming charging is done at a rate less than or equal to the energy storage's capacity. This renewable charging energy is then divided by 4 hours to determine the QC
   - The QC of the energy storage facility
2. Effective Solar QC = The remaining solar capacity, net of the capacity required to charge the battery (i.e., Effective ES QC), multiplied by the ELCC factor for the month

Notes:
- Effective Solar QC is dependent on the **Effective ES QC** because the Effective Solar QC is dependent on the energy consumed for charging by the energy storage facility
- Renewable Hybrid QC will consider the deliverability of the project but was omitted here to make the framework more concise
- Wind resources would look at the wind generation from 2 hours after the net peak load to 2 hours before the net peak load for each month

Detailed Example

10MW Solar Facility paired with 5MW/20MWh energy storage facility with 10MW of deliverability



** September*

Hybrid QC Counting	Solar Contribution	Energy Storage Contribution	Total Hybrid QC
SCE Proposal	(10.0-2.5)MW * 0.14% = 1.05MW	20MWh / 4h = 5.00MW	6.05MW
Interim CPUC Proposal	0.00MW	5.00MW	5.00MW

Thank You.

CONTACT INFO:

Michael Norbeck

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sunrun

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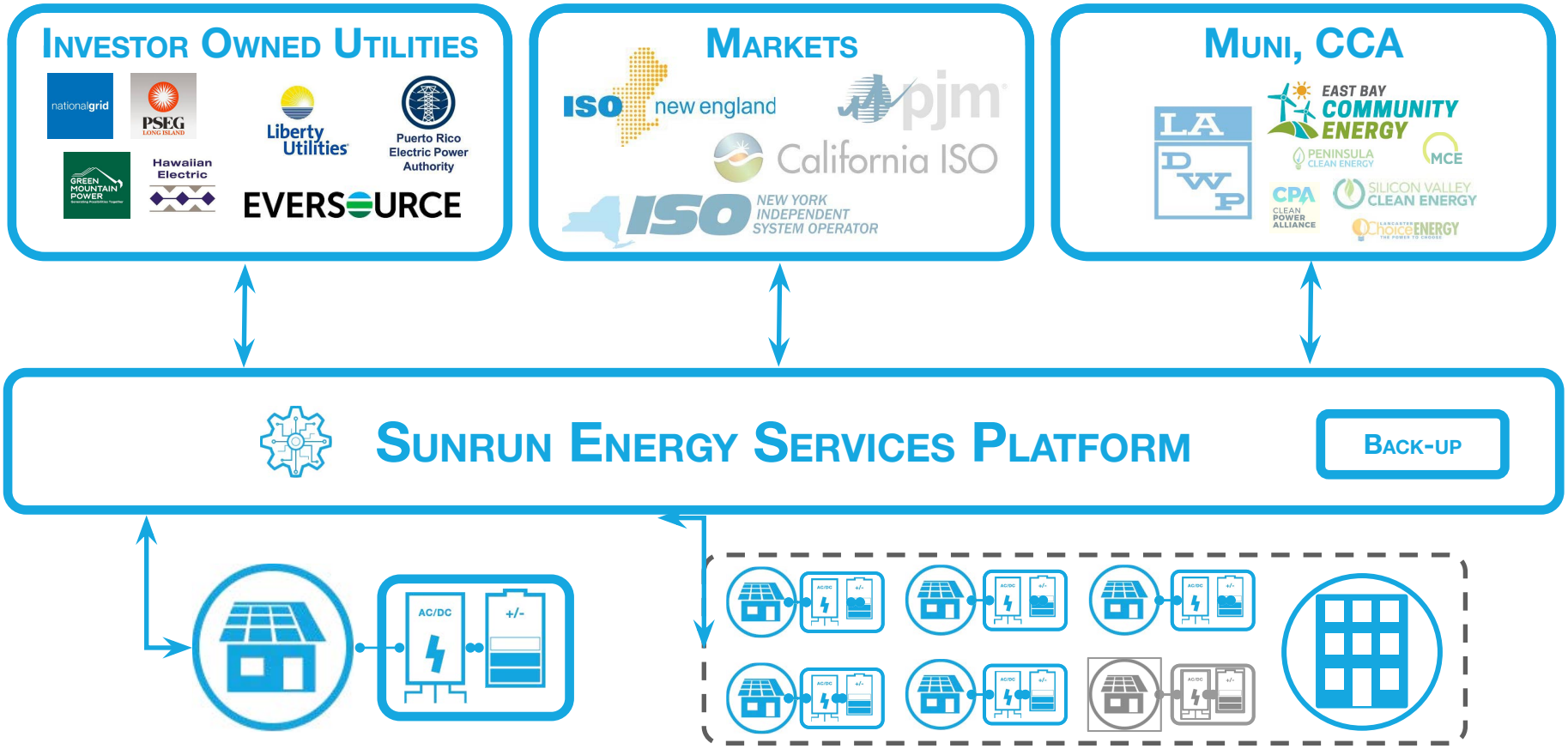

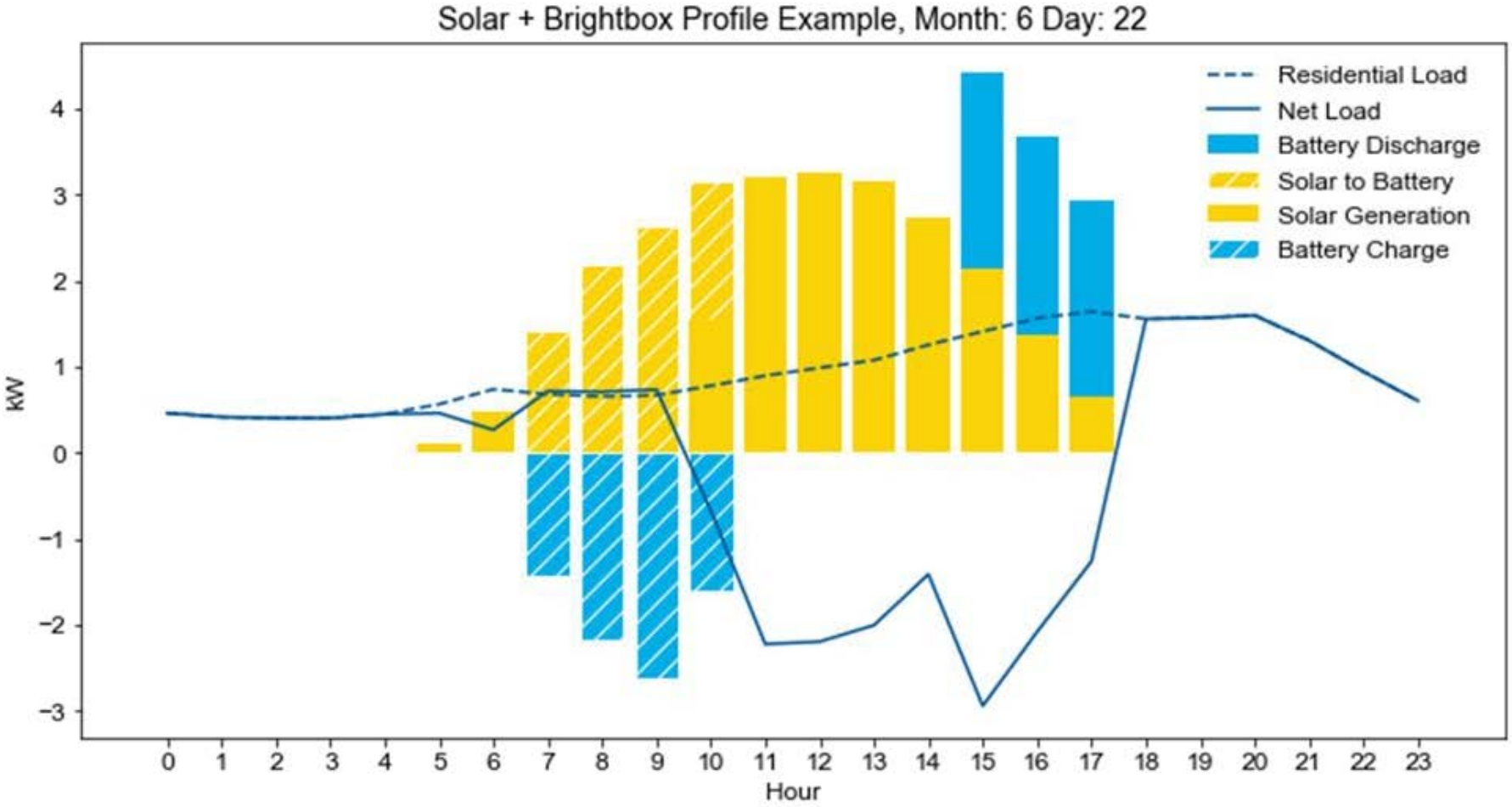
Solar + Brightbox Profile Example, Month: 6 Day: 22
Residential Load
Net Load
Battery Discharge
Solar to Battery
Solar Generation
Battery Charge
kW
4
3
2
1
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−1
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0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour

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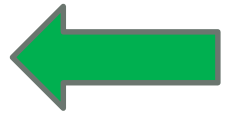
High RA Imports	-$389	$168	$970	-$389	-$305	-$271
High Load Baseline	$745	$1,306	$2,212	+$745	+$834	+$971
OTC Extension	-$173	$299	$1,068	-$173	-$173	-$173
Partial OTC Extension	-$132	$341	$1,109	-$132	-$132	-$132
Early Shed DR Availability	-$18	$465	$1,234	-$18	-$8	-$7

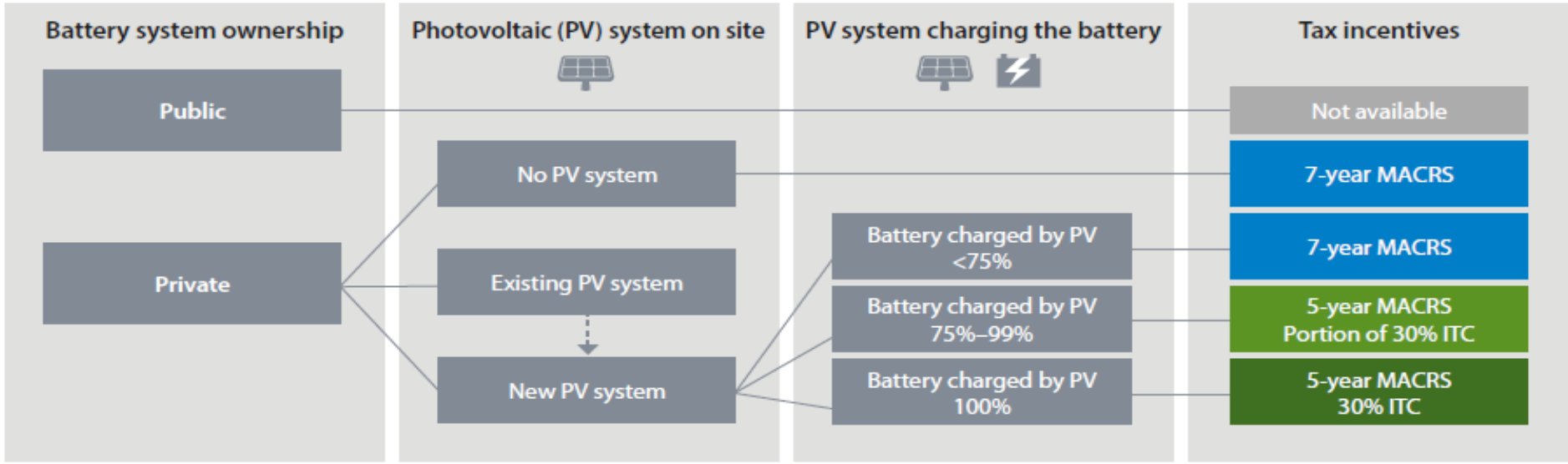


D. 20-01-004 Adopts an Interim Methodology

- Two approaches on the table
  - "Additive" method proposed by petitioners, based on an SCE proposal
    - Sum of NQCs of the individual Co-located Generation and Storage Units
  - "Maximum" method proposed by SDG&E
    - Maximum of the separate NQCs of the Co-located Generation and Storage Units
- D. 20-01-004 adopted the Maximum approach, as interim method
  - Concern with "operational restrictions"
  - Little data presented on how to reflect this constraint.
  - CPUC adopts the "conservative" Maximum approach.
  - Recognizes that this may undervalue hybrid resources
- Also caps the monthly QC of the battery "at the amount of energy that can reasonably be expected to be available to charge the storage device on a daily basis" (p. 9).

"Operational restrictions" of Hybrid Resources

- D. 20-01-004 clarifies that these are the qualification rules for the ITC:



- DC-coupled hybrids may have physical restrictions.
  - Tightly-coupled DC-DC hybrids cannot use grid power,
  - But recover "clipped" solar output, and avoid a second inverter.
  - Inverter size can limit maximum output of solar + storage to the grid.

Hybrid Resource Configurations

- AC-coupled
  - Two inverters
  - Can operate solar and storage separately
- DC-coupled
  - Single inverter, bi-directional
  - Can fill storage from the grid
- DC-coupled (tight)
  - Single inverter, export only
  - Can charge storage only from on-site solar, cannot use grid power
- See NREL, *Evaluating the Technical and Economic Performance of PV Plus Storage Power Plants* (August 2017).

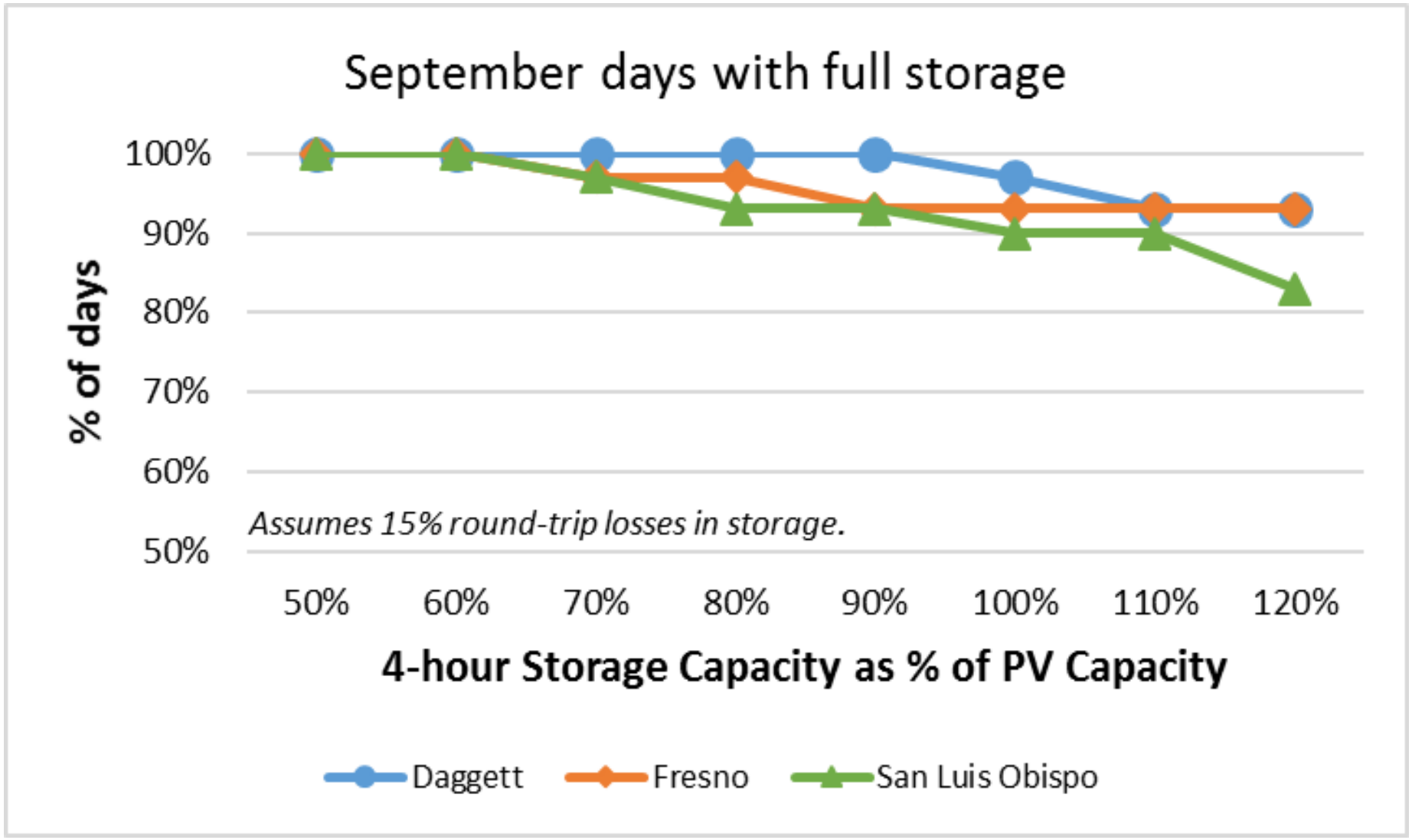
Issues for an RA Counting Method for Hybrid Solar

- Can solar fill the paired storage on all days?
  - If not, how much grid power is needed to fill storage?
  - Should the QC of the battery be de-rated to account for unfilled storage on some days? Or should the storage owner bear the risk of using grid power to fill storage, thus losing ITC?
  - Key metrics:
    - Relative sizes of the solar nameplate and the storage discharge capacities
    - Storage duration (i.e. MWh stored / MW discharge capacity)
- After filling storage, is the RA value of the remaining solar output to the grid the same?
  - When paired with storage, is the solar output to the grid reduced during the peak hours?
  - Is the simultaneous export of solar + stored power limited by the inverter size of DC-coupled systems?

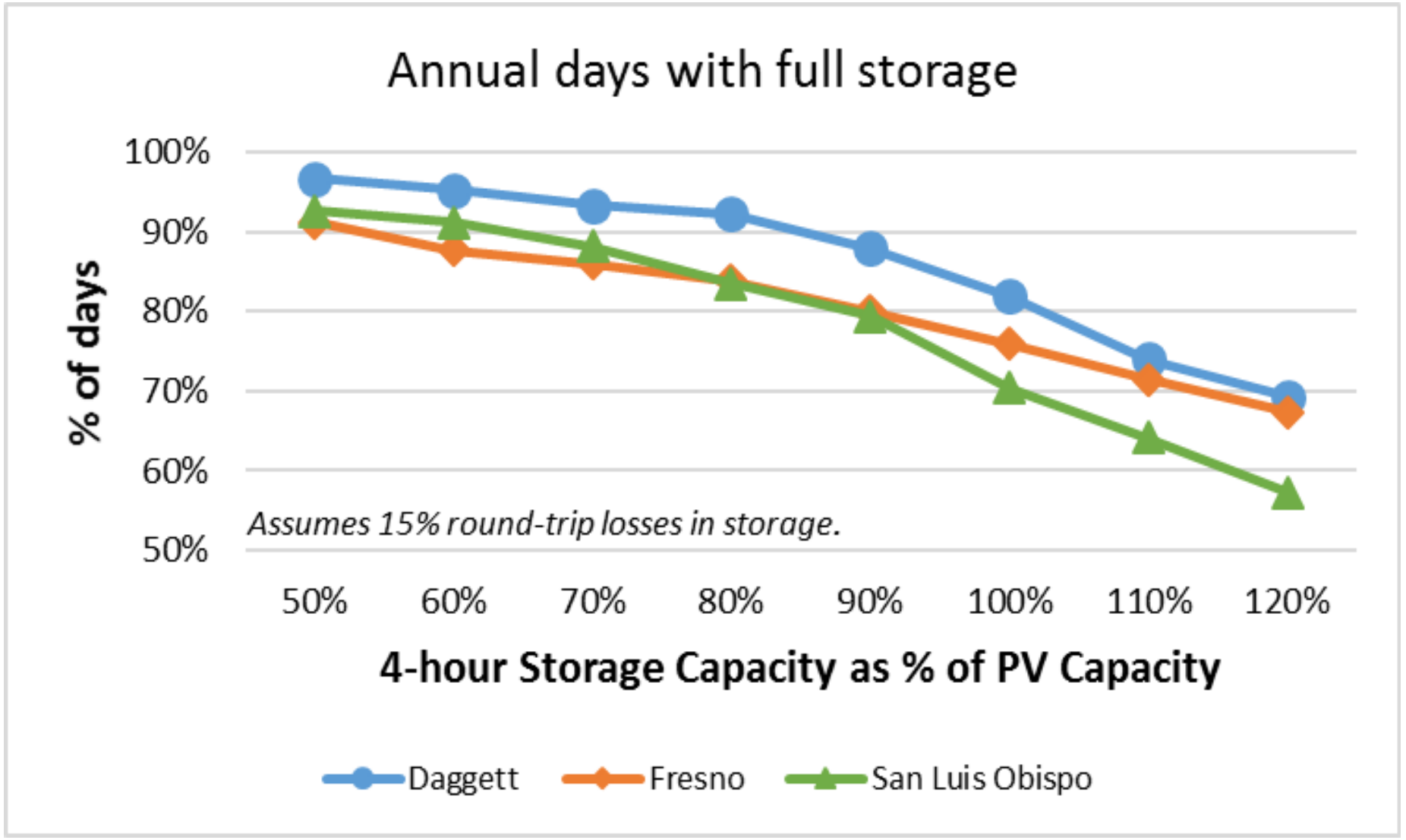
Analysis of RA Impacts of "Operational Restrictions"

- Three locations:
  - Daggett (western Mojave)
  - Fresno (southern San Joaquin Valley)
  - San Luis Obispo (Central Coast)
- Single-axis tracking solar, using PVWATTS
- 4-hour storage sized from 50% to 120% of solar nameplate
- AC-coupled, no POI limitations on output to the grid
- 15% round-trip storage losses
- Full daily cycling (100% of stored energy discharged 4p to 9p)
- All on-peak (4p to 9p) solar output is exported; none is stored.

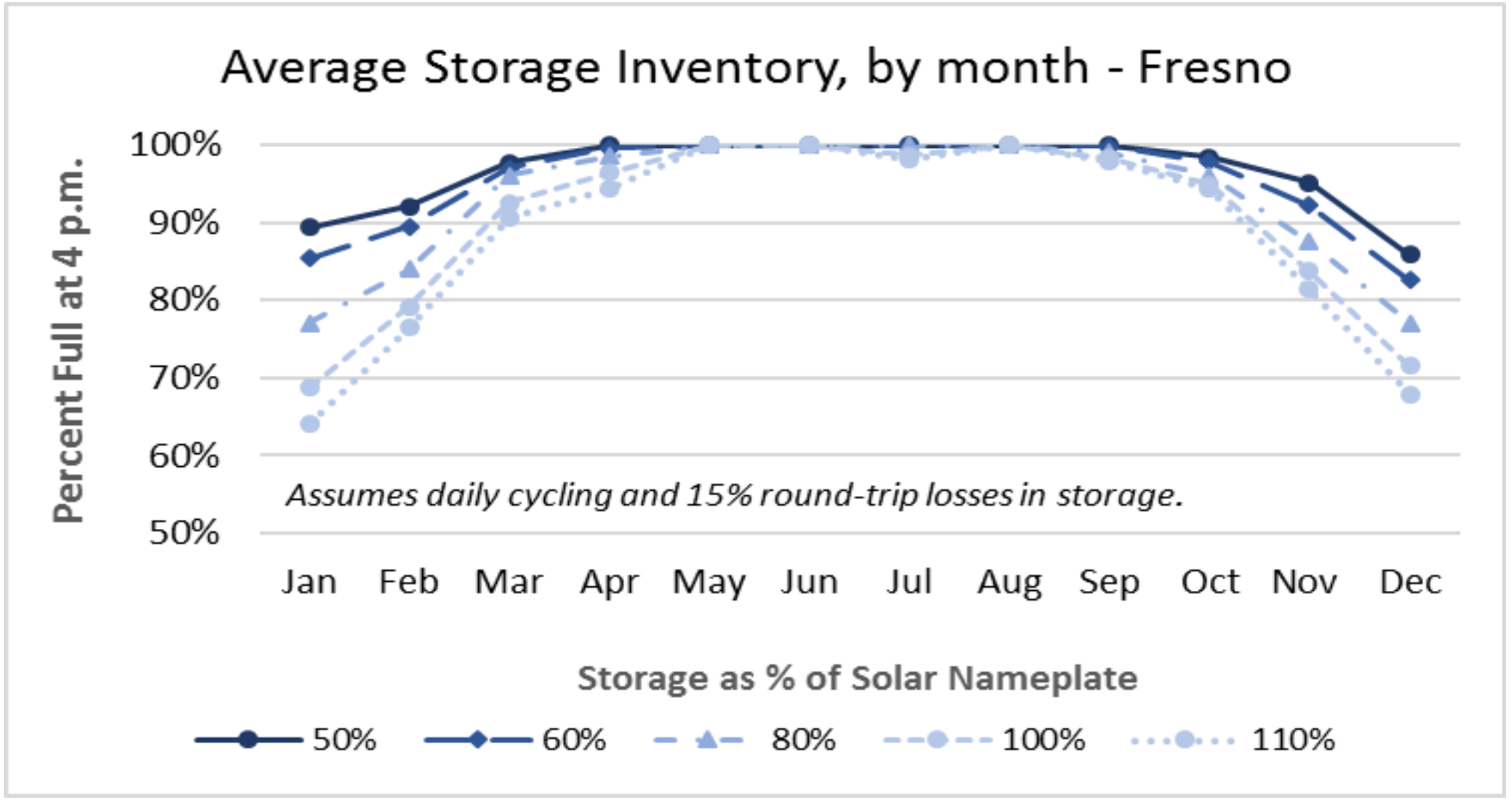
Results – Peak Month (September)



Results – Annual



Winter Months Are Most Challenging



On-Peak Solar Output Is Unchanged, After Filling Storage

- Storage can be filled off-peak, leaving on-peak solar output unchanged.
- On-peak (4p-9p) solar capacity factor typically exceeds solar ELCC.

Solar PV and Solar Thermal		On-peak 4p-9p Capacity Factor		
Month	CY 2020 Solar ELCC	Daggett	Fresno	SLO
1	4%	2%	5%	3%
2	3%	5%	8%	6%
3	18%	23%	22%	21%
4	15%	31%	28%	32%
5	16%	37%	36%	38%
6	31%	44%	42%	47%
7	39%	35%	39%	48%
8	27%	31%	38%	42%
9	14%	24%	29%	29%
10	2%	16%	19%	17%
11	2%	2%	3%	3%
12	0%	0%	2%	1%

Recommendation

- RA counting for hybrid solar resources can move to Additive method
  - Use Sum of QCs of the Co-located Solar and Storage Units
  - Subject to a cap of the inverter capacity for DC-coupled systems
  - No restrictions if 4-hour storage capacity < 75% of solar nameplate capacity.
- Possible conditions on use of the Additive method if 4-hour storage capacity > 75% of solar nameplate capacity.
  1. De-rate monthly storage QC in months where:
     - Storage is too large to fill on every day, and
     - Hybrid resource is not configured to use grid power, or chooses not to use grid power to fill storage. Hybrid resource owner can decide if added RA revenues from storing grid power offset loss of the ITC.
     - De-rate monthly storage QC by the daily average shortfall.
  2. Solar component of a hybrid project should retain its full RA QC, provided that off-peak solar is used to fill storage.