California ISO

Storage as a Transmission Asset:

Enabling storage assets providing regulated cost-of-service-based transmission service to access market revenues

Working Group Meeting

Karl Meeusen, Ph.D.

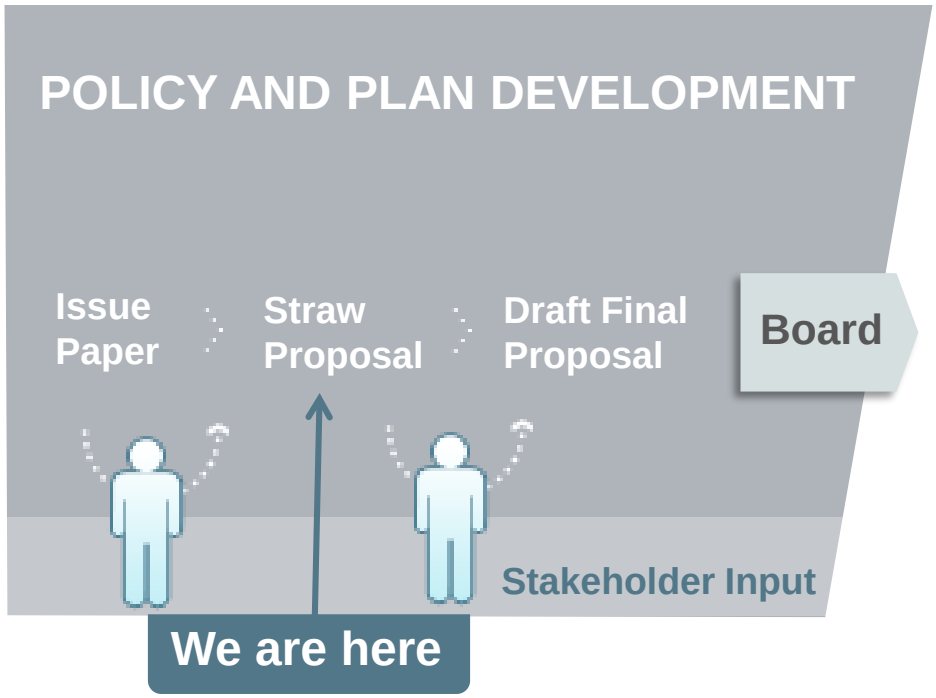
Stakeholder Meeting

June 29, 2018

Storage as a Transmission Asset Working Group Meeting Agenda – 6/29/2018

Time	Topic	Presenter
10:00 – 10:10	Introduction	James Bishara
10:10 – 10:40	Informational: Assessments of need and technical requirements	Neil Millar
10:40 – 11:10	Informational: Economic evaluation of project alternatives	
11:10 – 11:40	Informational: Transmission Asset versus Market resource considerations	
11:40 – 12:00	Informational: Operational Control	
12:00 – 1:00	Lunch	
1:00 – 1:45	Proposal: SATA Contracts	Riddhi Ray
1:45 – 3:15	Panel: Cost Recovery Alternative	Karl Meeusen, Kerinia Cusick, Jan Strack
3:15 – 3:30	Next Steps	James Bishara

Stakeholder Process



Stakeholder Engagement Plan

Date	Milestone
Jun 29	Working group meeting
Jul 16	Stakeholder comments on working group meeting due
Aug 14	Revised straw proposal
Aug 21	Hold stakeholder meeting on revised straw proposal
Sep 4	Stakeholder comments on revised straw proposal due
Sep 24	Draft final proposal
Oct 4	Hold stakeholder meeting on draft final proposal
Oct 15	Stakeholder comments due
Nov 14-15	Present proposal to ISO Board

Storage as a Transmission Asset

Neil Millar
Executive Director Infrastructure Development

June 29, 2018

The planning process and methodologies provide the context for the initiative.

Background Topics Previously Reviewed in the Stakeholder Process

- Transmission Planning Process
- Scope of evaluation for storage assets
  - Types of projects considered
  - Interconnecting voltage
- FERC storage resource participation principles

Additional Stakeholder Workshop Topics identified to be helpful

- Assessments of need and technical requirements
- Economic evaluation of project alternatives
- Transmission Asset versus Market Local Resource considerations
- ISO Operational control of storage assets

Storage – and other preferred resources - may meet different types of transmission planning needs

- Addressing grid reliability requirements:
  - The most frequent candidate for storage in the past, as identified by the ISO and stakeholder submissions
- Identifying upgrades needed to meet California's policy goals (e.g. Renewable Portfolio Standards)
  - While possible, no identified opportunities for storage thus far
- Exploring projects that can bring economic benefits to consumers
  - Upgrades alleviating congestion to provide access to lower cost resources, but not a competing resource
  - The bulk of all storage market economic benefits identified to date have been as a market resource inside a constrained area
  - Differentiating between the two can be complex

Storage, to be a Transmission Asset as a subset of Advanced Transmission Technologies must:

- Provide a transmission service (*e.g.*, voltage support, mitigate thermal overloads)
- Meet an ISO-determined need under the tariff (reliability, economic, public policy)
- Be the more efficient or cost-effective solution to meet the identified need
- “Increase the capacity, efficiency, or reliability of an existing or new transmission facility”
- Be subject to competitive solicitation if it is a regional transmission facility

Assessment of Need and Technical Requirements

TPP Consideration Of Preferred Resources-Identification and requirements determination

- ISO has always assessed non-transmission alternatives albeit on a case to case basis due to labor intensive nature of the analysis
- ISO published a methodology document “Consideration of alternatives to transmission or conventional generation to address local needs in the transmission planning process,” to improve ISO’s past approach to evaluating non-conventional transmission solutions
- Methodology proposed a 3 step approach that includes identifying generic resources type, determining an effective mix and monitoring the development of selected mix
- Methodology was advanced and used to establish the Moorpark sub-area local capacity requirements in the 17-18 TPP cycle

TPP Consideration Of Preferred Resources- Application in future cycles

- TPP Phase 2 will produce a subset of identified reliability issues that can potentially be mitigated by preferred resources (EE, DR, and energy storage – and can consider preferred resources and storage whether a resource or transmission asset)
  - ISO will identify the area, need and required performance characteristics
  - Primary identification will be based on in-progress Transmission Planning Process analysis
  - Stakeholders can also propose projects for reliability issues with sufficient lead time, focusing on High Potential Areas where the ISO has identified the issue (reliability/economic/policy) but no solutions were approved in the prior TPP - such as the Oakland area

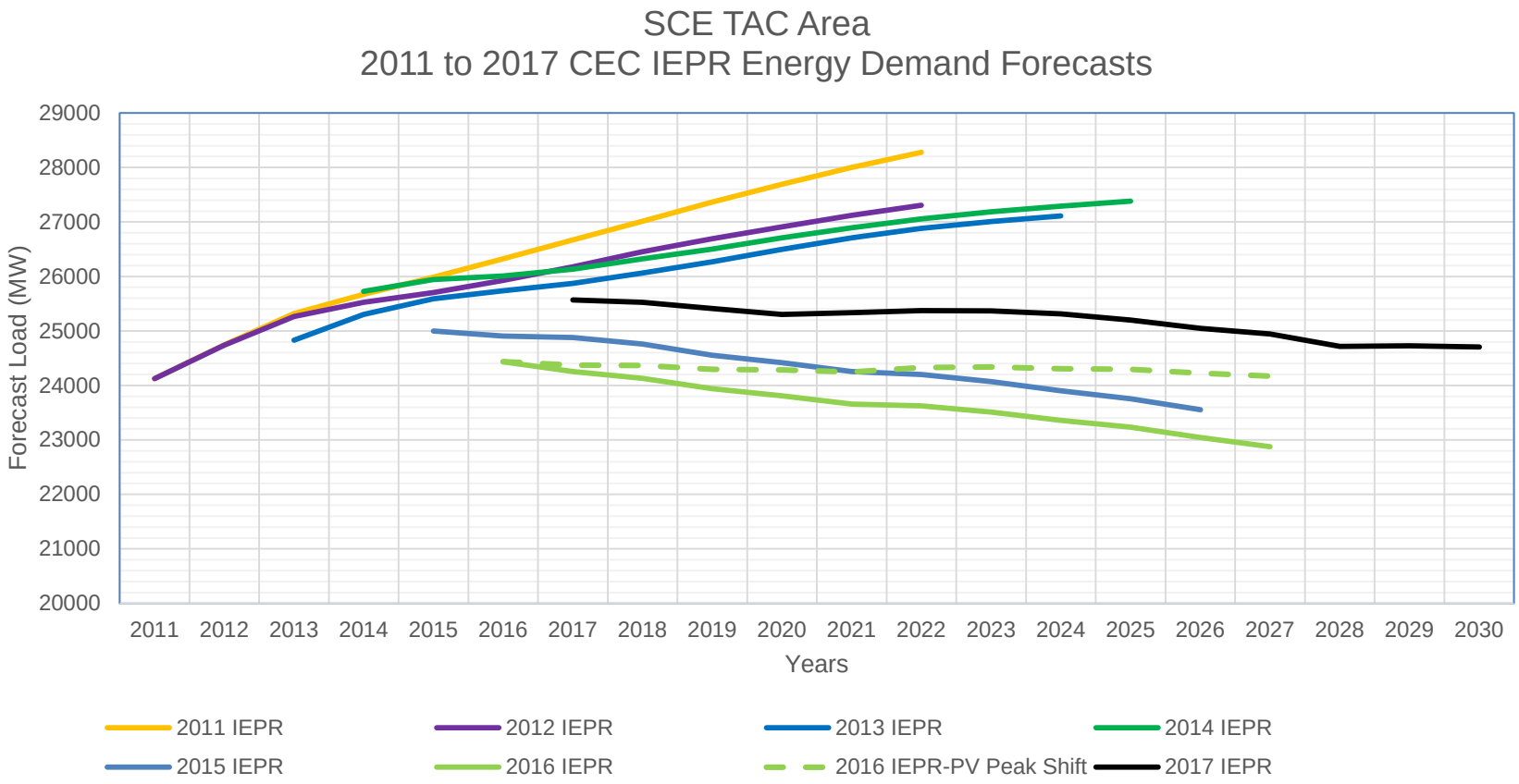
Technical studies are required to validate solutions and protect against other unintended consequences:

- Planning assessments consist of:
  - Power Flow Contingency Analysis
  - Post Transient Thermal Loading Analysis
  - Post Transient Voltage Stability Analysis
  - Post Transient Voltage Deviation Analysis
  - Voltage Stability and Reactive Power Margin Analysis
  - Transient Stability Analysis

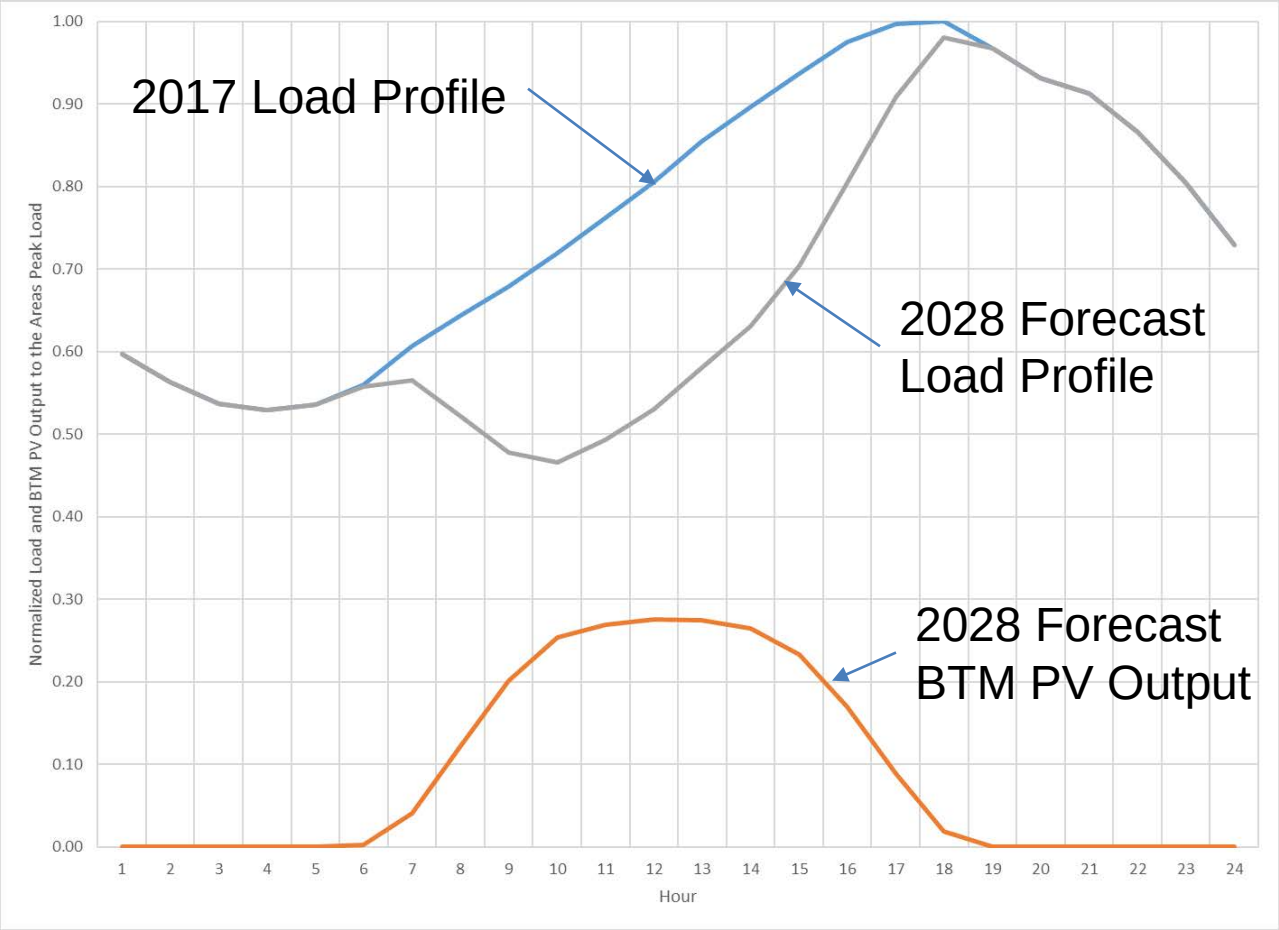
Assessing predictability of transmission need would have to account for uncertainties and risks

- Load forecast
  - Account for significant variability in the official IEPR numbers
  - More granular (local) hourly load forecast needed because storage-based mitigation is more likely to be local in nature
  - Forecasts beyond the 10 year planning horizon are necessary for comparing storage against projects with a longer lifespan
- Future trends including behind-the-meter resources, time of use rates, transportation electrification have to be captured at a more local level in order to assess storage feasibility
- Any subsequent changes to TPP study inputs will change the prior determination of predictability of transmission need and hence of the feasibility of a storage resource to access market revenues

The CEC IEPR load forecast for the SCE area is one example of the variations in load forecast levels



Besides peak loads, the local area load shapes are also shifting dramatically for a number of reasons



Example: Greater Bay Area Planning Area

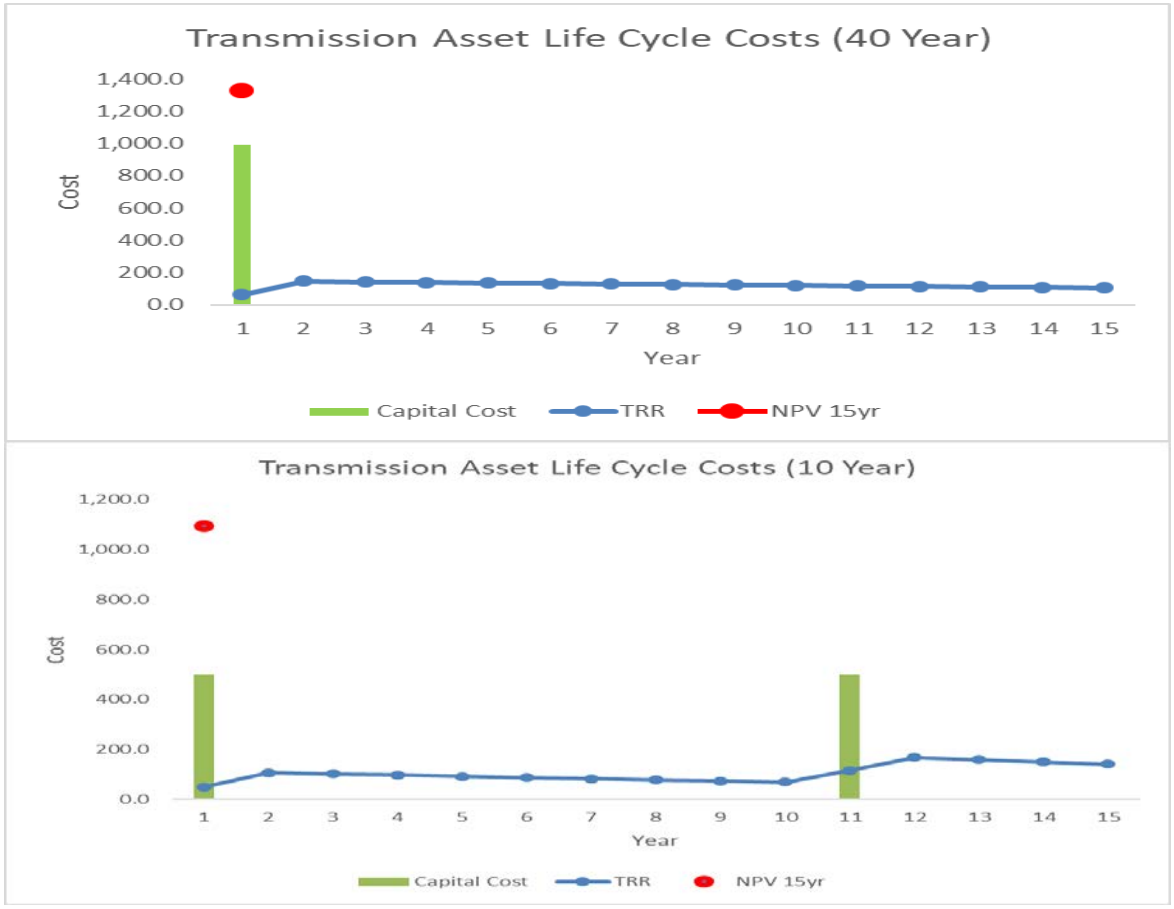
2017 Load Profile and current 2028 Forecast Load and Behind-The-Meter Profile Normalized to the Area's Peak Load

Economic Assessments of Project Alternatives (transmission and preferred resources)

- The ISO is not locked into one single economic evaluation but can consider a range of evaluations as appropriate
- When the ISO compares to similar types of assets delivering the same benefits such as a reliability need, capital costs are the primary economic consideration
- More complex analysis is performed with the benefits differ and the cost implications are dissimilar
  - e.g. lifecycle, operations and maintenance costs, etc.
- The value of net benefits considered are the summation
  - e.g. the net present value, of the benefits for all market participants who pay for the project less the costs incurred
- Results in complex cases are compared using multiple discount rates and sensitivity analyses

Net-present-value analysis on annualized costs accommodates a range of cost and benefit profiles

- Sensitivities can provide input for risk considerations.



* Charts based on results from the ISO HV TAC estimating model*

Transmission asset vs market (local Resource Adequacy) resource considerations

- When would a transmission need move from the local Resource Adequacy framework to a Transmission Asset?
- Can criteria be definitively developed to identify transmission need that cannot be (or should not be?) addressed by local Resource Adequacy procurement
- Note that the ISO preference is clearly to treat storage consistent with other preferred resources, so there needs to be a reason to move to transmission asset treatment and no restrictions standing in the way

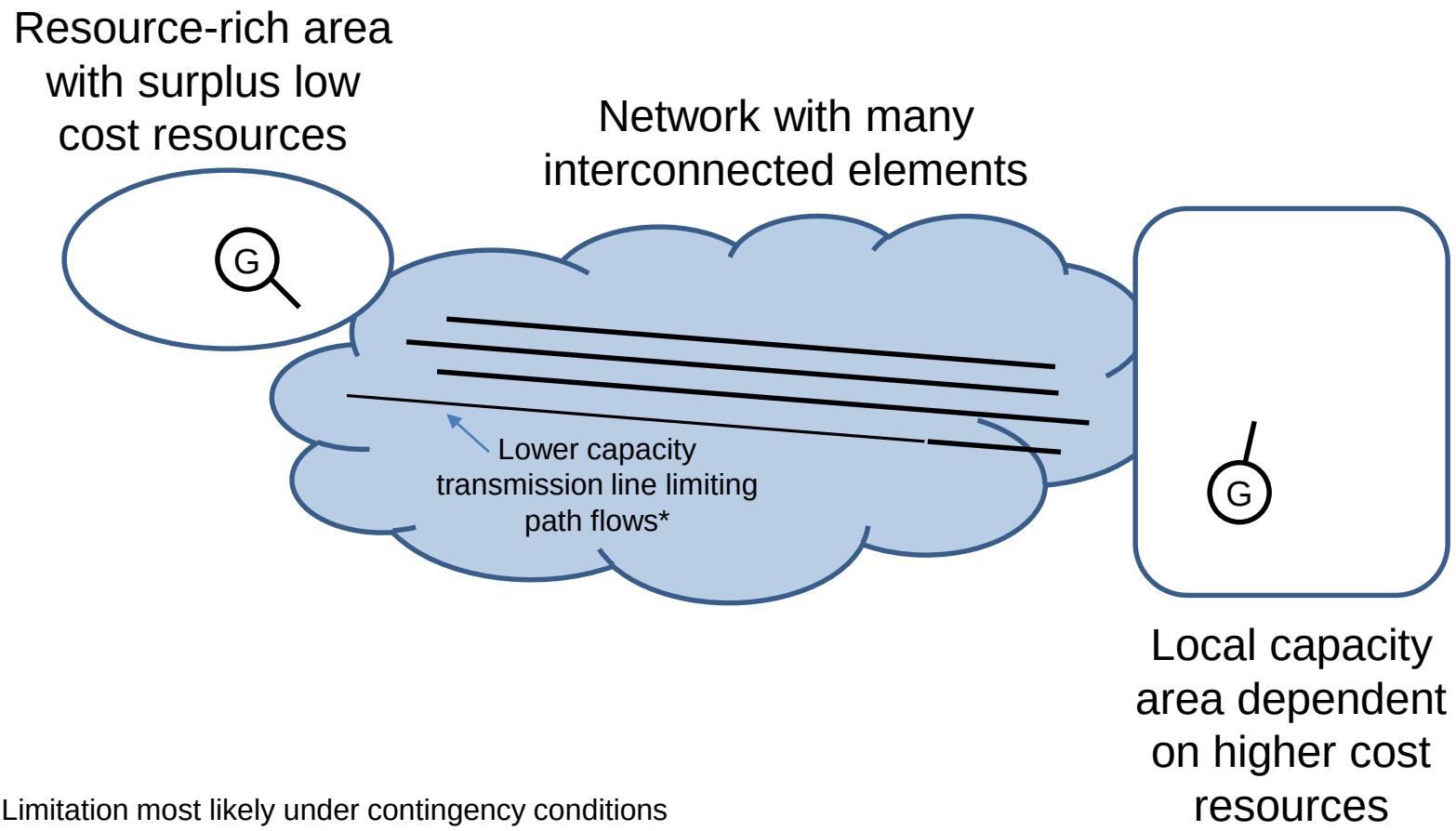
To date, the ISO has identified limited compelling reasons for particular storage needing to be a transmission asset

- Visibility needed through real time operations (of complete path to device)
- Heavily constrained operations expected - e.g ., would otherwise be exceptionally dispatched a great deal of the time
- Procurement as a local capacity resource not considered feasible or much less viable to meet specific need;
  - Resource Adequacy must-offer obligations not consistent with transmission system needs
- Overly complex interconnection as a market resource

Limitations on considering storage as a transmission asset:

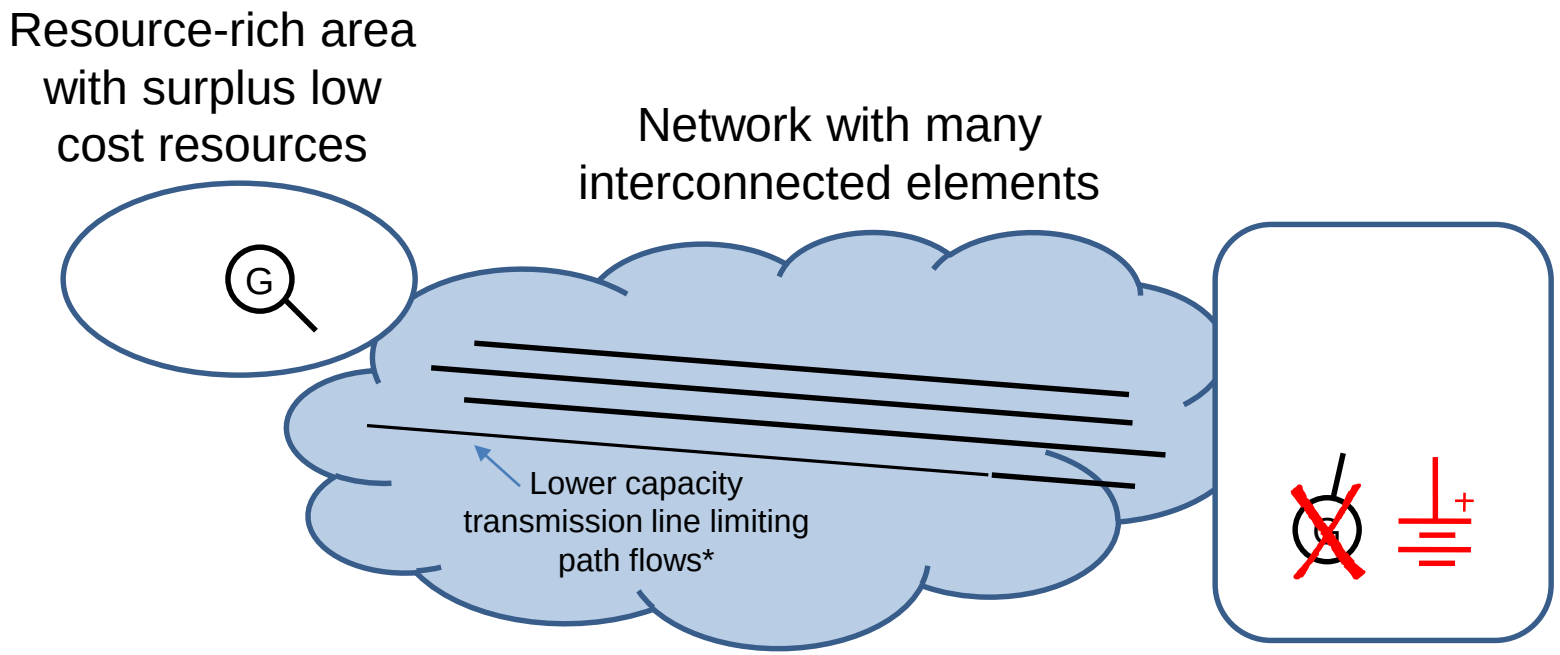
- As noted in previous stakeholder sessions, the ISO's economic-driven transmission framework is not an alternative to resource planning
- As noted earlier, storage as a transmission asset must "*increase the capacity, efficiency, or reliability of an existing or new transmission facility*"

Consider examples by way of a simplified hypothetical situation:



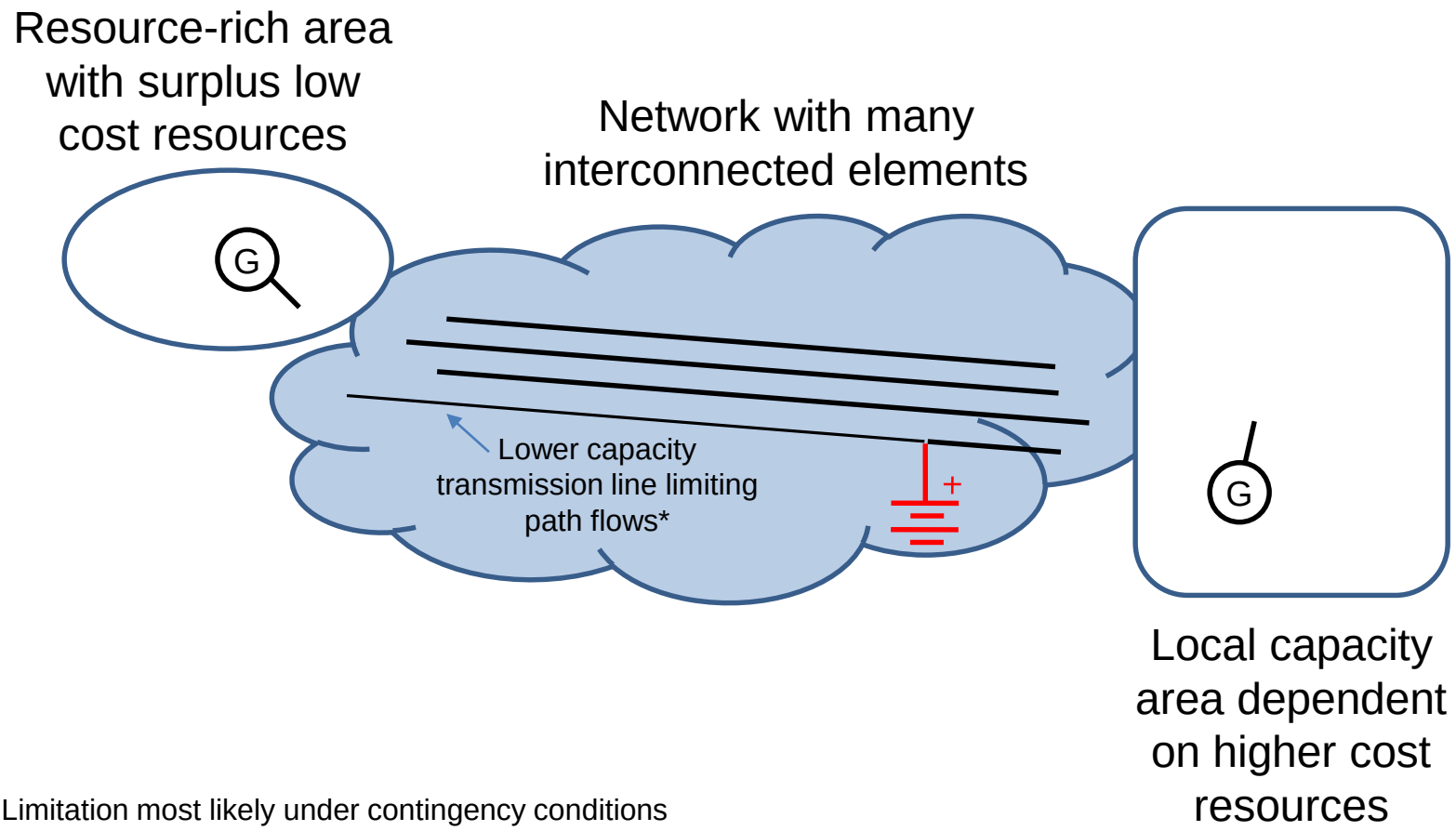
* Limitation most likely under contingency conditions

Replacing the local capacity resource with storage is an example of market resource considerations



* Limitation most likely under contingency conditions

Compare to a storage device “pushing back” on a limiting flow, increasing path flows overall:



* Limitation most likely under contingency conditions

Operational Control - Practical meaning of ‘operational control’ of SATA facilities

- Tariff Appendix A defines Operational Control as –

  “*The rights of the CAISO under the Transmission Control Agreement and the CAISO Tariff to direct Participating TOs how to operate their transmission lines and facilities and other electric plant affecting the reliability of those lines and facilities for the purpose of affording comparable non-discriminatory transmission access and meeting Applicable Reliability Criteria.”*
- In SATA proposal, the practical meaning of operational control is a hands-on out-of-market state-of-charge (SOC) control – a new definition may be appropriate
- Orchestrated in a way that the market system reflects any change in SOC

SATA agreement provisions

Riddhi Ray
Regulatory Contracts

June 29,2018

Outline

- Local versus regional
- Different scenarios of SATA resources
- Alternatives for contractual arrangements
  - TCA
  - New SATA agreement
- CAISO proposal

Local versus System

- Local(< 200 kV)
  - No competition therefore direct assigned to incumbent PTO
  - Will have market charges and revenue
  - Cost-of-service recovery only
  - Monitoring of construction schedule
- Regional(> 200kV)
  - Competition available
  - Will have market charges and revenue
  - Cost recovery – combination of cost-of-service and market
  - Monitoring of construction schedule

Different scenarios of SATA resources

- Scenario 1: Storage asset, owned by incumbent PTO, no market participation (but still market charge and revenue)
- Scenario 2: Storage asset, owned by incumbent PTO, market participation
  - With market risk
  - No market risk (but subject to market charges)
- Scenario 3: Storage asset, owned by non-incumbent PTO, market participation
  - With market risk
  - No market risk (but subject to market charges)

Obligations of resources

- Shall perform as a transmission and generation asset
  - Even if the storage unit is not in the market, it will need to be charged and discharged therefore incurring market charges and revenue
  - It will need to be dispatched in the market

- Shall be maintained as a transmission asset
  - Life of product is 40 years

Revenues for resources

- Annual revenue requirement
  - Fixed capital recovery cost
  - Variable O&M cost
- Revenues from market participation
  - Pass through to ratepayers
  - Kept by resource owner

Structure of SATA

- Performance, including obligation to perform
- Operations and maintenance
- Cost recovery
- Resource characteristics
- Dispatch of resource
- CAISO operational control vs market participation
- Construction schedule, if applicable

Hybrid of TCA + APSA+ PGA+RMR+MSA+GIA

One agreement to cover all aspects

Allowing TCA for Scenario 1

- Multilateral agreement-all 18 parties must agree
- Need amendments for
  - Classifying storage as transmission facility
  - Adding market dispatch protocols
  - Transferring operational control
- Has different [performance, maintenance, availability] requirements from “traditional” transmission lines and associated facilities

Use SATA agreement for all scenarios

- Defines obligations/requirements for storage resources
  - Transmission asset
  - Market participant
- Addresses specific provisions for operations, transfer of operational control, dispatch, availability, market participation *etc.*
- Agreement allows owner to select options applicable to S\scenarios 1,2 and 3
- Filed as *pro forma* - bilateral agreement between CAISO and resource owner

CAISO proposal

- Use SATA agreement for all scenarios
- Keep separate from TCA
- Accommodates both new PTOs and incumbent PTOs
- Would tie TAC to SATA agreement
- Easier to amend/modify as requirements change

Cost Recovery Mechanisms

Karl Meeusen
Markets Design and Regulatory Policy

June 29,2018

The ISO is proposing two cost recovery options for regional SATA projects

1. Full cost-of-service based cost recovery with energy market crediting

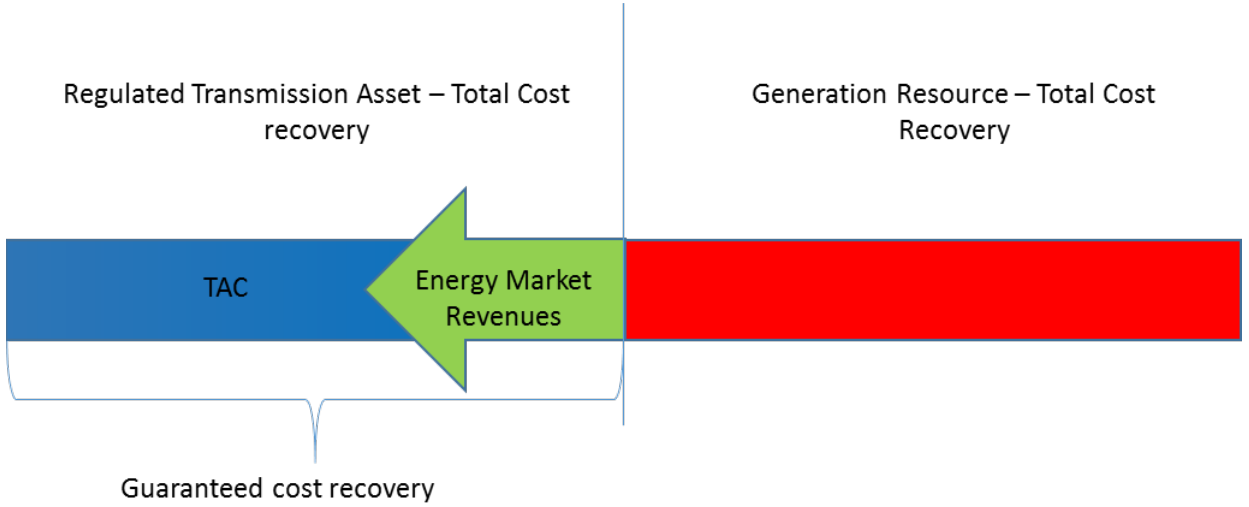
2. Partial cost-of-service based cost recovery with no energy market crediting

Market services must not conflict with the fundamental reliability purpose for which the resource was selected in the TPP

Local projects may only use full cost-of-service option because they are not open to track 3 competitive solicitation process

Full cost-of-service based cost recovery with energy market crediting ensures that a resource's TRR is covered through TAC

- Any revenue received from market services would be treated as a revenue offset
  - Reduces the revenues otherwise required through TAC

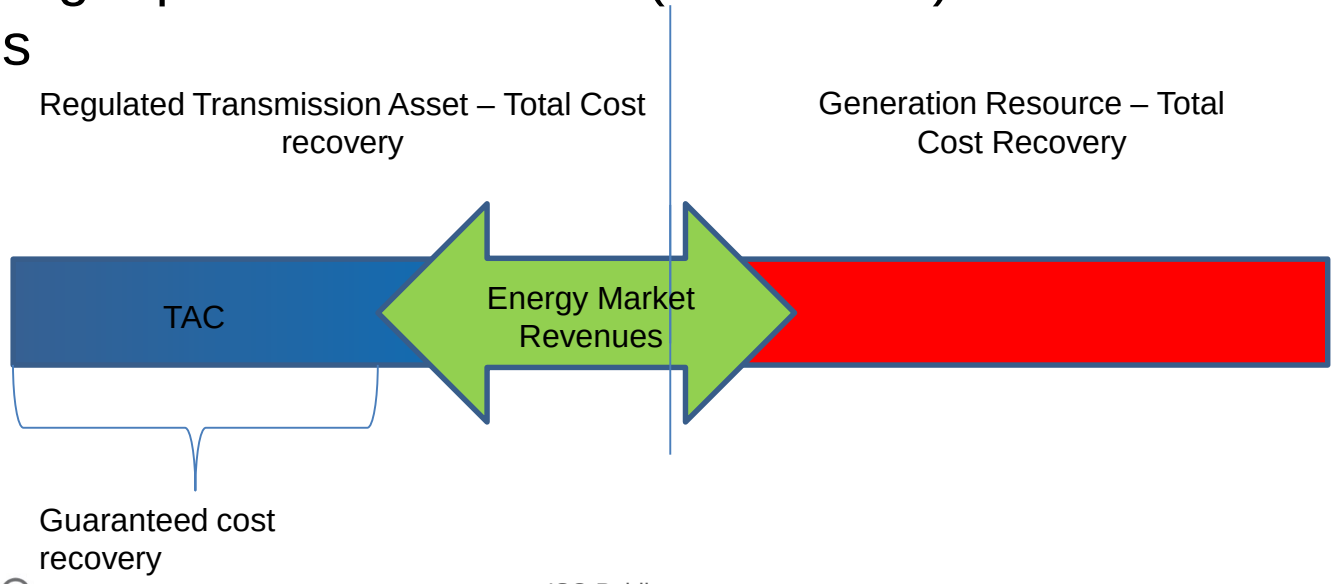


Resources must be available to meet identified need, but still participate in the market to the extent possible

- ISO does not need to provide any additional compensation to the SATA resource if conditions change opportunities for market participation
- Resources will not have any specified must-offer obligation
  - As a result, and as a starting point, the ISO will assume zero market participation in the assessment of alternative projects
    - The ISO remains open to revisions based on stakeholder feedback

Partial cost-of-service with no energy market crediting ensures that a portion resource's total costs are covered, the remainder is recovered through market

- Guarantees less of the TRR through TAC
  - ISO market revenues would not be credited against the TAC recovery
- Resource owner accepts both upside and downside risk of recovering a portion of its costs (and return) from market services



Changes in market participation opportunities can impact a resource's ability to cover costs

- ISO proposes to work with the resource to determine appropriate compensation to ensure the resource is justly compensated for any changes in the ability to participate in markets
- SATA resource may not request a change to the opportunities to provide market services
  - *i.e.,* If the expected market revenues are not reaching forecasted levels, the resource cannot seek to revise the agreement to increase the portion of costs covered under cost-of-service rates

Cost recovery for shared facilities will apply only to network upgrades

- Interconnection facilities and generation will not be covered

- Questions: How should the ISO address resources connected to SATA resources? How might cost recovery differ?
  - Interconnection queue
  - Some project options may be foreclosed if not built simultaneously (i.e. pump storage)

Next steps

- Stakeholders are asked to submit written comments by July 16, 2018 to: initiativecomments@caiso.com

- The initiative page is available at the following link: http://www.caiso.com/informed/Pages/StakeholderProcesses/StorageAsATransmissionAsset.aspx