Resiliency & Microgrids Working Group Meeting 2

Resiliency and Microgrids Team, Energy Division

November 4, 2020

California Public Utilities Commission

WebEx and Call-In Information

Join by Computer:

https://cpuc.webex.com/cpuc/onstage/g.php?MTID=e4faac686776bf2cd7e7d0b350f8f086a

Event Password:RMWG20!

Join by Phone:

- Please register using WebEx link to view phone number.

(Staff recommends using your computer's audio if possible.)

Notes:

- Today's presentations are available in the meeting invite (follow link above) and will be available shortly after the meeting on https://www.cpuc.ca.gov/resiliencyandmicrogrids.

- This meeting will not be recorded and there will not be meeting minutes.

WebEx Logistics

- All attendees are muted on entry by default.
- Questions can be asked verbally during Q&A segments using the "raise hand" function.
  - The host will unmute you during Q&A portions and you will have a maximum of 2 minutes to ask your question.
  - If you have another question, please "re-raise your hand" by clicking on the "raise hand" button twice.
- Questions can also be written in the Q&A box and will be answered verbally during Q&A segments.

WebEx Tip

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1. Click here to access the attendee list to raise and lower your hand.

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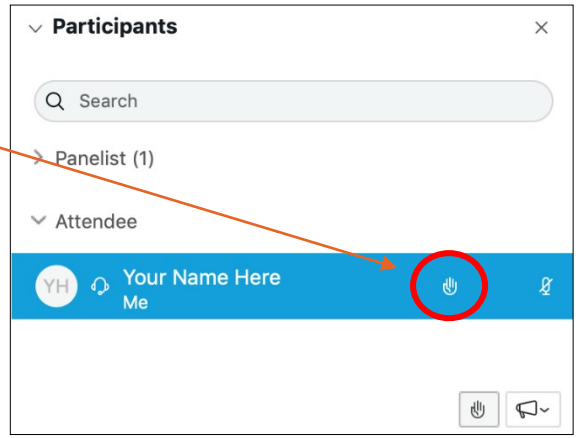
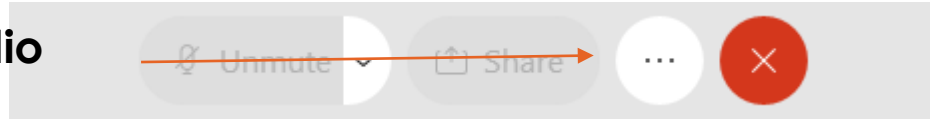
3. Lower it by clicking again.



Access your meeting audio settings here



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- Review WebEx logistics
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- Clarify rationale for scope and issue prioritization (CPUC)
- Provide overview of DER participation opportunities in wholesale markets (CAISO)

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- Present overview of Community Microgrid Enablement Tariff's (CMET) goals and challenges (PG&E)

Lunch Break 12:10 – 12:55

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- Discuss response to Redwood Coast Airport tariff approach and CMET and potential opportunities and challenges related to tariff standardization (SDG&E)

V. Microgrid Standards 1:30 – 2:00

- Present currently developing microgrid standards (UL)

**Q&A and Discussions after each set of presentations*

Update on RMWG Scope and Issue Prioritization

Patrick Saxton, CPUC

Priorities Identified in RMWG Charter

- Tariffs or procurement approaches for multi-property microgrids (Types III/IV), including but not limited to rates, rules, standard contracts, agreements, and cost allocation
- PUC 218-compliant approaches for multi-property microgrids
- Value of resiliency, including but not limited to metrics or frameworks for value discovery

DRAFT Scope of the Resiliency and Microgrids Working Group FAQ

- Sent to the service list on October 29, 2020.
- Will be posted on https://www.cpuc.ca.gov/resiliencyandmicrogrids/.
- Staff prepared document to:
  - Help tailor focus of the RMWG to improve its efficacy.
  - Avoid duplication or inconsistency with other CPUC proceedings.
  - Avoid topics already subject to formal comments, unless otherwise directed by a ruling or decision.
  - Avoid relitigation of previously resolved issues formally adopted by CPUC.
- Does not predetermine the scope of Track 3.

DRAFT Scope of the Resiliency and Microgrids Working Group FAQ

- General Principles.
- Issue-Specific Guidance.
- DER Proceeding Directory: Where to Litigate Specific Issues.
- Proceedings that Intersect with R.19-09-009.
- Recurring Themes in R.19-09-009 and Response from Staff.

DRAFT Scope of the Resiliency and Microgrids Working Group FAQ – General Principles

1. Proper forum for issues explicitly in scope of another CPUC proceeding is that proceeding, not R.19-09-009.
2. Issues subject to previous decision in another CPUC proceeding are generally out of scope for R.19-09-009 and the RMWG.
3. Issues in scope of R.19-09-009 but subject to either D.20-06-017 (Track 1 decision) or already the subject of comments are generally out of scope for the RMWG unless otherwise directed by a ruling or decision.
4. The CAISO's stakeholder process is the proper forum for issues explicitly in the CAISO's jurisdiction.

DRAFT Scope of the Resiliency and Microgrids Working Group FAQ – Issue-Specific Guidance

1. The RMWG is an appropriate forum for discussion of a tariff specific to microgrids, including rate schedules, rules, and agreements.
2. Staff proposes the RMWG focus on tariff issues for multi-property in-front-of-meter microgrids (Type III/IV) because there is a significant gap in the existing regulatory scheme for these resource types.
3. Issues related to single-property behind-the-meter (BTM) resources (Type I/II) are generally not in the scope of the RMWG.
4. Parties who propose focusing on BTM microgrids should specifically identify issues they believe prevent deployment of BTM microgrids and that are not being considered in other CPUC proceedings.
    - Staff anticipates seeking informal comments on such gaps once Track 2 of the R.19-09-009 concludes.

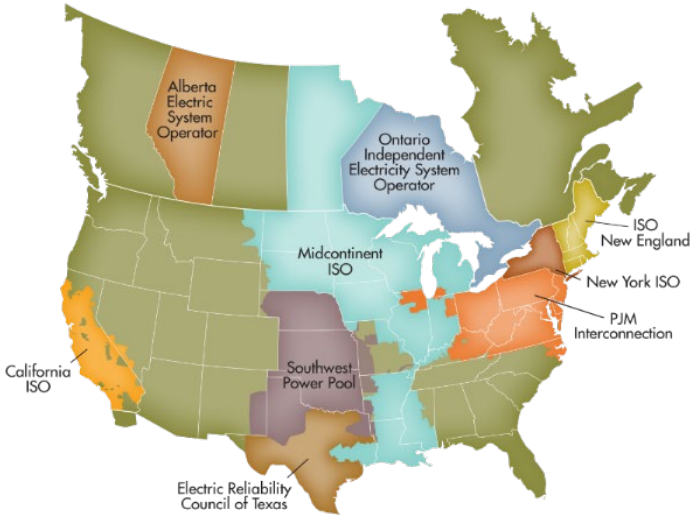
Introduction to CAISO Interconnection Processes

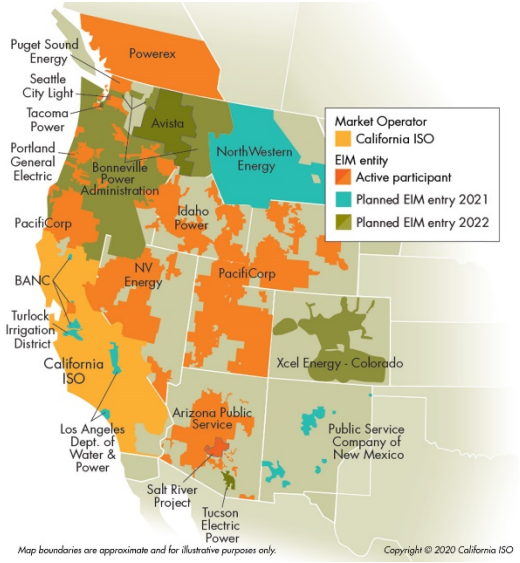
Delphine Hou
Director, California Regulatory Affairs

Presented to CPUC Resiliency and Microgrids Working Group
November 4, 2020

The California ISO: one of nine grid operators in North America

- **Nonprofit** public benefit corporation
  - **Created** by CA statute
  - **Regulated** by the Federal Energy Regulatory Commission
- **One of 38** balancing authorities in the western interconnection
  - **Serving 30 million people in** 80% of CA & small portion of NV





- **Western Energy Imbalance Market (EIM)** launched in 2014
  - **Market** for serving real-time consumer demand with low-cost energy
  - **Integration** of renewables across a larger geographical area
  - **Reduces** costs through automatic economic dispatch

Key functions of the CAISO

- Uses advanced technology to balance supply and demand every 4 seconds
- Operates markets for wholesale electricity and operating reserves
  - Day-ahead
  - Real-time
    - Fifteen minute
    - Five minute
- Conducts transmission planning to identify expansion needs and new generator interconnections
  - CAISO provides open and non-discriminatory access to the transmission grid and wholesale power market for all resource types

CAISO is technology neutral and focuses on services and capabilities for the wholesale markets

- Three major categories:
  - Reduces load only
    - Examples include: “traditional” load drop, various demand response programs, storage-backed demand response
  - Generates only
    - Examples include: generation connected at the transmission and distribution level
  - Reduces load and generates
    - Examples include: storage resources, aggregation of distributed energy resources

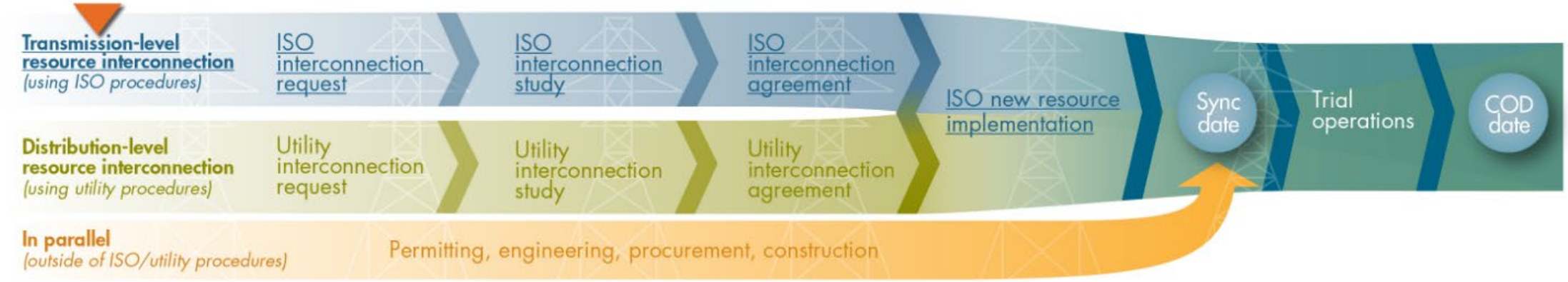
Interconnection processes at the CAISO by capability

- Reduces load only

Less complicated

- Generates only
- Reduces load and generates

More complicated



See: http://www.caiso.com/participate/Pages/ResourceInterconnectionGuide/default.aspx

Wholesale market responsibilities

- Participation in the wholesale market has costs and responsibilities and compensation is at the wholesale market prices
  - See: http://www.caiso.com/TodaysOutlook/Pages/prices.html
- To participate in the CAISO markets, must be a certified scheduling coordinator (SC), or retain the services of a certified SC. SCs are entities that bid or self-schedule resources into the market.
- Resource responds to wholesale market signals and dispatch

Grid Architecture: Avoid Tier Bypass in Energy Service Supply Chain

- **Primacy?**
- **Incrementality?**
- **Capacity Value?**
- **Double Counting?**

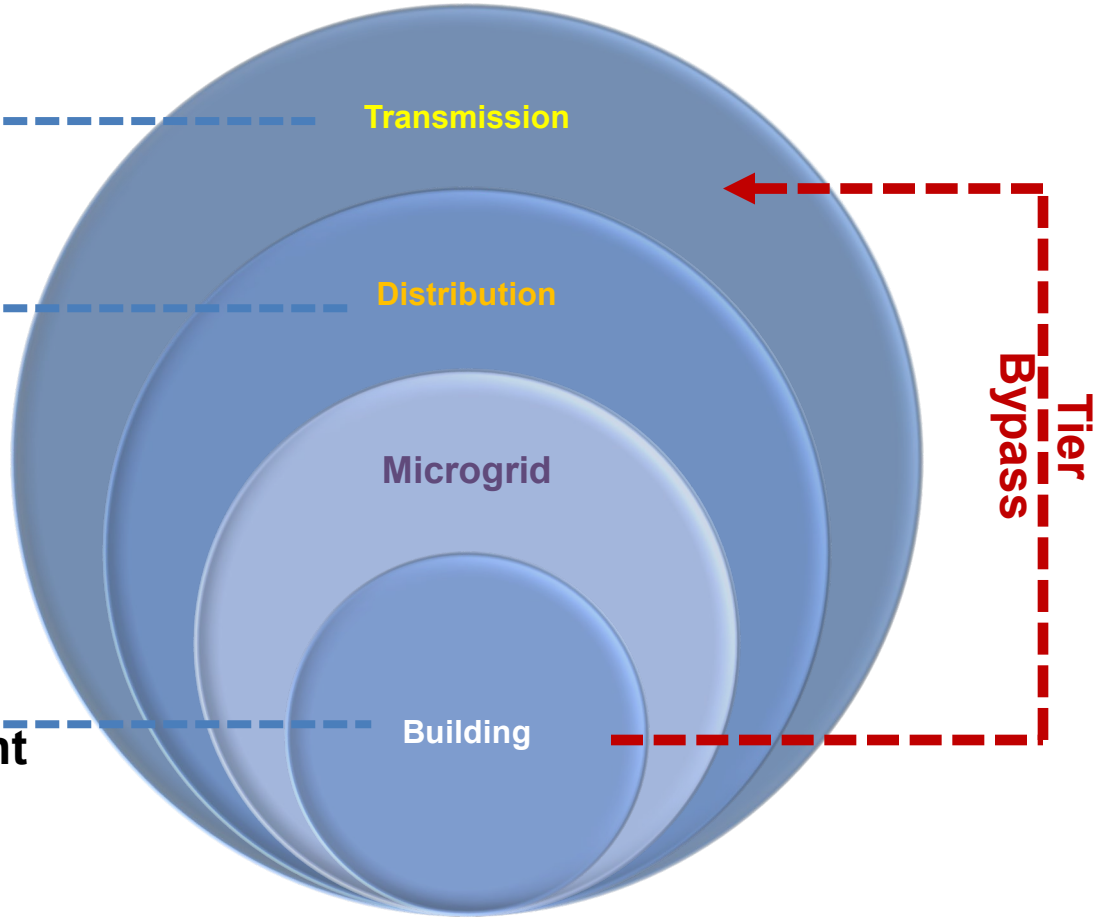
Behind the Meter Battery

(Limited MWh)

Energy Services

Asset Deferral

Demand Management



APPENDIX: DISTRIBUTED ENERGY RESOURCES AND THE CAISO MARKETS

Participation models for DERs to participate in the CAISO's markets

Models

Proxy Demand Resource (demand response)

- Enables dispatchable load curtailment to participate in the wholesale market
- Aggregate multiple end-use customers into single DR resources >100 kW
- Provide energy and ancillary services
- Investigating load shift/consumption capability under PDR

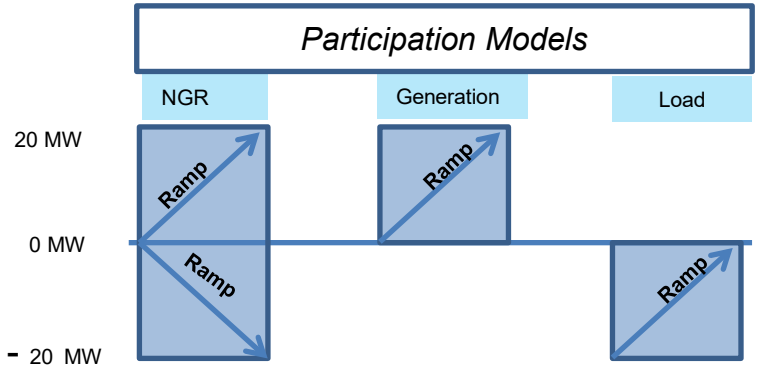
Non Generator Resource (storage devices including DERs)

- Designed for resources that vary between consuming & producing energy
- Sophisticated modeling available- state of charge optimization, energy limits

DER Provider (aggregated DER)

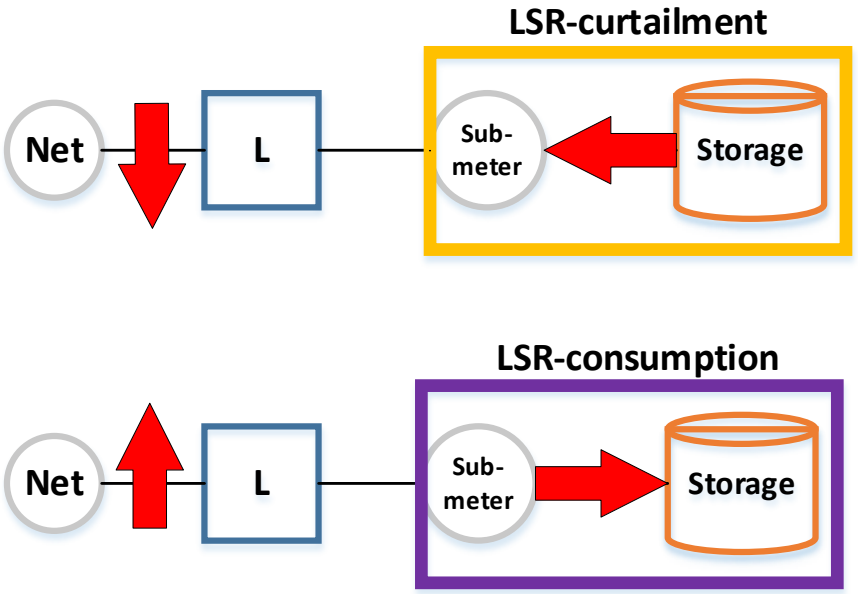
- Aggregate all types of DER for ISO market participation
- In front of and behind the meter
- Resource size: min 500 kW and max 20 MW in aggregate
- Individual sub-resources less than 1 MW in size

Future electricity markets must be technology agnostic and accommodate new and diverse providers

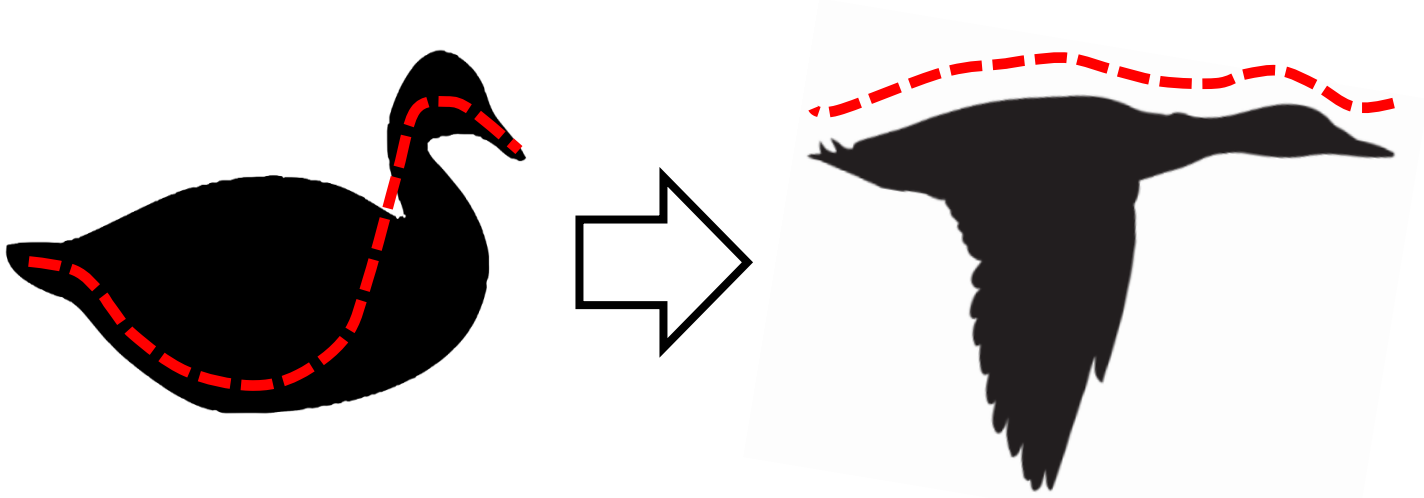


Most recently, the CAISO developed the Load Shift Resource for behind the meter battery storage devices

- The Load Shift Resource (LSR) allows a behind the meter battery to not only discharge (load curtailment) but charge (load consumption) during negative price intervals.



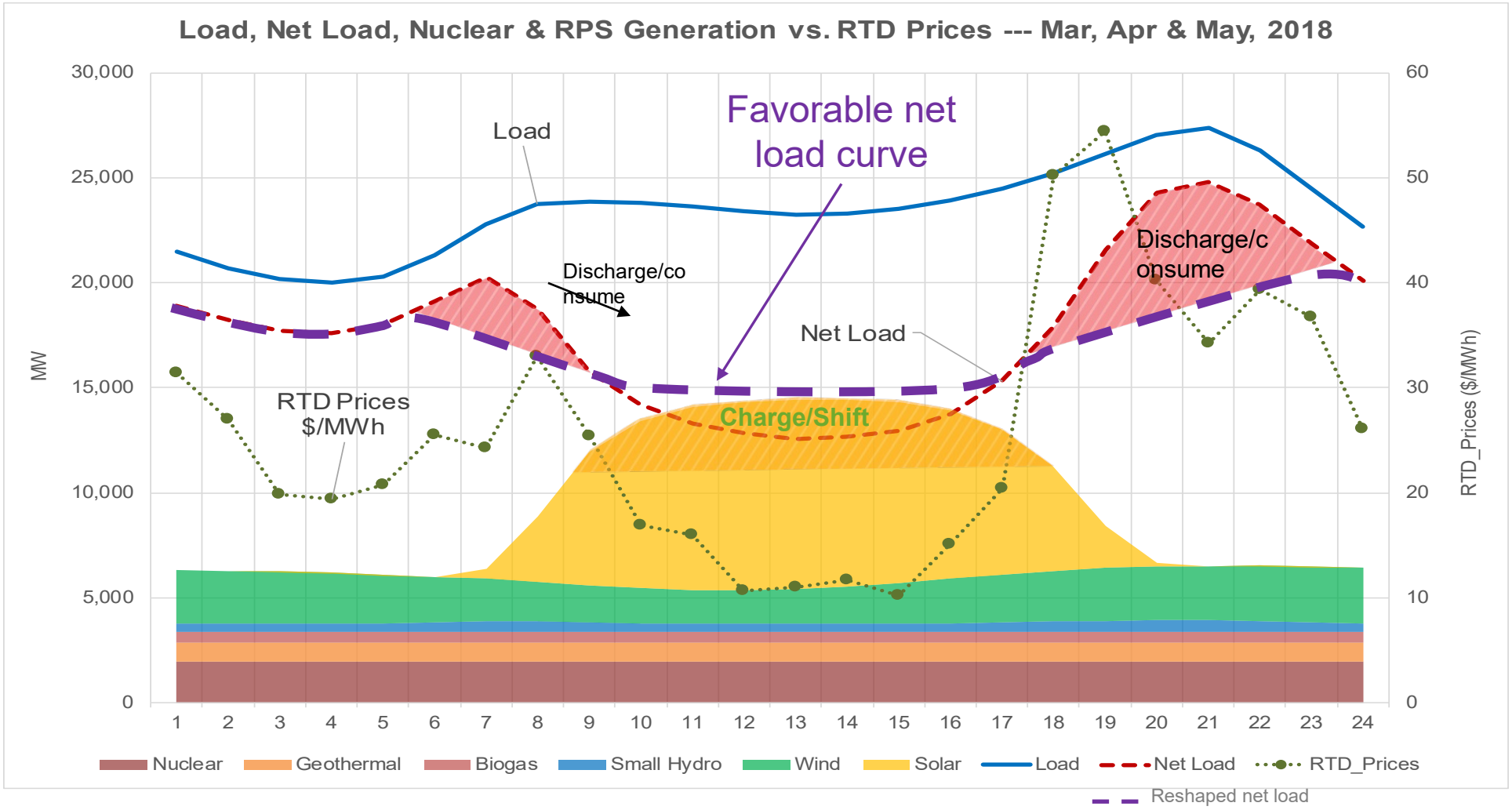
How are we going to ensure our energy future is resilient, sustainable and efficient?



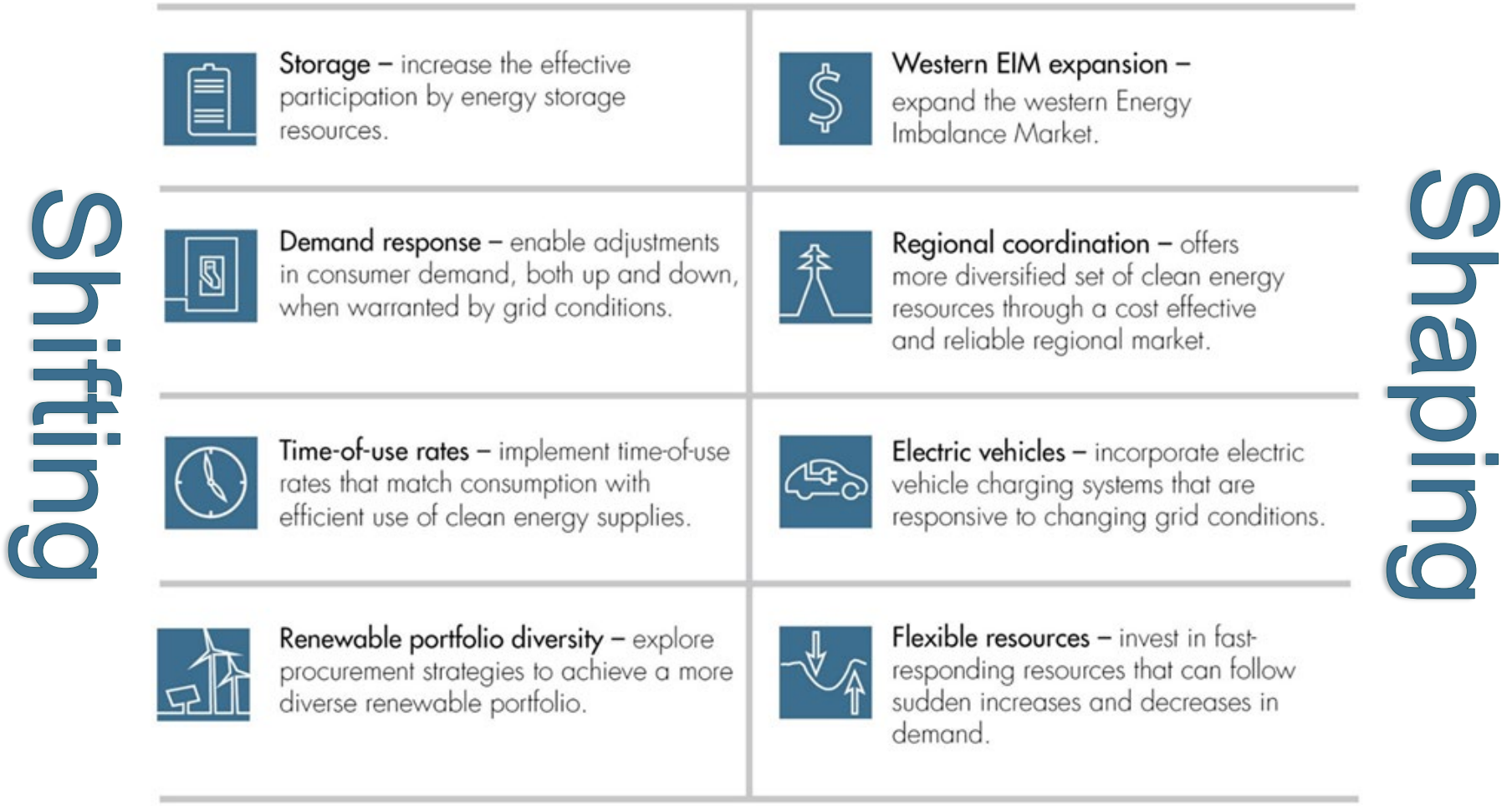
We must make the duck fly!

A healthy grid must counter-act the ill-affects of the sitting “duck curve”

Must leverage all capabilities across the grid to achieve a more favorable/flatter net load profile



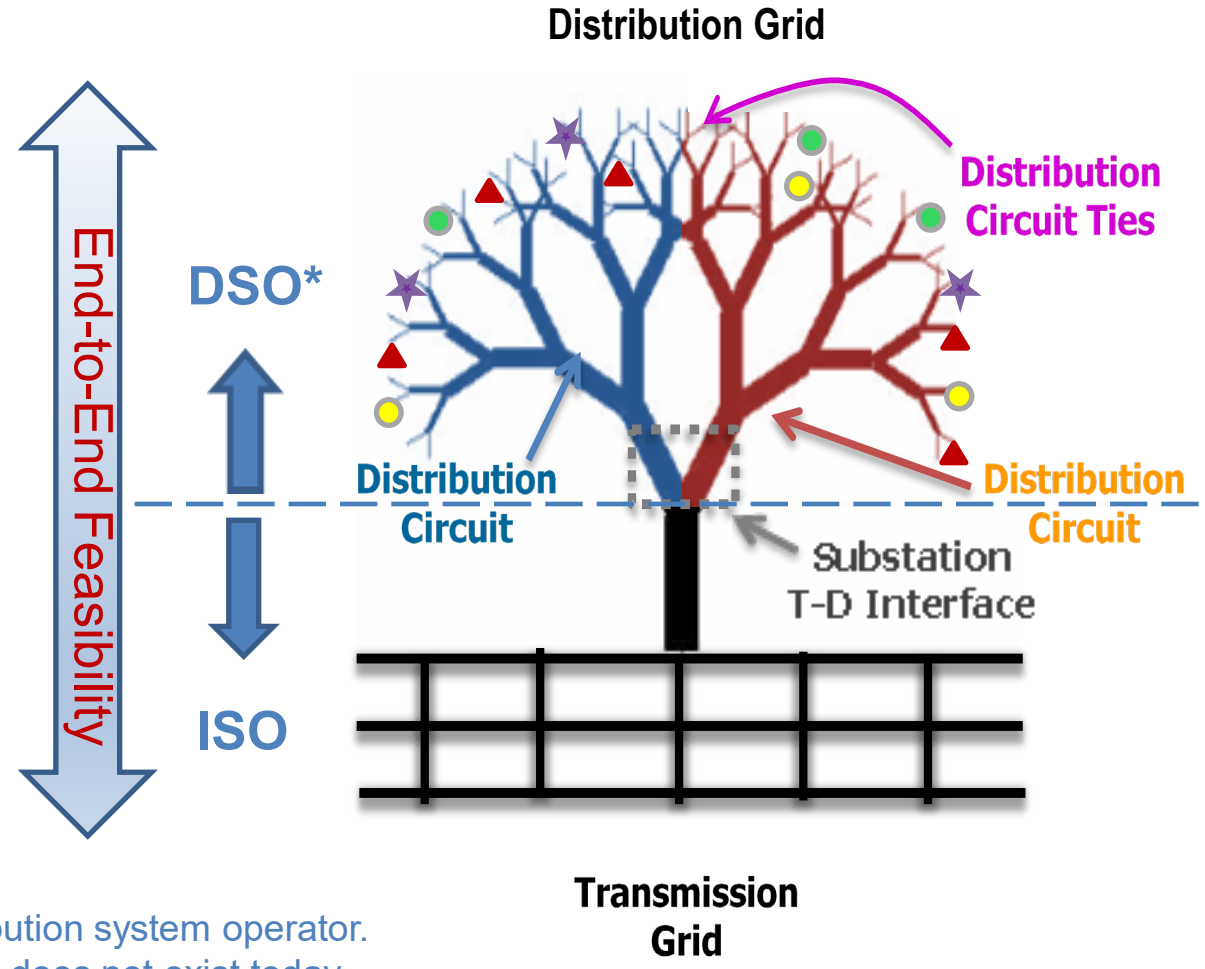
What actions must we take to create a more favorable load shape and an operationally sustainable grid?



Industry-wide collaboration is required to help the duck fly so we can achieve a cost-effective, low carbon grid

Wholesale	Retail	Legal/Regulatory
Technology agnostic market participation models that allow large, small, and aggregate resources to participate	Grid informed time-variant and dynamic rates (TOU, RTP)	Electrification goals and mandates designed to create a sustainable and efficient grid
Market structures that reward flexibility and minimize uncertainty	Critical peak and critical consumption pricing periods	Grid harmonized building codes and appliance standards
Regional markets that leverage diversity and generate operational efficiencies	Load management programs that reward favorably shifting and shaping energy use	Retail markets, structures that create resiliency, grid-informed price signals, and low-friction energy exchange

Rapid DER deployment is spurring a decentralized system calling for enhanced coordination at the Transmission & Distribution interface.



Top Down?

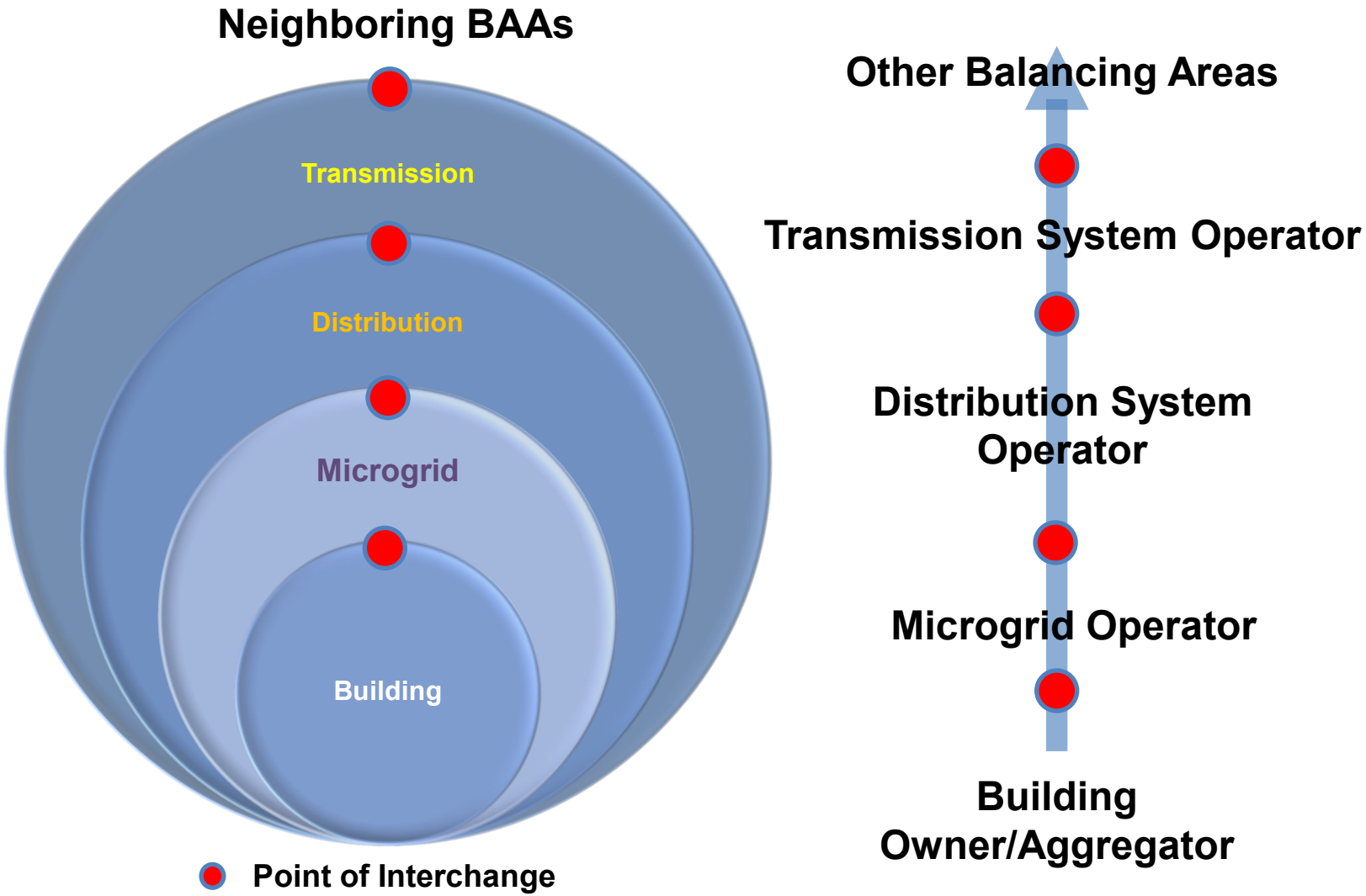
Bottom Up?

DSO* - Distribution system operator.
This construct does not exist today.

Grid Architecture: Layered Grid Interoperability Model

Bottom-up Approach

- **Transact for net sales or purchases**
- **Manage volatility**
- **Deep situational awareness and control not required**
- **Layered control structure reduces complexity, allows scalability, and increases resiliency & security**
- **No tier bypass**



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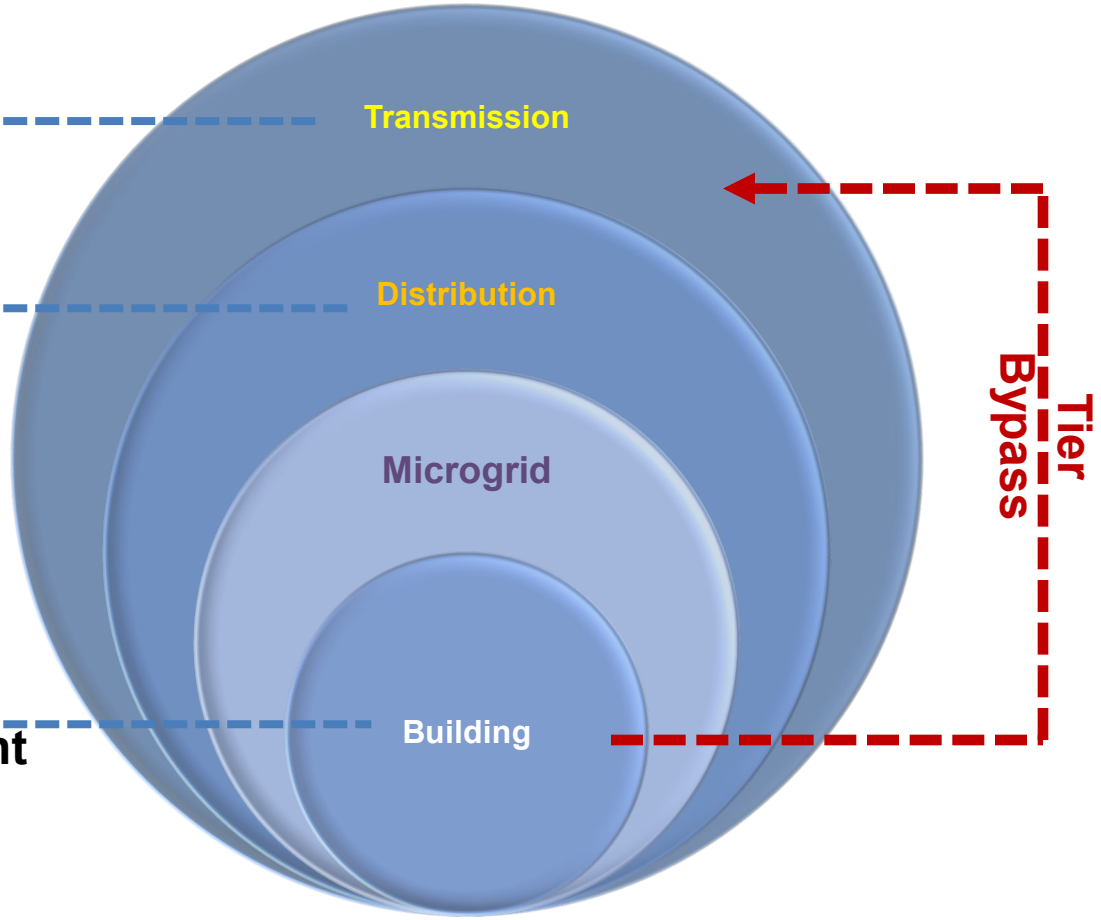

Discussion and Q&A

WebEx Tip

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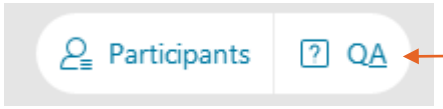

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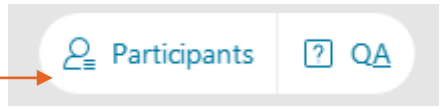

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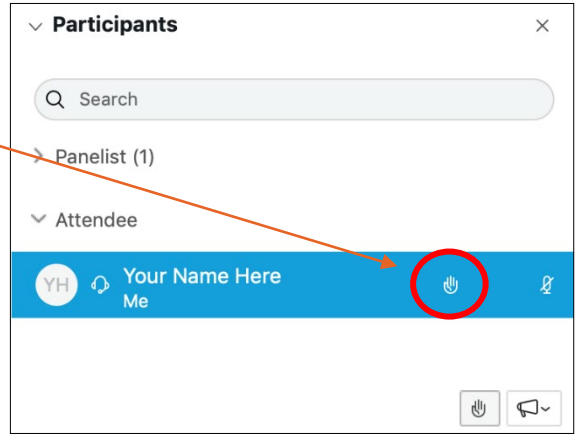

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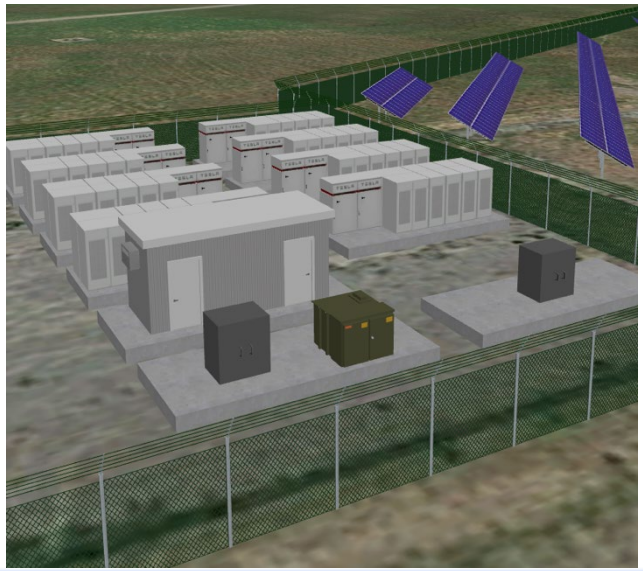
**Q&A and Discussions after each set of presentations*

Redwood Coast Airport Renewable Energy Microgrid

Microgrid Tariff Work and Lessons Learned

CPUC Resiliency & Microgrid Working Group Meeting
November 4, 2020

Jim Zoellick, Principal Engineer
Schatz Energy Research Center, Humboldt State University

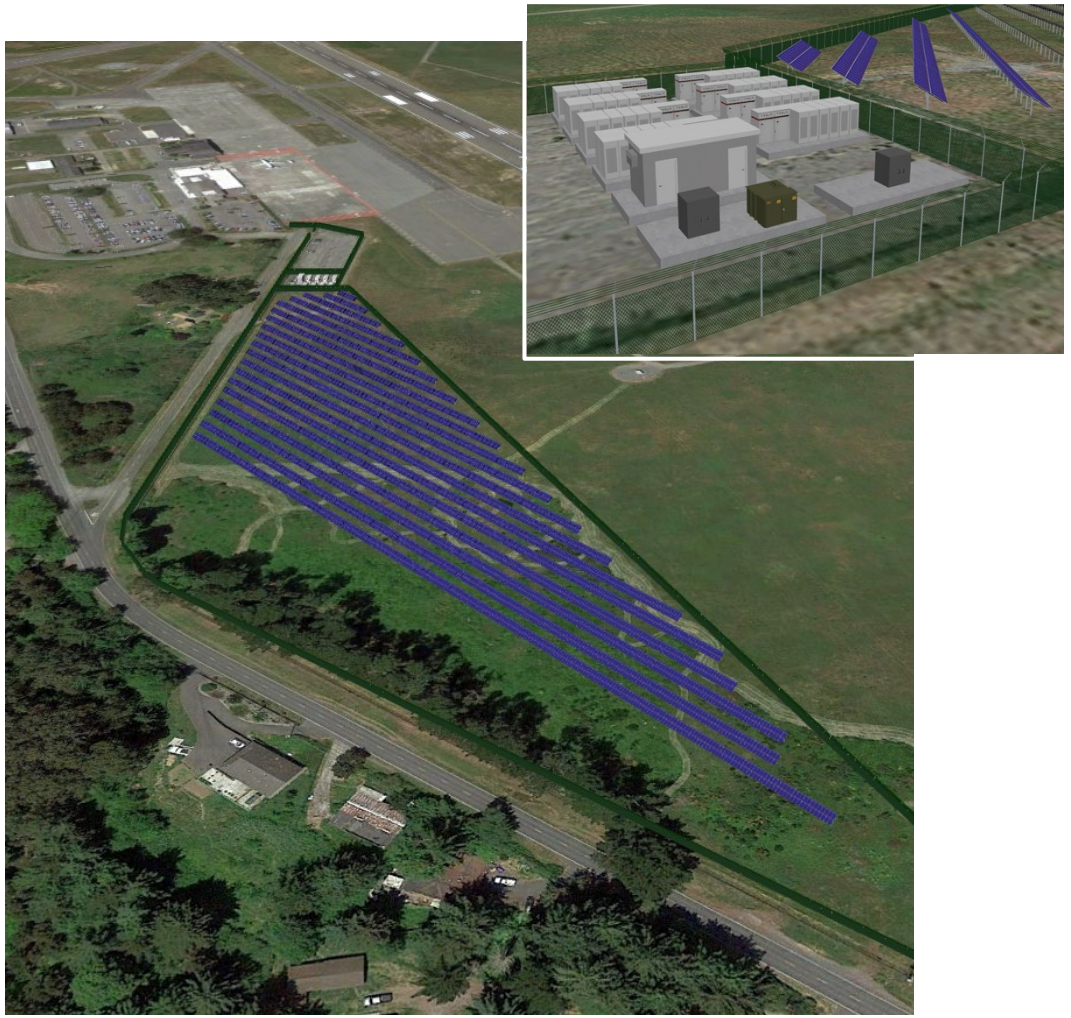


Operating microgrids in Humboldt County

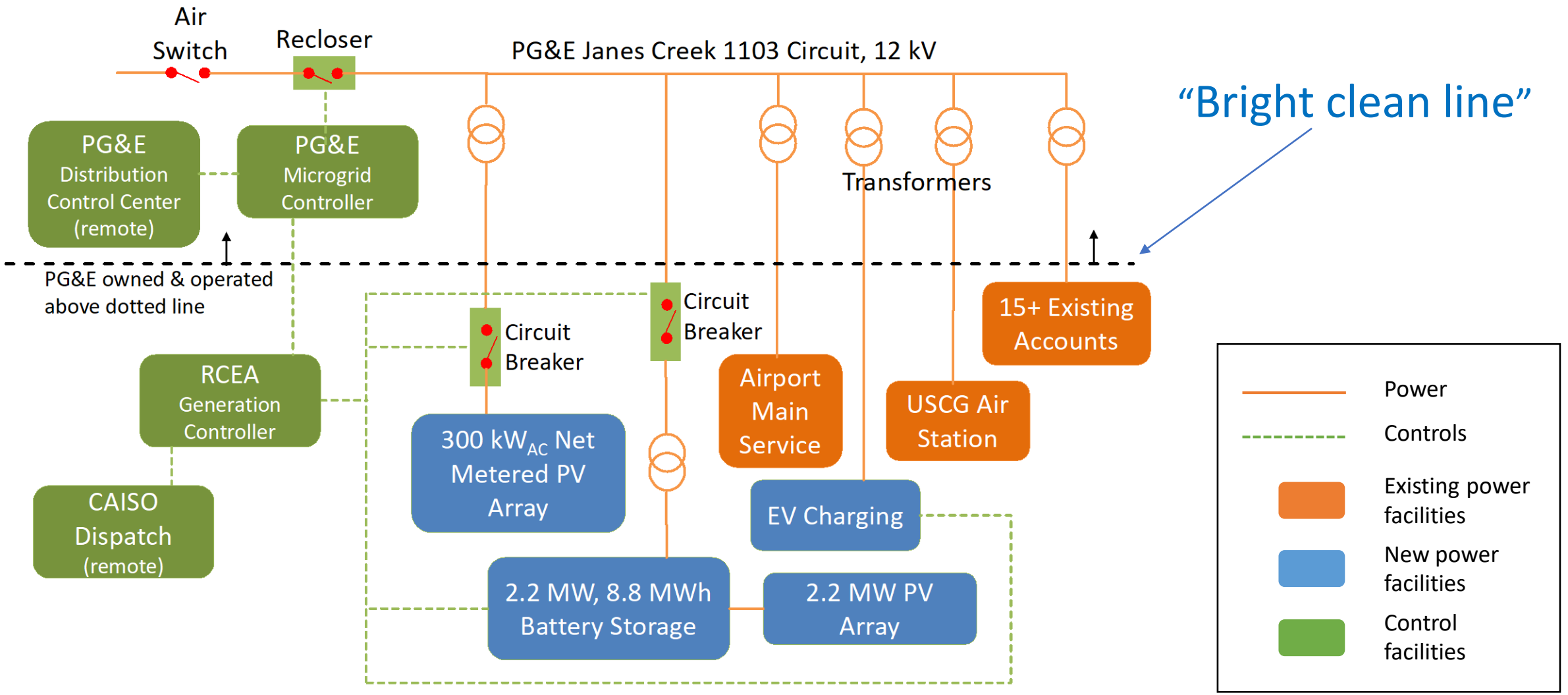
- Two BTM microgrids at the Blue Lake Rancheria
  - One single facility MG
  - One multi-facility MG w/ multiple meters reconfigured as a single primary voltage service
- Both Rule 21 interconnections, NEM2 tariff
- No new tariffs were necessary

Redwood Coast Airport Microgrid (RCAM)

- First front-of-meter, multi-customer microgrid on the PG&E (DSO) system; 100% renewable
- RCEA (CCA), owns & operates generation
  - CCA controls generation in blue-sky mode
  - DSO dictates islanded operation
- 2.2 MW PV array DC-coupled to 2.2 MW/8.8 MWh battery storage
  - Blue-sky: CAISO market participation
  - Island mode: grid-forming generator
- 300 kW_{AC} net-metered PV array
  - Reduces airport electric bills



Redwood Coast Airport Microgrid



RCAM Tariff Work Context

Challenge: Need mechanism to allow a 3rd party owned generator to form a portion of the DSO's grid

RCAM tariff work:

- Covers community microgrids (FTM, multi-customer)
- Covers compensation and cost allocation
- Defines operational roles and responsibilities for multiple entities
- Develops necessary agreements for the RCAM project, with options for replicability

RCAM Tariff Work Context

Guiding Principles:

- Distribution system upgrade costs required for islanding would not be socialized.
- Grid related benefits provided by the DERs/microgrid would be compensated at fair market value.
- Microgrid tariff will not replace or duplicate existing tariffs.

The RCAM tariff work and associated learnings have informed the development of PG&E's Community Microgrid Enablement Program & the pro forma Community Microgrid Enablement Tariff and Microgrid Operating Agreement.

Source: US Coast Guard

RCAM Tariff Work Evolution

Since first publicly discussing RCAM tariffs at a December 2019 CPUC SB 1339 workshop, the project team's approach has evolved.

- **MG Infrastructure Cost Recovery Tariff** → Covered by Rule 2 Special Facilities Agreement
- **Islanded Energy Tariff** → Not necessary, always in CAISO market
- **Islanded Grid Services Tariff** → Very few islanding hours results in minimal compensation with high transaction costs. Alternative: PG&E to offer upfront incentive to reduce first cost.
- **Operational Roles and Responsibilities** → In process, key element of the RCAM Microgrid Operating Agreement

RCAM Microgrid Operating Agreement

The RCAM Microgrid Operating Agreement will serve as the umbrella document. Key Elements of the RCAM MOA will include:

- Operational Roles and Responsibilities
  - Modes of Operation
  - Operational Coordination (communications, operating procedures and protocols, planned maintenance, emergency response, etc.)
- Interconnection Agreements
- Special Facilities Agreements
- Project Safety Plan
- Commissioning Plan
- Performance Requirements & Testing
- Confidentiality and Data Security, Non-Disclosure Agreements

RCAM Microgrid Operating Agreement

- Utilization of existing tariffs and processes
  - WDAT and Rule 21 NEM2 tariffs
  - Rule 2 Special Facilities Agreement (to cover distribution upgrades required for islanding)
  - Standard interconnection process → System Impact Study, Facilities Study
- Operational Roles and Responsibilities

Microgrid Islanding Study

Technical Design Specs
- CONOPs
- Controls and comms equipment
- Cybersecurity
- Protection
- "Bright clean line"

On-going Operations
- Communications & notifications
- Responsibility & authority
- Access permissions
- Maintenance, testing, safety
- Settlement

Operational Procedures & Protocols

Questions?

Email: jimz@humboldt.edu

Additional Informational Resources:

- CPUC Microgrid Workshop 1, Dec. 12, 2019 https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/Infrastructure/Resiliency_Microgrids/11_2022_Beyond_Redwood%20Coast%20Airport%20Microgrid.pdf
- Clean Coalition Webinar, https://clean-coalition.org/news/webinar-redwood-coast-airport-microgrid-sep-2020/

Glossary

- Blue-sky mode = parallel operation with the bulk grid
- BTM = behind-the-meter
- CAISO = California Independent System Operator
- CCA = Community Choice Aggregator
- CONOPs = concept of operations document
- CPUC = California Public Utilities Commission
- DER = distributed energy resource
- DSO = distribution system operator
- FTM = front-of-the-meter
- Island mode = disconnected from the bulk grid
- MG = microgrid
- MOA = microgrid operating agreement
- NEM2 = the 2nd phase of the net energy metering tariff
- RCAM = Redwood Coast Airport Microgrid
- RCEA = Redwood Coast Energy Authority
- Rule 21 = interconnection tariff for generation and storage facilities connected to the distribution system as net metered or non-export facilities
- WDAT = wholesale distribution access tariff

Source: TrinidadMike

Paving the Way: Lessons Learned and Best Practices for Community Microgrid Tariff Development

Resiliency and Microgrids Working Group

November 4, 2020

Multi-user/Community Microgrid Tariff Development

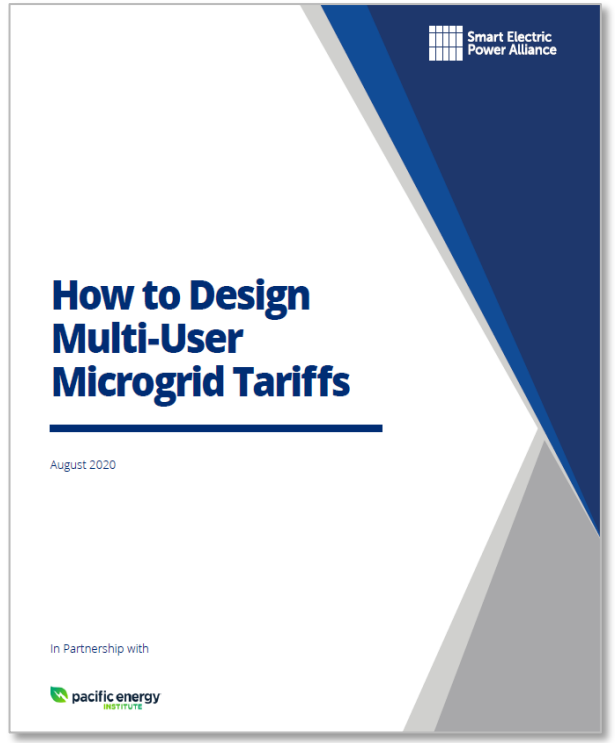
Community Microgrids are at a very early stage of commercial development & involve complex engineering, operational, commercial & regulatory considerations

- Leveraged insights from early community microgrid tariff & enabling program developments across the US, including work by the entities to the right
- Leveraged insights from RCAM – one of the first joint operational community microgrids in the US
- Engaged consultant that supported development of Hawaii's draft microgrid tariff & interconnection rule changes

Multi-user/Community Microgrid Tariff Development

What is the purpose & scope of the community microgrid tariff?

- Tariff Structure and Eligibility
- Microgrid Energy Producing Resource Requirements
- Microgrid Interconnection and Islanding Capabilities
- Blue Sky Microgrid Services & Applicable Tariffs/Rules
- Utility Provided Services
- Microgrid Development (Construction & Testing)
- Microgrid Islanded Operational Structure & Procedures
- Future Material Changes



https://sepapower.org/resource/how-to-design-multi-user-microgrid-tariffs/

Simplify Whenever Possible

Microgrid Tariff and Operating Agreement Development Principles

- **Safety and cybersecurity are first priority**
  - Do not compromise them under any circumstance
- **Remember what the tariff is intended to address**
  - The islanding component and implications is the missing piece
- **Do not recreate the wheel**
  - Leverage existing frameworks or processes where it makes sense
- **Remember that the tariff is one piece of a much larger microgrid puzzle**
  - The microgrid tariff must mesh with all other relevant pieces
- **Clear division of ownership, roles and responsibilities**
  - Without it things get messy really quickly
- **After accounting for all those constraints, ensure the end-product is user friendly**
  - Do not overcomplicate the tariff and allow sufficient flexibility via an operating agreement

Tackling the Complex Technical, Safety, Security and Operational Challenges of a Community Microgrid

PG&E's experience with RCAM directly informed how we addressed each of these challenges:

INTERCONNECTION AND SERVICE PLANNING PROCESSES

Existing DER interconnection processes are both functional and codified. Need only to address islanding gap.

DESIGN AND PROTECTION

Need study to determine islanded design and protections to maintain safety and power quality

OPERATIONS INTEGRATION

Must clearly define, enable and integrate the full range of operational conditions and contingencies

MICROGRID TESTING

Testing islanding operations is complex. Must allot time and resources. Pre-testing and standardization will lower study costs and timelines.

COMMS/CYBERSECURITY

Must maintain visibility and control for DCC, while limiting cyber threats

Community Microgrid Enablement Tariff Overview

Resiliency and Microgrids Working Group

November 4, 2020

The Community Microgrid Enablement Program: Enabling Community Resilience and Customer Choice

CMEP Objective: To **enable and partner** with communities in their resilience efforts by supporting community-driven resilience for critical facilities and vulnerable customer groups.

Inquiry Intake Funnel

- Enhanced Tools & Information
- Enhanced Utility Technical Support
- Multi-customer Microgrid Cost Offsets
- Multi-customer Microgrid Tariffs

Some elements of this may support behind-the-meter (BTM) as well as front-of-the-meter (FTM) microgrids

Specifically intended to support FTM, multi-customer microgrids

Community Microgrid Enablement Tariff Overview

Tariff Section	Key Points
Applicability • Governs eligibility, engineering studies, development, and islanded and transitional operation of Community Microgrids	• **Section Purpose:** Why does this tariff exist?
Eligibility Criteria • Critical Facilities located in Tier 2 or Tier 3 High Fire Threat District, PSPS impacted, or prone to outage • Up to 20MW in aggregate capacity • Distribution level • Project resources interconnected pursuant to WDT and/or Electric Rule 21 • Demonstrated community interest	• **Section Purpose:** Define what types of projects and parties qualify • **Key Takeaway:** CMET eligibility is narrowly tailored to CMEP enablement • **Key Implication:** CMET could be generalized by relaxing some of these criteria

Community Microgrid Enablement Tariff Overview

Tariff Section	Key Points
CMET Period – How long will this tariff be available? • Applications must be submitted by December 31, 2022 • Aligns with current CMEP funding cycle	• **Purpose:** Define how long the tariff will be available • **Key Takeaway:** Commission authorization required to extend program and tariff • **Key Implication:** Reauthorization provides logical opportunity to modify program and/or tariff
Interconnection Studies – How do the project resources interconnect to the system? • Project resources must complete an interconnection study under either WDT or Rule 21 • Interconnection process for project resources unchanged • Decision Point: Applicant determines whether to move into the Microgrid Islanding Study Phase	• **Purpose:** Define how project resources interconnect • **Key Takeaway:** Interconnection process for DERs unchanged • **Key Decision Point:** Applicant determines whether to move into the Microgrid Islanding Study Phase

Community Microgrid Enablement Tariff Overview

Tariff Section	Key Points
Microgrid Islanding Study (MIS) The MIS covers: • Engineering and operational viability • Protection requirements to ensure faults within the microgrid can be detected when islanded • Controls requirements to ensure power quality • Telemetry and cybersecurity requirements • Required electrical system upgrades (Special Facilities)	• **Purpose:** Determine whether the microgrid can safely island and what is required to do so • **Key Takeaway:** Determines estimated costs and scheduled completion date for special facilities • **Decision Point:** Upon study completion the Applicant determines whether to proceed with MOA
Community Microgrid Development and Operation Roles and Responsibilities • PG&E provides distribution service • Community Microgrid Aggregator coordinates islanded DERs within identified parameters Microgrid Operating Agreement (MOA) • Governs development, testing, and commercial operation	• **Purpose:** Define processes, roles, and responsibilities for building and operating the microgrid • **Key Takeaway:** Successful negotiation and execution required to move forward with the project • **Decision Point:** Following MOA negotiation the Applicant determines whether to proceed with project development

Community Microgrid Enablement Tariff Overview

Tariff Section	Key Points
CMET Services and Fees • Applicant is responsible for study and project development costs • Projects that meet CMEP eligibility criteria are eligible for cost offsets	• **Purpose:** Determine cost responsibility for utility incurred project development costs • **Key Takeaway:** Maintains well-established Special Facilities cost responsibility with CMEP program overlay
PG&E Tariffs, Programs and Service Agreements • End use customers are unaffected • All other applicable blue sky mode tariffs remain in effect • Project resources may still participate in other PPAs or programs to the extent they do not impede islanding • When islanded, project resources continue to be compensated as under blue sky (i.e., CAISO market settlement or NEM)	• **Purpose:** Determine how CMET relates to other applicable tariffs • **Key Takeaway:** Leverages and enables existing Commission policies, frameworks, approved tariffs and programs. • **Key Implication:** Promoting the Utility-Community Partnership: facilitating use of the utility grid for community-driven resilience projects

Benchmarking Against ED RMWG Framework

Sound Economic Principles

- ✓ **Adheres to Prior Commission Findings**
  - "Tariffs currently in place were found to be just and reasonable by the CPUC. By definition, they were found to reflect CPUC's best judgment. They balance various policy goals and responsibilities." – ED RMWG Kickoff Presentation (October 13, 2020)
- ✓ **Determine how a utility recovers its costs and set the rate or price for utility services**
- ✓ **Enable state policy goals and incorporate ratemaking principles**
  - No undue constraints on project resource participation in programs, market, bilateral contracts
  - Maintains just and reasonable rates
  - Avoids cross-subsidization
  - Provide equitable service, provide universal access, avoid discriminatory practices

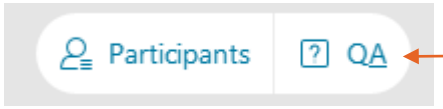
Necessary Tasks

- ✓ **Define technical & operational requirements for safety & reliability**
  - Microgrid controller technical requirements, specifications, and certification
  - Microgrid transitional requirements
- ✓ **Define roles and responsibilities for the business transactions**

Discussion and Q&A

WebEx Tip

Option 1:



Access the written Q&A panel here

Option 2:

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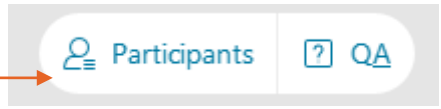

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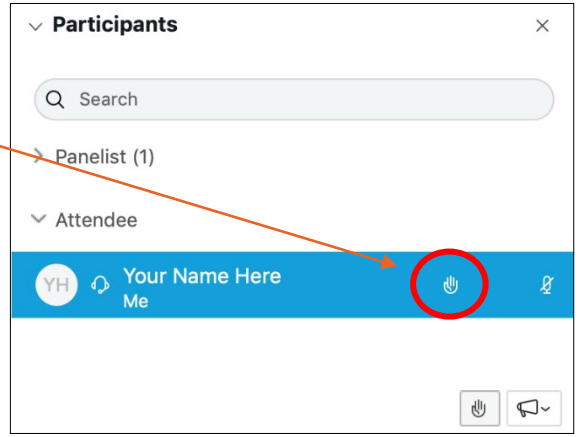


LUNCH

We will resume at 12:55PM.

Agenda

I. Introductions 10:00 – 10:10

- Review WebEx logistics
- Review agenda

II. Update on RMWG Scope and Issue Prioritization 10:10 – 10:50

- Clarify rationale for scope and issue prioritization (CPUC)
- Provide overview of DER participation opportunities in wholesale markets (CAISO)

III. Multi-Property Tariff Development 10:50 – 12:10

- Update on the Redwood Coast Airport Microgrid tariffs development update (Schatz)
- Present overview of Community Microgrid Enablement Tariff's (CMET) goals and challenges (PG&E)

Lunch Break 12:10 – 12:55

IV. Multi-Property Tariff Development cont. 12:55 – 1:30

- Discuss response to Redwood Coast Airport tariff approach and CMET and opportunities and challenges related to tariff standardization (SCE)
- Discuss response to Redwood Coast Airport tariff approach and CMET and potential opportunities and challenges related to tariff standardization (SDG&E)

V. Microgrid Standards 1:30 – 2:00

- Present currently developing microgrid standards (UL)

**Q&A and Discussions after each set of presentations*

PG&E's Community Microgrid Enablement Tariff (CMET)

CPUC Resiliency and Microgrids Working Group Meeting

November 11, 2020

The CMET concept seems feasible, but the details need to be worked out.

The CMET concept appears to address many of the key issues because it enables community microgrids while maintaining utility ownership and operational control of the distribution system such that the utility can continue ensuring safety and reliability.

However, the CMET concept is novel and complex and has not yet been proven through a full implementation; more work is required to determine if it is truly feasible.

- Fully understand interactions with Rule 2, Rule 21, and WDAT.
- Consult CAISO to identify any FERC jurisdictional issues with islanded operations.
- Build the capabilities necessary to conduct Microgrid Islanding Studies.
- Develop operational requirements for project resources to ensure customers are receiving quality service during islanded mode.
- Enable customer choice to participate (or not) and safeguard customers in cases where material modifications trigger unforeseen costs and/or cancelation of the microgrid.

Perspective on Community Microgrid Tariffs

Resiliency & Microgrids Working Group

November 4, 2020

Key Elements of Microgrid Policy

Customer protection is the paramount concern

Safety

- Existing laws were established to protect customers, workers, and the public: Public Utilities Code §§ 216, 218, 394, etc.
- Requests to circumvent regulation may put customers at risk

Reliability

- Need to distinguish microgrids as a resiliency tool vs. microgrids as a business model
- Maintenance of infrastructure is a key component

Sustainability

- Prevent cost shifts: exemption from cost responsibility or expansion of NEM cross-subsidy
- Requests to bypass jurisdiction do not create a sustainable policy

Necessity

- SB 1339 defers to the CPUC's regulatory expertise to "…develop…rates and tariffs, ***as necessary***"
- Existing tariffs allow for microgrids as a resiliency tool (Rules 18/19 and 21)

State laws and regulations protect customers and the general public regarding energy services to and from the grid.

Bypassing such statutory and regulatory measures introduces safety, reliability, and financial risks.

Critical Tariff Considerations

Utility Control and Operation

- Utility to maintain constant control of the operation and use of its infrastructure.
- Utility to have the ability to isolate, and manage distribution power flows, frequency, and voltage at safe and reliable levels including during islanding.

Cost Equity

- No exemptions from cost-responsibility surcharges.

Microgrid Operating Agreement (MOA)

- Tariff provides for an MOA that allows utility visibility to resources for both planned and unplanned islanding.
- MOA must define terms and conditions, roles and responsibilities, performance requirements, and liability.
- Need to clarify maintenance requirements and termination provisions.

The complicated configuration of a microgrid requires detailed planning, testing, and clear roles and responsibilities of all loads and resources involved.

Critical Tariff Considerations – *continued*

Microgrid Study

- Study initiated through request process needs to be developed and proven viable to ensure safe and reliable operation. Would identify required upgrades and device settings.
- Modifications, including changes in loads and generation, triggers re-study.
- Testing and performance requirements met and demonstrated prior to operation.

System Protection

- System protection settings meet minimum operating standards.
- Need to ensure end-to-end communication and performance requirements.
- Low-inertia environments must ensure stability of the microgrid including potential equipment additions.

Other

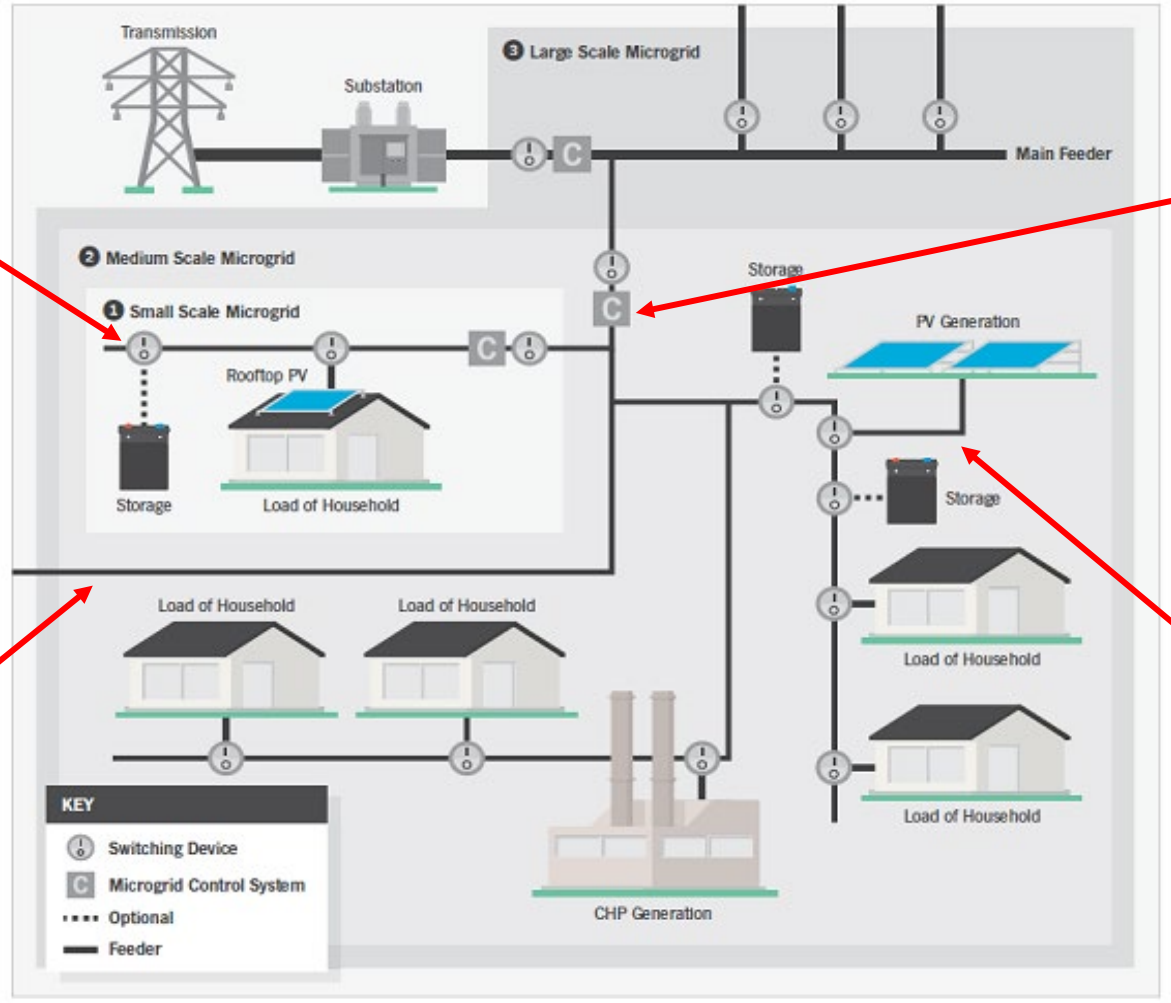
- Mixed ownership and operation could create potential for constraints associated with liability.
- Confirm interactions between Rule 21 and WDAT.
- No violation of or infringement upon PU Codes and FERC jurisdiction.
- Customers should have the ability to opt-out.

The complicated configuration of a microgrid requires detailed planning, testing, and clear roles and responsibilities of all loads and resources involved.

Microgrids of Scale

The utility must have control of all significant energy resources and Switching Devices for “grid-forming” to ensure safe operation on its infrastructure.

Only the utility may have control of utility infrastructure.



SOURCE: GTM RESEARCH, DOE

The Microgrid Control System must meet a variety of functional, performance, communication, and cybersecurity requirements.

All resources providing microgrid services require a Switching Device.

Resiliency Microgrids in SDG&E's Service Territory

- SDG&E's current WMP microgrid projects satisfy the same objectives as the CMET Eligibility Criteria.

Ramona Air Attack Base	Cameron Corners	Butterfield/Agua Caliente	Shelter Valley
CAL FIRE Air Support U.S. Forest Service Air Support Fire-retardant mixing stations	CAL FIRE Station, a school, and telecom switching center (east San Diego County)	Desert community (far east San Diego County)	Desert community San Diego Fire Station Community Center (far east San Diego County)
Distribution circuit serving critical facilities impacted by PSPS	Distribution circuit serving critical facilities and the community impacted by PSPS	Upstream distribution circuit impacted by PSPS resulting in outages	Upstream distribution circuit impacted by PSPS resulting in outages
Portable generator in place	Portable fossil fuel generator will serve customers this fire season	Portable fossil fuel generator will serve customers this fire season	Portable fossil fuel generator will serve customers this fire season
Renewable source completion year-end 2020	Renewable source completion by July 2021	Renewable source completion by December 2021	Renewable source completion by December 2021
Energy Storage	Solar + Energy Storage	Solar + Energy Storage	Solar + Energy Storage

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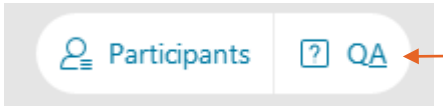

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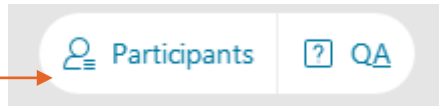

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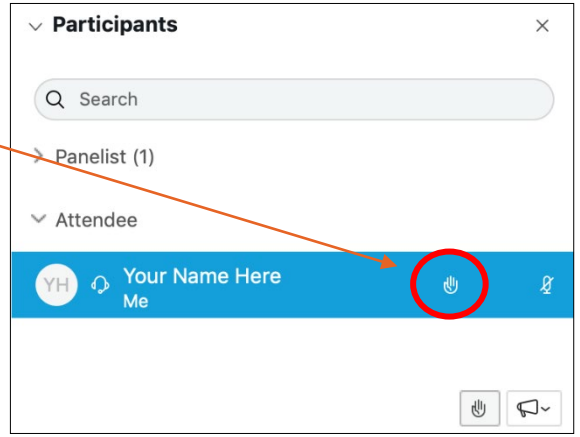

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UL 3001 Overview

Distributed Energy Resource Systems (microgrids)

2020

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Why create UL3001?

Standards exist to cover DER System components and subsystems including inverters, PV, battery system, source interconnection switches, etc.

However, it is possible to create an unsafe system out of certified generation building blocks. While individual generation devices are evaluated for their specific purpose they are not evaluated to operate properly and safety in parallel with other energy sources.

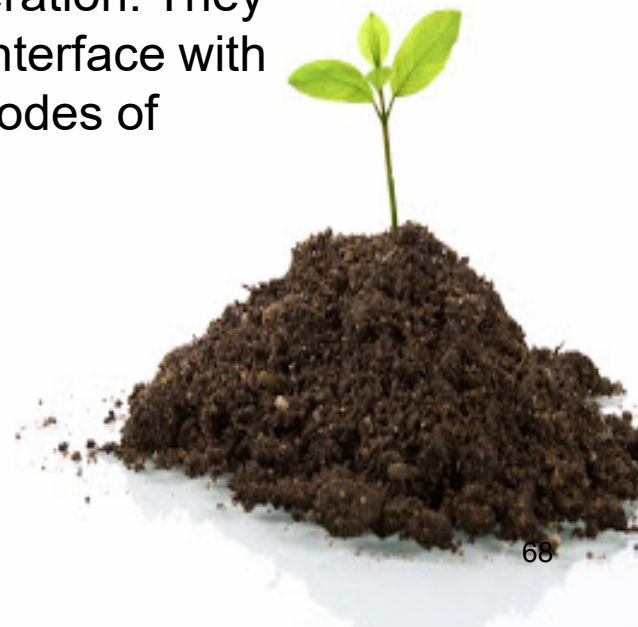
Electrical Inspectors (AHJs) do not have the tools to evaluate whether the system installation complies or is safe. Components and subsystems have not been evaluated to work together.

UL3001 Distributed Energy Resource Systems

Draft Scope

This standard covers the safety and performance of distributed energy resource systems. These systems may be comprised of distributed energy sources such as photovoltaic arrays or wind turbines in homogenous or hybrid configurations, energy storage systems, grid interface equipment and related equipment to accomplish functionality of the distributed energy system.

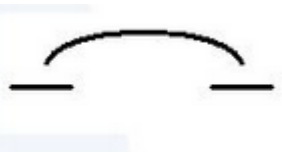
These requirements address the safety of system design, integration and operation. They also cover the performance of these systems as it relates to grid operability, interface with premises wiring systems, and performance of the equipment in the various modes of system operation.



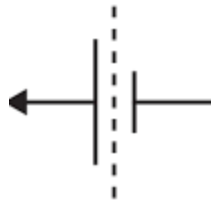
Protection of Sources

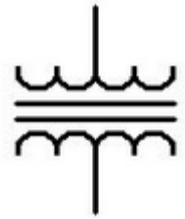
Renewable power sources have specific installation and protection requirements to maintain them within their safe operating parameters and limits to prevent electric shock, fire and mechanical hazards.

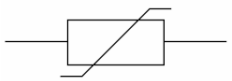
Photovoltaics (PV)
Wind turbines
Hydro turbines
Fuel Cells
Batteries
EVs
Generators
Others



Maximum system voltage
Maximum normal current
Charge discharge current
Maximum fault current
Reverse current
Ground faults
Arc faults
Overload
Overspeed
Thermal limits







Coordination of DERS Equipment

- System components need to operate safely under normal and foreseeable abnormal system conditions
- Differentiate between system faults to which equipment need to respond to vs single fault failures within a piece of equipment
- Interaction between energy sources and power conversion equipment
- Operation ranges of system equipment
- Protection from system faults
- Source parameters

Continued Expansion of Advanced Functionality

Transition to Smart Inverters - From “Old School” UL1741 1547-2003 & 1547.1-2005 Utility Interactive Inverters to Smart/Advanced Inverters UL1741 SA and SB/ 1547-2018 & 1547.1-2020.

Next Transition for Grid Tied and Island Mode Operation. Generation products are being designed to change their operational parameters to optimize performance depending if they are Grid Tied or operating in Island Mode. Most advanced inverter functions used to stabilize the grid will similarly stabilize a microgrid.

UL3001 will directly reference other standards for proper operation of the microgrid. – UL1741 as well as the IEEE 1547 and IEEE 2030 series of standards.

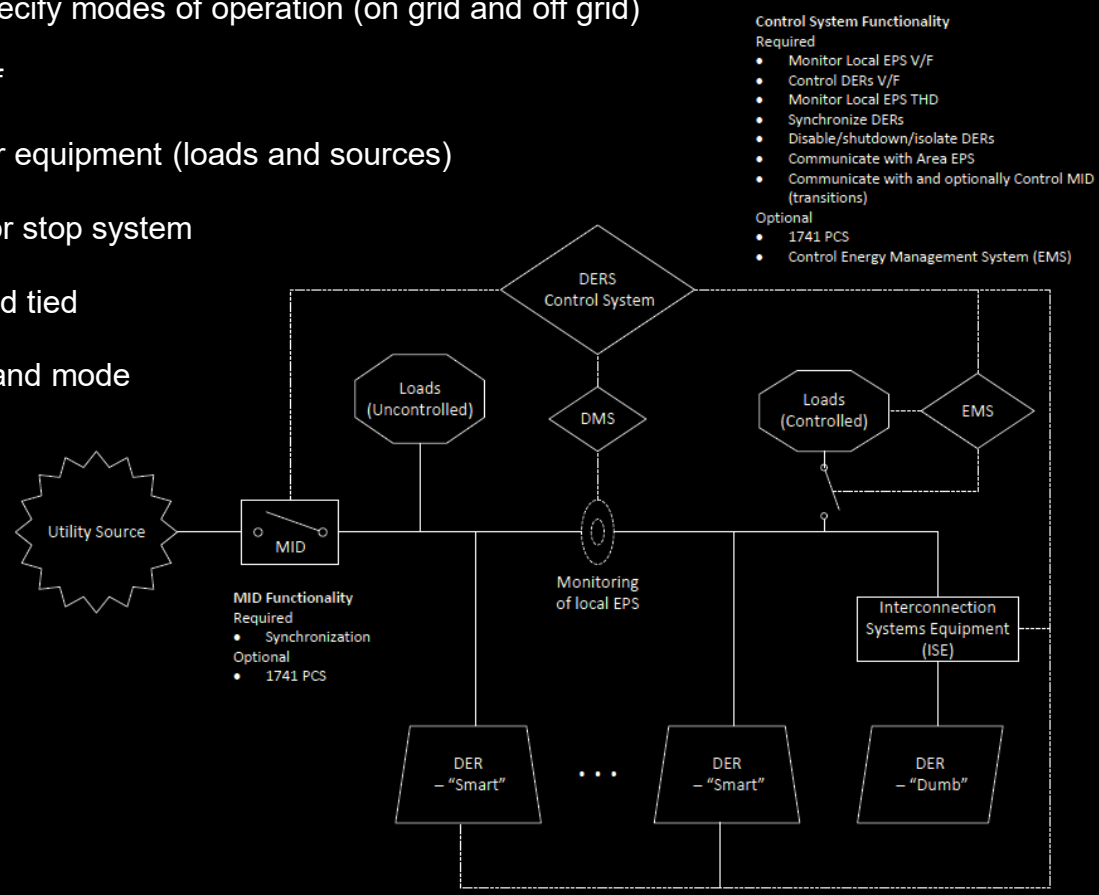
- Monitor voltage, frequency
- Control voltage and frequency
- Monitor Power Quality Voltage THD
- Synchronization Grid interconnection (connect to grid and depart from grid) in accordance with local interconnection rules.
  - Will a Microgrid controller ever need to synchronize islanded sources in a microgrid?
- Communications with EPS in accordance with local interconnection rules.
  - Specify modes of operation (on grid and off grid)
- On/Off
  - For equipment (loads and sources)
- Start or stop system
  - Grid tied
  - Island mode

Microgrid Controllers Functions Being developed in real-time

-Oversee/Monitor

-Control

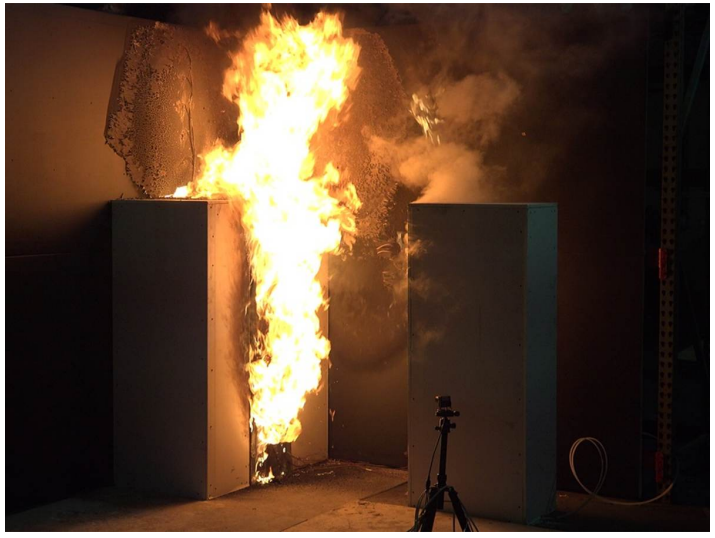
-Protect



Why create a Standard?

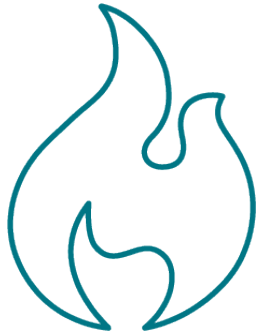
System level safety concerns include (but are not limited to):

- Islanded or stand-alone power quality (voltage, frequency, V THD, flicker)
- Unintended power export, particularly when the grid is down
- Unstable or unintended interaction between devices
- Interoperability & cybersecurity of networked devices and systems
- Power Control System (PCS) functionality



System vs Product Approach

Challenges with variability, end use and complexity



All UL standards address general risks:

- Electric Shock
- Fire Hazards,
- Mechanical Hazards
- Product Ratings (accuracy, conditions of use, etc..)

And sometimes additional concerns:

- Interoperability
- Cyber Security
- Performance

Product Certification (laptop computer)	System Certification (DERS)
All components known, tested and documented	*Unlimited combination of components*
End use known or restricted	End use unknown, limited restrictions
Full testing performed on sample in laboratory	*Cannot test all possible combinations, cannot laboratory test*
All hazards relatively known and addresses	*Potentially unknown hazards depending on design and operation*
Rely on documentation and follow-up inspections	*Rely on Hazard Based Safety Engineering, field and commissioning testing and design requirements*

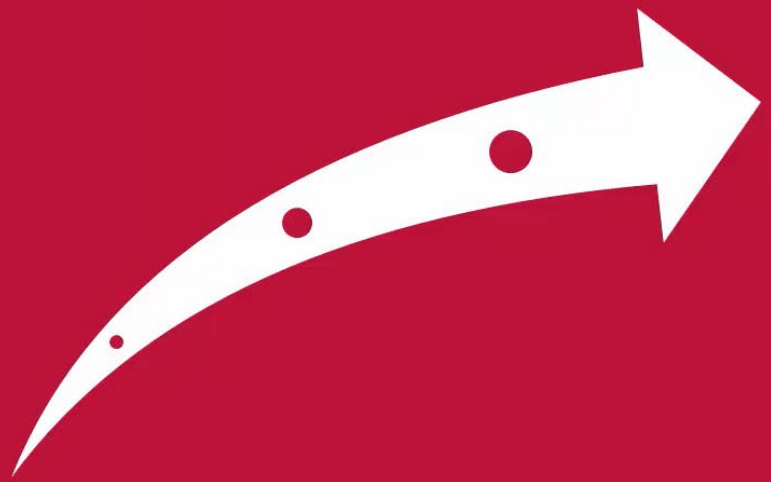
System Approach for UL 3001

Utilizing Hazard Based Safety Engineering, product certification, design requirements and field testing

Issue	Methodology
Unknown components	*Product certification, design parameters, interoperability requirements, field testing*
End use unknown before production, limited restrictions in use or environment	For each microgrid, end use known during design phase which allows precise requirements to be applied
Cannot test all possible combinations, cannot laboratory test complete DERS	*Heavily utilize product certification with interoperability and software evaluations, field verification testing and safeguards*
Potentially unknown hazards depending on design and operation	*Identify hazard types and develop requirements for assessment of addressing risk*

UL's ANSI Consensus Standards Development Process

Phases of the process



Proposal Submission

Preliminary Review

YES

NO

Proposal Review

Recirculation

Thank you!

Tim Zgonena

Principal Engineer UL3001

timothy.p.zgonena@ul.com

Jason Hopkins

Principal Engineer UL3001

Jason.D.Hopkins@ul.com

Empowering Trust™

Appendix

Empowering Trust™

What are the key attributes of a DERS?

Augment or replace traditional utility-provided power

Provide power when the grid is down

Provide power where there is no grid

Provide ability to utilize local renewable generation

Ability to control voltage and frequency to any specification

Complete independence

Operate in parallel to grid

Operate islanded from grid

Operate independent of any grid

Operate in conjunction with other DERS

DERS owner sets priorities and specifications

Achieve specific goals of the owner

Reliability/power quality

Fuel source mix (renewable)

Cost (generation, arbitrage)

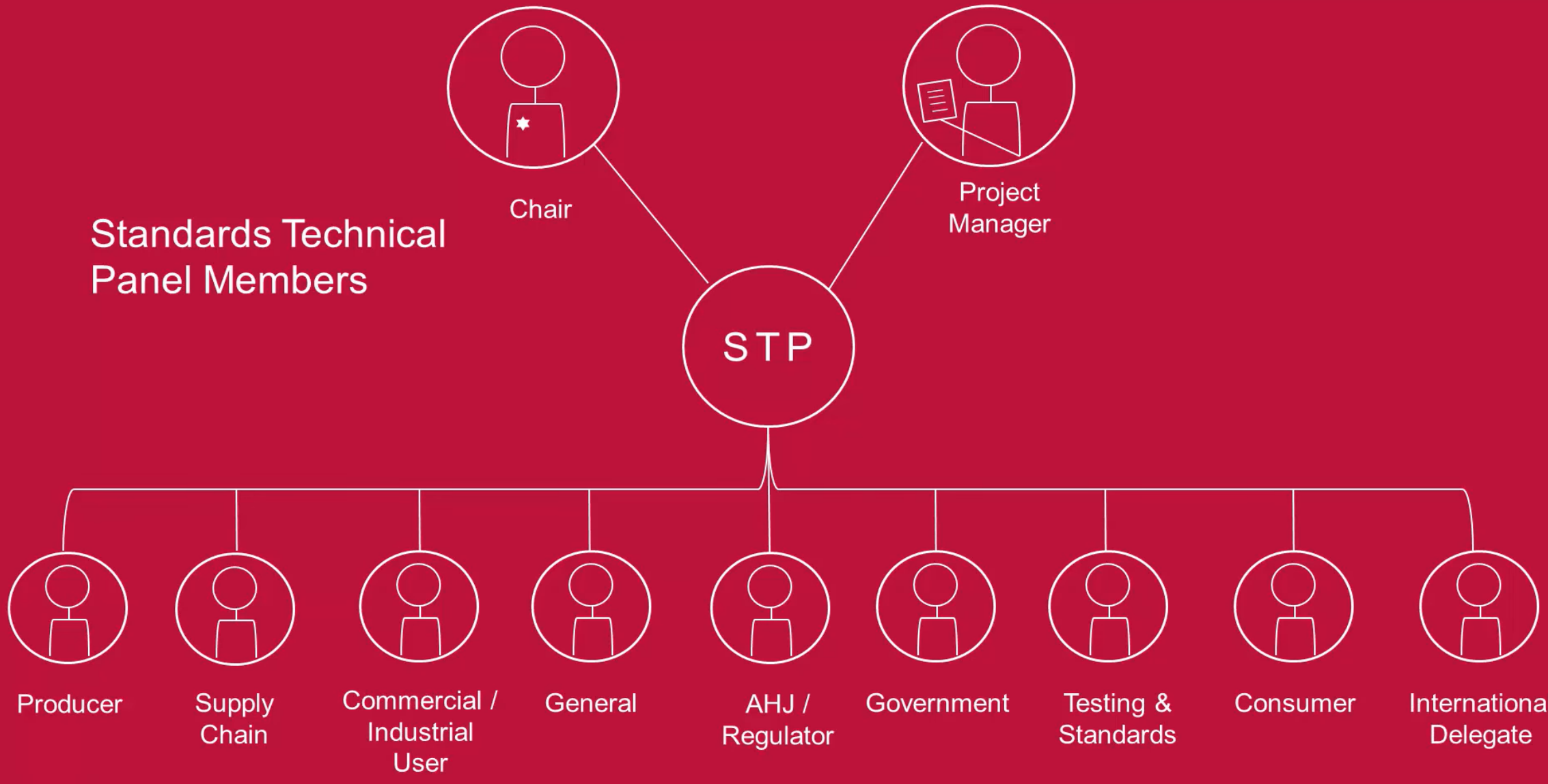
“Good Neighbor”

Security

Task group breakout for UL 3001

1. Overarching
2. Scope & title
3. Terms, definitions and standard references
4. Critical system components & DERS protective functions
5. Merged with TG7
6. Merged with TG4
7. Grid interconnection, coordination and interoperability, islanded operation & DERS interoperability
8. Laboratory & field testing, EMC
9. Ratings, markings and instructions
10. Grounding
11. System safety related requirements, tests other than EMC, energy storage

Standards Technical Panel (STP) – the driving force



Key factors in a consensus standards development process

- Every member of the STP gets one vote, including UL. No single party can force an outcome or timeline.
- Consensus must be reached before standard is published.
- STP makeup ensures differing viewpoints to provide robust and accepted requirements.
- Consensus standards are “live” documents, often in a near constant state of review, especially with new technology.
- New STP members may join at any time, but voting rights may depend on join date.

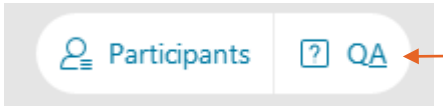
STANDARDS MATTER

Improving and saving lives.

Discussion and Q&A

WebEx Tip

Option 1:



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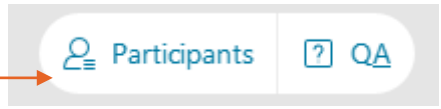

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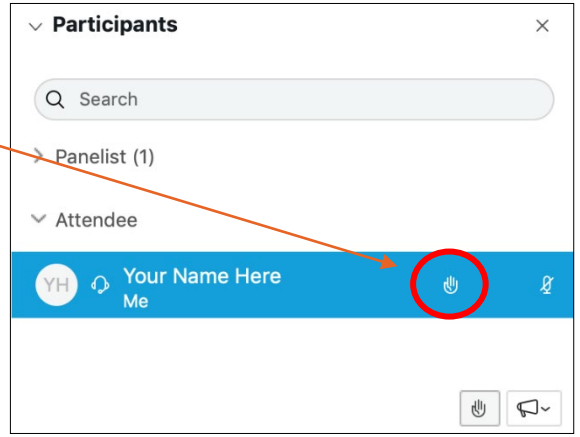

Next Steps

- Today's presentations will be available shortly at: https://www.cpuc.ca.gov/resiliencyandmicrogrids/

- Next Meeting: Early December 2020

For more information:

Jessica.Tse@cpuc.ca.gov
https://www.cpuc.ca.gov/resiliencyandmicrogrids/