

DOCKETED

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Grid Modernization Research Scoping Workshop

Qing Tian, Ph.D. P.E.

July 21, 2023



Housekeeping

- This workshop will be recorded.
- Workshop slides and the Zoom recording will be posted on our webpage, <https://www.energy.ca.gov/event/workshop/2023-07/grid-modernization-research-scoping-workshop>
- Participants will be muted during the presentation. Please chat your questions in the Q&A window.



Workshop Agenda

Time	Topics
9:30 am	Information on a Future Solicitation <ul style="list-style-type: none">➤ Background➤ Potential Solicitation Concepts➤ Questions for Stakeholders
10:00 am	Stakeholder Presentations <ul style="list-style-type: none">➤ Clyde Loutan and Peter Klauer – California ISO➤ Juan Castaneda - Southern California Edison➤ Omid Sarvian - Pacific Gas and Electric Company➤ Ben Kroposki - National Renewable Energy Laboratory➤ Jake Gentle - Idaho National Laboratory
11:00 am	Panel Discussion
11:30 am	Public Comments
12:00 pm	Adjourn



EPIC Research and Development Program

- ~\$130 million annual budget, funded by ratepayer surcharge from IOUs.
- Invests in pre-commercial technology innovation complementing other state activities including standards, regulations, and incentives for commercial technologies.
- Provide electricity ratepayer benefits including improved safety, reliability, affordability, environmental sustainability, and equity.

To access report:

<https://www.energy.ca.gov/publications/2021/electric-program-investment-charge-proposed-2021-2025-investment-plan-epic-4>



CALIFORNIA
ENERGY COMMISSION



CALIFORNIA
NATURAL
RESOURCES
AGENCY

California Energy Commission

COMMISSION REPORT

The Electric Program Investment Charge Proposed 2021–2025 Investment Plan

EPIC 4 Investment Plan

Gavin Newsom, Governor

November 2021 | CEC-500-2021-048-CMF



Achieving 100 Percent Clean Electricity

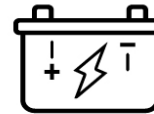
- Triple electricity grid capacity
- Sustainable expansion of clean electricity generation
- Accelerating advancements in emerging technologies



Solar & Wind

3X

Solar and wind build rates need to nearly triple*



Battery

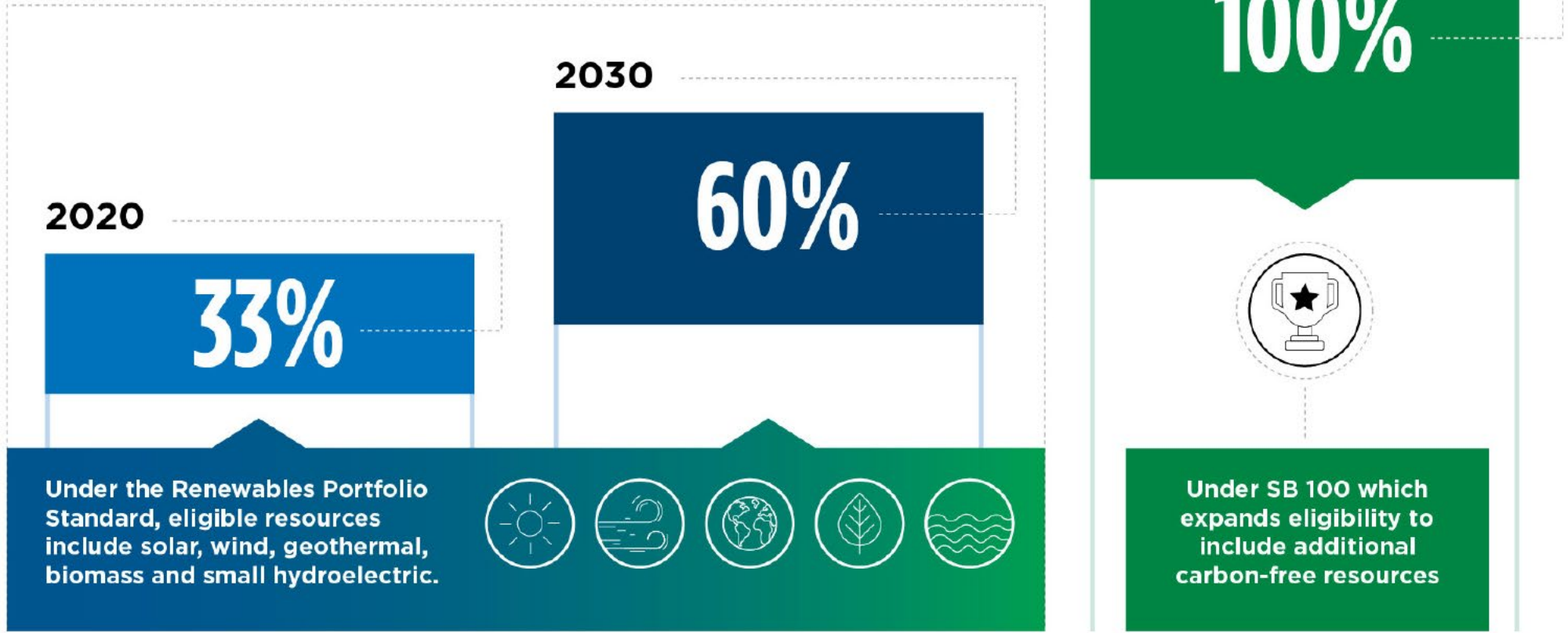
8X

Battery build rates need to increase by nearly eightfold**



Progress to 100% Clean Electricity

California's Clean Electricity Goals





Future Grid and challenges

- Move toward a distributed and inverter-centric system




- Potential challenges

- Grid disturbances/faults
- Power quality and grid inertia
- Renewable curtailment
- Grid congestion
- Cybersecurity





Accelerating Grid Modernization

Segments	FY 21-25 EPIC 4 Research Initiatives
	Technology Demonstrations to Address Grid Congestion in a Decarbonized California
	Demonstrate Technologies to Maintain Reliability and Power Quality in the Inverter-centric Grid of the Future
	Furthering Cybersecurity with Highly Modulatable Grid Resources



Why Are We Seeking Your Input?

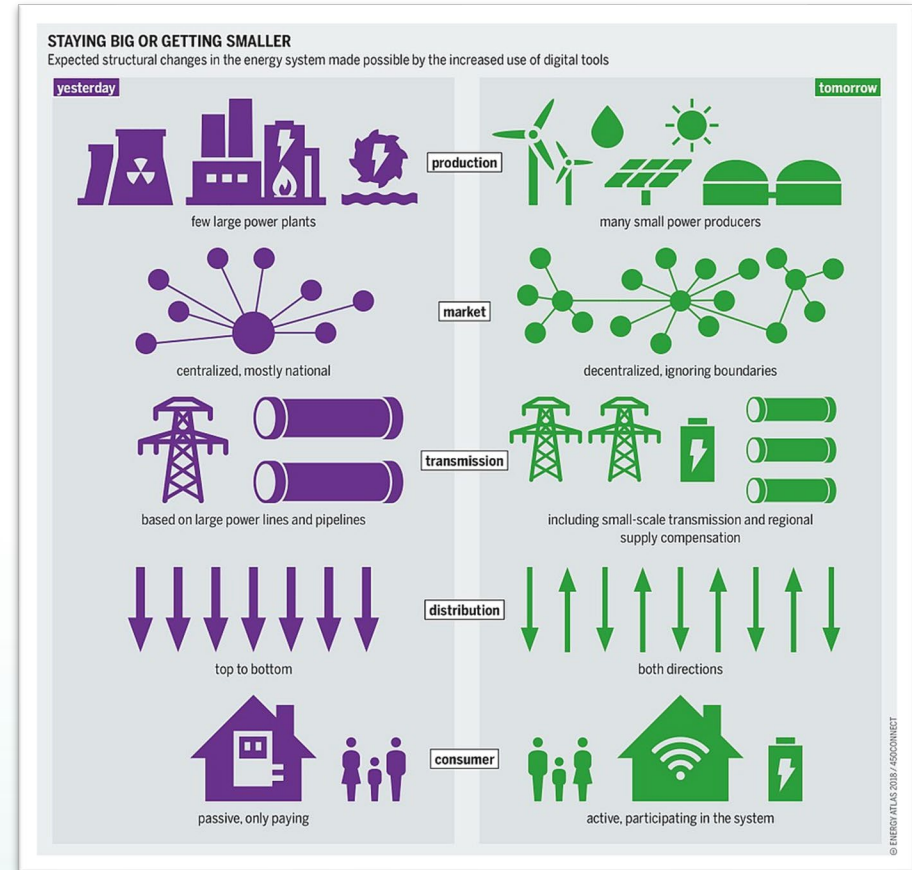
- A forthcoming grant funding opportunity: up to \$28M to drive the advancement of technologies for grid modernization.
- To ensure high-impact research, seeking input to inform solicitation development.





Purpose of Forthcoming Solicitation

- Accelerate technology advancements to meet SB100 goals
- Drive grid modernization
- Prepare for the imminent transition to the inverter-centric grid





Advancing Grid Enhancing Technologies for Increased Transmission Capacity

Research Scope:

- Demonstrate Grid Enhancing Technologies (GETs):
 - Power Flow Control
 - Dynamic Line Rating
 - Advanced Conductor Technologies
 - Energy Storage (excluded)
- Increase Transmission Capacity within Existing Rights-of-way
- Collect Cost and Performance data
- Facilitate Broader Deployment and Commercialization
- Advance Cybersecurity Protection





Research Focus

Research Concepts	Technology Advancement	Expected Outcomes
#1 Targeted assessment of transmission congestion and benefits of GETs	<ul style="list-style-type: none">• Advanced modeling and analysis• Integrated resource planning for renewables and electrification• Assessment of transmission issues and risks of renewable curtailment• Techno-economic analysis of GETs	<ul style="list-style-type: none">• Comprehensive evaluation of GETs• Optimal resource allocation and infrastructure development• Policy recommendation



Research Focus

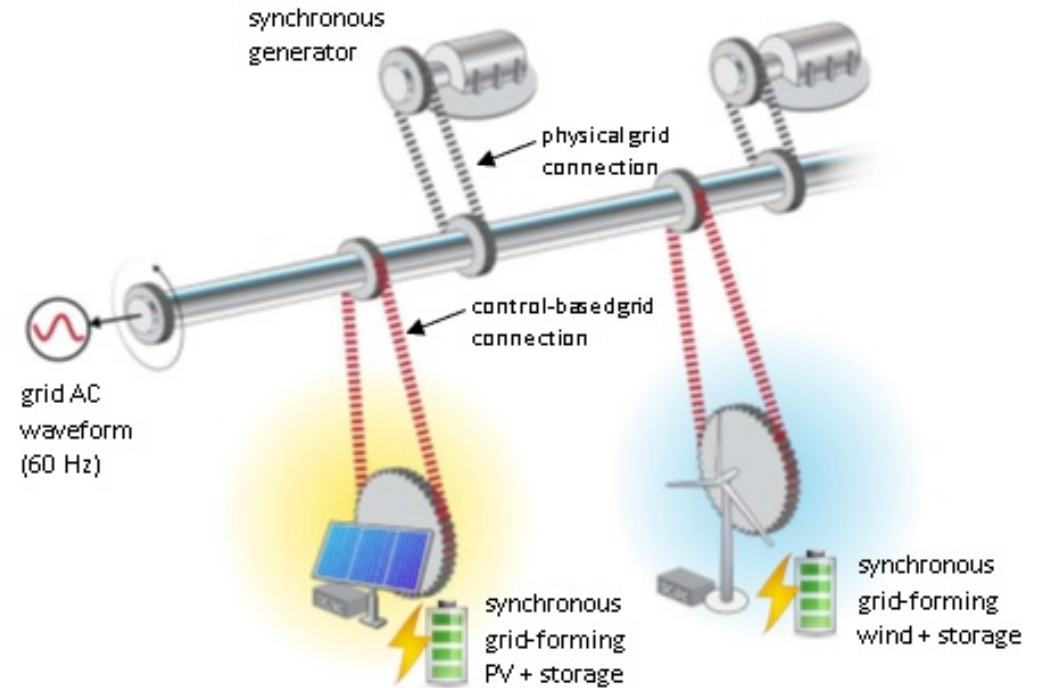
Research Concepts	Technology Advancement	Expected Outcomes
#2 Demonstration of GETs to mitigate grid congestion	<ul style="list-style-type: none">• Technology deployment and demonstration• Cybersecurity enhancement• Cost and performance evaluation• Standardization and market facilitation	<ul style="list-style-type: none">• Transmission congestion relief• Transmission upgrade deferral• Renewables curtailment relief• Technology commercialization



Sustaining Reliability and Power Quality in an Inverter-Centric Grid

Research Scope:

- Support Secure and Reliable Inverter Operations
- Improve Situational Awareness and Maintain System Stability
- Inform Standards, Protocols, and Best Practices
- Advance Cybersecurity Protection



Source: B. Kroposki et al., "Achieving a 100% Renewable Grid – Operating Electric Power Systems with Extremely High Levels of Variable Renewable Energy,"



Research Focus

Research Concepts	Technology Advancement	Expected Outcomes
#3 Wide Area Monitoring, Protection and Control of Modern Power Systems	<ul style="list-style-type: none">• Advanced sensors, measurement techniques, and software system• System inertia measurement, and forecast• Big data and analytics• Advanced grid visualization• Grid event detection and forecast• Protection and control schemes	<ul style="list-style-type: none">• Proactive grid management• Mitigating disturbances and preventing blackout.• Improved system security and reliability



Research Focus

Research Concepts	Technology Advancement	Expected Outcomes
<p>#4 Development and demonstration of grid forming inverters</p>	<ul style="list-style-type: none">• Performance testing and validation• Grid support function optimization• Advanced control strategy development and demonstration• Testing and implementation of cybersecurity protocols• Best practices and standards	<ul style="list-style-type: none">• Advanced grid functions and capabilities to support grid and ride-through grid disturbances• Blackstart without synchronized machines• Maintaining system stability• Standardized framework for deployment



Questions for stakeholders

- What specific research gaps or technology advancements should be prioritized to enhance grid reliability, resiliency, and flexibility to meet SB100 goals?
- What target metrics can be used to assess the efficacy of grid modernization technologies in mitigating grid congestion, ensuring system reliability, and enhancing operational flexibility?
- Are there developed technologies or lessons learned and best practices from other regions including internationally that could be applied to grid modernization efforts in California?
- What collaboration opportunities exist between stakeholders, utilities, technology providers, research institutions, and government agencies to accelerate grid modernization research and implementation?
- What other considerations or requirements should be incorporated into the future GFO?



Panel Presentation and Discussion



Clyde Loutan
California ISO



Peter Klauer
California ISO



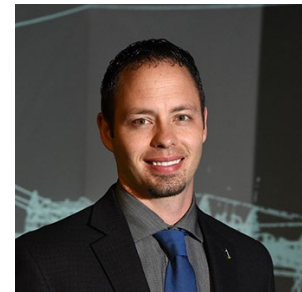
Juan
Castaneda
SCE



Omid Sarvian
PG&E



Ben Kroposki
NREL



Jake Gentle
INL



Comments and Questions

- **Three ways to provide feedback or ask questions:**

- 1. Use the raise hand function in Zoom:**

- Zoom Phone controls:
 - *6 - Toggle mute/unmute.
 - *9 - Raise hand.
- Please introduce yourself by stating your name and affiliation.

- 2. Type comments and questions in the question function on Zoom:**

- Please provide name and affiliation.
- Please indicate which discussion questions you are commenting on (E.g., 1a, 1b, 2, etc.).

- 3. Submit written comments & questions:**

- Send written comments & questions to docket@energy.ca.gov by no later than **August 25, 2023, 5 p.m. PST.**
 - Include docket number 23-ERDD-01 and “Staff Workshop on Grid Modernization Research” in the subject line



Questions

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