The Power Grid for the Future

Experience from California

Vice-Chair Siva Gunda
November 12, 2022
California COP 27 Energy Delegation

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California’s Climate Policy Framework

GHG Targets & Goals
Legislation & Executive Orders: Total GHGs (AB 32/SB 32) or sector targets (SB 1383/ SB 100), etc.

Scoping Plan
Actionable plan across all sectors

Action
Regulations & Incentives: Advanced Clean Cars, climate change investments, etc.

Projects
Examples: Building compost facilities, digesters, renewables, energy infrastructure, etc.

Legislature
Air Resources Board
Public Utilities Commission and Energy Commission
Create Policies and Programs
California’s GHG Trends

Electricity Sector Improvements 2000-2020

GHG Emissions from the CA Electricity Sector

GHG Intensity of California Electricity

Electrification is a Critical Component of CA’s Climate Policy
THE DUCK CURVE
(Net load chart)

Net load - March 31

Megawatts

potential overgeneration

increased ramp

Hour

12am 3am 6am 9am 12pm 3pm 6pm 9pm

2012 (actual)

2013 (actual)

2014

2015

2016

2017

2018-2019

2020
Progress to 100% Clean Electricity

- **2013**: 41%
  - 9% Large Hydro
  - 22% Renewables
  - 10% Nuclear

- **2020**: 59%
  - 13.9% Large Hydro
  - 34.5% Renewables
  - 10.6% Nuclear

- **2045**: 100%
Foundations of Grid Transition

- Clean
- Reliable
- Affordable
- Equitable
# California Clean Electricity Resources

Projected to increase annual costs 6% above a 60% RPS baseline

* Includes in-state

** Includes in-state and out of state capacity

† New hydro and nuclear resources were not candidate technologies for this round of modeling and could not be selected

<table>
<thead>
<tr>
<th>Resource Type</th>
<th>2019*</th>
<th>2030**</th>
<th>2045**</th>
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<tbody>
<tr>
<td>Solar (Utility-Scale)</td>
<td>12.5 GW</td>
<td>16.9 GW</td>
<td>69.4 GW</td>
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<td>Solar (Customer)</td>
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<td>Storage (Battery)</td>
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<td>Hydro (Large)</td>
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<td>Hydro (Small)</td>
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<td>Nuclear</td>
<td>2.4 GW</td>
<td>N/A†</td>
<td>N/A†</td>
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Achieving 100% Clean Electricity in California
To Achieve Clean Energy

Development Needs To Rapidly Accelerate

- **Solar & Wind:** 
  - Solar and wind build rates need to nearly triple*

- **Battery:** 
  - Battery storage build rates need to increase by nearly eightfold**

*Based on 10-year average | **Based on 2020
Reliability Challenges

Capacity Needed in Year X

Meet Coincident Events

Authorized Procurement

Cover Drought and Fire Events

Cover Extreme Heat

Cover New Project Delays

Cover Changing Conditions*

Meet Traditional Planning Standard

*Demand conditions and assumptions may change resulting in a procurement lag
CA Experienced a Historic Heat Wave in Sept ‘22

Demand Volatility is becoming more and more common

Average Demand for Sept 2022 was forecasted to be ~44,600 MW

We were on track for a peak of ~53,000 before demand side load reductions were called on
Critical Elements Along CA’s progress

Floating Offshore Wind

Long Duration Storage

California Energy Commission recently awarded $31 Million grant to Viejas tribe

Distributed Energy Resources

Kincardine Offshore Wind Project
Aberdeen, Scotland

Source: https://www.offshorewindca.org/photo-gallery

Source: https://www.contextlabs.com/
Seeking Ways to Leverage CA Leadership on Electric Vehicles for Reliability

• All new passenger vehicle sales in CA will be electric by 2035
• Expecting 7-8 Million EVs by 2030
• Investing $4B in Zero Emission Infrastructure including V2G
• Just 5 million bidirectional EVs store enough energy to power every home in California for a day
California’s Climate Commitment | 2021-2022 Budget Agreements

$13.8 Billion Transportation
$10 Billion Zero-Emission Vehicles
$9.1 Billion Clean Energy & Reliability
$8.7 Billion Drought & Water Resilience
$5.7 Billion Climate Resilience

$2.3 Billion Wildfire & Forest Resilience
$1.1 Billion Agriculture
$975 Million Climate Homes
$723 Million Climate Schools & Research

$54.1 Billion TOTAL

$525 Million Climate Innovation
$460 Million Circular Economy
$346 Million Climate Health
$315 Million Climate Jobs

September 2022
Strategic Electricity Reliability Reserve (AB 205)

- $2.4 Billion: Strategic Reliability Infrastructure Assets
- $700 Million: Distributed Electricity Backup Assets
- $295 Million: Demand Side Grid Support

$3.4 Billion TOTAL

*As of September 2022*
Clean Energy Alternatives for Reliability (SB846)

$1 Billion Clean Energy Reliability Investment Plan

- Electric supply and demand needs for near- and mid-term reliability
- 100 percent zero-carbon and renewable energy by 2045
- Greenhouse gas emissions reduction target for electricity
- Preferred resources, such as demand response and energy efficiency

Load Shift Goal

- Adopt a goal for load shifting to reduce net peak electrical demand
- Increase demand response and load shifting
- Do not increase GHG emissions or electric rates
Power Plants are Disproportionately Located in Disadvantaged Communities

Source: PSE Healthy Energy California Power Map
Equity and Justice Has to Be Foundational

1) **Words matter.** It is *our* energy system, not *the* energy system.

2) **Timing matters.** We must engage early, often, and meaningfully with tribes, communities, and local leaders.

3) **People matter.** We must be thoughtful about inviting people, who represent and work closely with the residents to make sure we are getting a comprehensive set of voices at the table.

4) **Build trust.** We must build true relationships with partners and communities to carry out our work equitably. We will achieve more and do better when we work and act together.

5) **Consistency and communication matters.** Equity relies critically on consistent commitment of resources and communication to build those relationships and break down silos.

6) **Conflict is necessary.** To achieve equity, change is required and when change happens, conflict arises. Rather than run away from this conflict we need to lean into it to learn from it and make progress.
The Great Implementation Will Require Finding Common Ground

1. Start with what we agree on
2. Align on where we are going
3. Recognize there will be tradeoffs along the way

…and lean into conflict!