SB 100 Joint Agency Report Results

Liz Gill, PhD
California Energy Commission
Senate Bill 100

Officially titled “The 100 Percent Clean Energy Act of 2018,”

Senate Bill 100 (SB 100, De León):

1. Sets a 2045 goal of powering all retail electricity sold in California and state agency electricity needs with renewable and zero-carbon resources.

2. Updates the state’s Renewables Portfolio Standard to ensure that by 2030 at least 60 percent of California’s electricity is renewable.

3. Requires the CEC, CPUC, and CARB to use programs under existing laws to achieve 100 percent clean electricity and issue a joint policy report on SB 100 by 2021 and every four years thereafter.
Inputs

Such as:
- Existing System
- Demand Forecasts/Scenarios
- Resource Costs
- Reliability Metrics
- Policy Goals
- Resource Potential
- Land Use Screens

Portfolio Development

(Capacity Expansion Modeling)

Scope of 2021 SB 100 Analysis

Reliability Testing

<table>
<thead>
<tr>
<th>Operability/Full Dispatch</th>
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<td>Production Cost Modeling</td>
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Portfolio Impacts

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<th>Rates</th>
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SB 100 Results are Directional

Inputs, impacts, and tools listed are for illustrative purposes
## Zero-Carbon Resources Included in Modeling

<table>
<thead>
<tr>
<th>Technology</th>
<th>Eligibility Basis</th>
<th>Scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV</td>
<td>RPS</td>
<td>Core and Study</td>
</tr>
<tr>
<td>Solar Thermal (existing only)</td>
<td>RPS</td>
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</tr>
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<td>Onshore Wind</td>
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<tr>
<td>Bioenergy</td>
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<tr>
<td>Fuel Cells (green H2)</td>
<td>RPS</td>
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<tr>
<td>Small Hydro (existing)</td>
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</tr>
<tr>
<td>Large Hydro (existing)</td>
<td>Zero-Carbon</td>
<td>Core and Study</td>
</tr>
<tr>
<td>Nuclear (existing)</td>
<td>Zero-Carbon</td>
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<td>Zero-Carbon Firm Dispatchable Resource</td>
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<td>Zero-Carbon Firm Baseload Resource</td>
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Core Assumptions: Demand Scenarios

PATHWAYS provides RESOLVE:

- Annual loads by category (GWh/yr)
- Some load shape information for load modifiers

As of 2019, there is 80 GW of in-state capacity in California.

Customer solar shown here is a demand-side assumption. No additional customer solar was selected.
Economy-wide Decarbonization Impacts
Resource Requirements
Resource Technology Pursued Impacts
Resource Requirements

Selected Cumulative Capacity (MW)

- Gas Capacity Not Retained
- Shed DR
- Long Duration Storage
- Battery Storage
- Customer Solar
- Utility-Scale Solar
- Offshore Wind
- New OOS Wind
- Wind
- Biomass
- Geothermal
- Hydrogen Fuel Cell
- Gas

Core
Resource Technology Pursued Impacts
Resource Requirements

- Gas Capacity Not Retained
- Shed DR
- Long Duration Storage
- Battery Storage
- Customer Solar
- Utility-Scale Solar
- Offshore Wind
- New OOS Wind
- Wind
- Biomass
- Geothermal
- Generic Zero-Carbon Baseload
- Hydrogen Fuel Cell
- Generic Zero-Carbon Dispatchable
Study scenario includes T&D and storage losses in zero-carbon target.
Going Beyond SB 100 Impacts Resource Requirements

- Gas Capacity Not Retained
- Shed DR
- Long Duration Storage
- Battery Storage
- Customer Solar
- Utility-Scale Solar
- Offshore Wind
- New OOS Wind
- Wind
- Biomass
- Geothermal
- Hydrogen Fuel Cell
- Gas
Electric Sector GHG Emissions

- No Combustion
  - Study: 96%
  - SB 100 Core: 90%
  - 60% RPS: 76%

- No Combustion
  - Zero-Carbon Generation
  - Annual GHG Emissions (MMT CO2)
  - 60% RPS: 57

- SB 100 Core
  - Study: 12
  - Zero-Carbon Generation
  - Annual GHG Emissions (MMT CO2)
  - 60% RPS: 24

- 60% RPS
  - Zero-Carbon Generation
  - Annual GHG Emissions (MMT CO2)
  - 60% RPS: 11
Resource Build Rates

Average Build Rate to Date

10-Year Average Yearly Build (GW/year)

- Solar
  - Highest 1-Year Historical

Average Build Rate to 2045

SB 100 Core
High Electrification Demand

25-Year Average Yearly Build (GW/year)

- Solar: 2.8
- Wind: 0.9
- Battery: 2.0
Key Takeaways from Modeling

This initial analysis suggests SB 100 is technically achievable through multiple pathways.

Construction of clean electricity generation and storage facilities must be sustained at record-setting rates.

Diversity in energy resources and technologies lowers overall costs.

Retaining some natural gas power capacity may minimize costs while ensuring uninterrupted power supply during the transition to 100 percent clean energy.

Increased energy storage and advancements in zero-carbon technologies can reduce natural gas capacity needs.

Further analysis is needed.
Recommendations for Further Analysis

1. Verify that scenario results satisfy the state’s grid reliability requirements.

2. Continue to evaluate the potential effects of emerging resources, such as offshore wind, long-duration energy storage, green hydrogen technologies, and demand flexibility.

3. Assess environmental, social, and economic costs and benefits of the additional clean electricity generation capacity and storage needed to implement SB 100.

4. Hold annual workshops to support alignment among the joint agencies and continuity between SB 100 reports.
Further Analysis and Related Work

**Inputs**
- Existing System
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Follow-on work goals:
Further quantitative assessment of reliability and portfolio impacts

Inputs, impacts, and tools listed are for illustrative purposes
Thank you!

The 2021 SB 100 Joint Agency Report and Summary Document can be found at:

https://www.energy.ca.gov/sb100