Building a Zero Carbon California Grid: Moving From Models to an Implementable Plan

November 2, 2021
• EDF, CATF, joined with TNC to explore constraints on decarbonizing the electric system.
• The team interviewed more than 60 stakeholders and experts on what they see as key challenges and risks to achieving this transition, and then conducted two workshops.
• Many challenges were identified, but a consensus view emerged that the state cannot meet its targets without (1) aggressive monitoring/management of RE development; (2) a commitment to build the underlying deliverability infrastructure and (3) a new process of engagement to assure developable sites do not become unobtainable, while protecting against unaffordable, inequitable costs.
• Accordingly, the team commissioned further analysis from Lucid Catalyst.
Equity, Environmental, and Social Justice Factors Are Essential for Planning

- Inclusivity is a must with all sectors and agencies
- Affordability and cost shifting need to be re-examined by agencies
- Economic and environmental costs and benefits of renewable energy and zero-carbon resources need to be added and updated in models
- Modeling improvements to ensure equitable indicators are included
- Cost and timing of fulfilling clean energy and electrification mandates are updated
- Costs and benefits of alternative scenarios should be provided to Tribes, Disadvantaged Communities, and Frontline Communities
Capacity Expansion Modeling Results

**Economy-wide**

NZAP Excludes imports, includes customer-sited PV

**Power Sector Only**

Total Installed Generation Capacity (80 GW)

**Historic Max Build out rate for PV (2.7 GW/yr) for 2021-2045 (64.8 GW)**

Incremental new build is 69.6 GW (higher than max historic rate)

NZAP excludes T&D and storage losses; includes out of state wind customer-sited PV
Moving from Models to Plans

Grid Decarbonization is Achievable
• Cost is no longer the limiting factor

Community Engagement is Essential

At this Scale of Build out Key Factors Include
• Inclusive and Equitable
• Available Land
• Permitting
• Transmission and Generation
Constraint #1:
Available Land to Build Generation and Transmission is Limited

These ~5 million acres are not uniform in terms of development cost and risk.
And even “Suitable” Land ≠ Developable Land

- **Land exclusion is but the first step** in identifying sites that are considered “developable.”

- Large areas of “available” land can be quickly dismissed for a variety of reasons:
  - Requires working with too many landowners to complete the project (including securing Right-of-Ways to interconnect project)
  - Contiguous parcels are too small
  - Etc.

- Even when attractive areas are identified, there are several reasons why projects never get built:
  - Landowners have no interest
  - Public opposition makes permitting impossible
  - Transmission studies reveal upgrades that make the project prohibitively expensive.
  - Etc.

- Each project development milestone has several risk factors and nearly all get more difficult as more projects are built in an area.

![Diagram of identifying land for RE projects](image)
Until now, all signs have pointed to a “hockey stick” growth curve.
As more projects are deployed in a region, the “hockey stick” is very likely to turn into a S-curve.

- Falling hardware costs
- Good project sites
- Access to transmission (low interconnection costs)
- Public support
- Etc.

- Increasing land costs & competing needs
- Fewer amenable landowners
- Further from transmission
- Lower capacity factors/ poorer resource
- Public opposition
- Interconnection queue
- Increasing # of gen tie Right-of-Ways
- Transmission Availability/ Capacity
- Etc.

Sites are increasingly difficult,

Therefore, expensive and risky to develop over time.

Most decarbonization scenarios show accelerating deployment over time.

(Based on interviews with utility-scale PV developers)
As more projects are deployed in a region, the “hockey stick” is very likely to turn into a S-curve.

These are OCCURRING AT THE SAME TIME, compounding cost & risk:

- Falling hardware costs
- Good project sites
- Access to transmission (low interconnection costs)
- Public support
- Etc.

- Increasing land costs & competing needs
- Fewer amenable landowners
- Further from transmission
- Lower capacity factors/ poorer resource
- Public opposition
- Interconnection queue
- Increasing # of gen tie Right-of-Ways
- Transmission Availability/ Capacity
- Etc.

- The best sites are developed first.
- Interconnection Process is more Taxed
- Therefore, sites are increasingly difficult, expensive and risky to develop over time.
- Most decarbonization scenarios show accelerating deployment over time.

(Based on interviews with utility-scale PV developers)
Constraint #2: Permitting - Siting Restrictions are Becoming Widespread

Utility-scale Solar

Cumulative Solar Deployment (MW)

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Map Projection: Mercator Auxiliary Sphere
Geodetic Reference System: WGS 1984
Sources: EIA, CA State Geospatial

Siting Conflicts with RE Development Over Time (Projects >100 MW)

2011

GW

250

200

150

100

50

0

2011

E+: 192

SB100: 69
Constraint #2: Permitting - Siting Restrictions are Becoming Widespread
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**Constraint #3:** Three-fold increase in CA transmission Capacity Needed

- Existing Transmission Capacity (Est.)*: ~15,000,000
- E+: 34,725,097
- E+RE+: 41,451,217

*Based on GIS analysis; only includes transmission >=220 kV

**Assumes all MW-miles are on new 500 kV double circuit lines**
Our Dialogues Suggest We Need:

- An Equitable Plan with Dates, Amounts and Spatial Priorities
- Contingency Plans Where Progress Falters
- A Single Point of Responsibility
- Measurable Milestones/Dashboard to Ensure Inclusivity and Accountability
There is no individual, central organization responsible for the state’s energy transition. Responsibility falls across several different organizations.

There are also several ways that outside organizations can influence the actions of “decision-makers”.

Achieving SB 100 is currently dependent on the coordination among a substantial number of groups, some of whom, do not always have aligned interests/remits.
All Agencies Would Play Their Role but Someone Must Lead

- **Federal government: DOE, FERC, DOI, EPA**
  - Lead on Grid Reliability, Transmission Planning

- **CARB**
  - Lead on Public Scoping, Emissions
  - Lead on Integrated Resource Plan and Procurement

- **Cal EPA**
  - Lead on Climate Action, Equity Screens, report cards

- **OPR**
  - Lead on Planning

- **CEC**
  - Lead on SB 100 report, Workshops, land use, Equity Maps
  - Lead on 30x30, Commissions

- **CAISO**
  - Lead on Grid Reliability, Transmission Planning

- **Dept. of Natural Resources**
  - Lead on Integrated Resource Plan and Procurement

- **County and local land use and environmental regulators**
  - Lead on Planning

- **Single Point of Responsibility**
Scoping Plan
Success must Consider the Following

- Inclusion and Equity
- Available Land
- Permittable Land
- Time and Pace of Transmission Build Out Coordinated with Generation
- Inter-agency Executed Plan Removing Roadblocks
Thank you!

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