Now Comes the Hard Part: Making California’s Clean Energy Future a Reality

_Presentation to the Business for Local Energy Symposium_

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“The views presented are mine only and do not necessarily reflect the opinions of the California Independent System Operator Corporation, its Board of Governors or staff.”
What is the future of the electricity industry?

Decarbonize
Decentralize
SB 350: Clean Energy and Pollution Reduction Act of 2015

• Increase Renewable Portfolio Standard from 33% to 50% by 2030
• Double energy efficiency in buildings
• Encourage increased investments in transportation electrification, including charging infrastructure
• Begin transition for the California ISO to become a multi-state western regional transmission organization
California has a long history of Energy Policy Innovation

- Decoupling (1982)
- Electric Utility Industry Restructuring Act (AB1890)
- Decoupling (1982)
- Blackouts begin
- PG&E files for bankruptcy
- Schwarzenegger replaces Davis
- SGIP launched
- 1st Energy Action Plan
- 20% RPS by 2017
- Net Energy Metering (AB 920)
- 33% RPS by 2020 (SB X1-2)
- Cap Raised on NEM
- Zero Emissions Vehicle targets
- 1.3 GW Storage Mandate (AB 2514)
- AB 327: Distribution Resource Plans
- AB 327: NEM 2.0
- AB 327: Residential Rate Redesign
- 50% RPS by 2030 (SB 350)
- California Solar Initiative (CSI)
- FIT for small-scale solar installations (AB 1969)
- AB32: CA Global Warming Solutions Act
- $2 bn budget for Energy Efficiency
- 33% RPS by 2020 (SB X1-2)
- SGIP extended (AB 1150)
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What could possibly go wrong?
California has a long history of Energy Policy Innovation

- **Decoupling (1982)**
- **Electric Utility Industry Restructuring Act (AB1890)**
- **Spot market for energy begins operation**
- **Blackouts begin**
- **PG&E files for bankruptcy**
- **Schwarzenegger replaces Davis**
- **SGIP launched**
- **1st Energy Action Plan**
- **20% RPS by 2017**
- **PG&E files for bankruptcy**
- **1.3 GW Storage Mandate (AB 2514)**
- **AB 327: Distribution Resource Plans**
- **AB 327: NEM 2.0**
- **AB 327: Resid Rate Redesign**
- **80% RPS by 2030 (SB 350)**
- **1.2 GW Storage Mandate (AB 2514)**
- **SGIP extended (AB 1150)**
- **$2 bn budget for Energy Efficiency**
- **Cap Raised on NEM**
- **Zero Emissions Vehicle targets**
- **50% RPS by 2030 (SB 350)**
- **California Solar Initiative (CSI)**
- **Net Energy Metering (AB 920)**
- **33% RPS by 2020 (SB X1-2)**
What could possibly go wrong?

### Problems

1. **Renewable integration challenges including over-generation**
2. **Greater complexity for the T&D grid**
3. **Investment in grid “assets” is expensive and growing**
4. **Institutional environment is disjointed and inflexible**
50% Renewable penetration will involve substantial Variable Resources

Alternative Renewable Energy Mixes in 2030

E3 PATHWAYS Study

Low Carbon Grid 2030 Study

Source: E3 PATHWAYS Study, 2014
https://ethree.com/documents/E3_PATHWAYS_GHG_Scenarios_UCDavis_CCPM_final.pdf

The management of a 50% Renewable portfolio is considerably more complex.

Energy Dispatch Stacks

Source: E3 PATHWAYS Study, 2014
https://ethree.com/documents/E3_PATHWAYS_GHG_Scenarios_UCDavis_CCPM_final.pdf
High renewable penetration may lead to substantial amounts of curtailment.

Source: E3/NREL, Western Interconnection Flexibility Assessment, October 30, 2015
Investment in grid “assets” is expensive and growing

Historical Growth in California Utility Rate Base vs Electricity Consumption

Projected Growth in US Grid Investments

Source: CPUC, Electric and Gas Cost Utility Report, April 2015; California Energy Commission

Much greater complexity for the Transmission & Distribution grid

Complex structure and coordinated set of interactions required between wholesale/transmission operations and distribution level operations for a high Distributed Energy Resource (DER) system.

This complex structure is already in operation and developing in several US states and countries.

There are significant scaling issues that need to be addressed in a more distributed future.

Institutional environment is disjointed and inflexible

Navigating the regulatory maze is daunting

**CPUC Proceedings impacted by R.16-02-007**

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“...this proceeding will serve as a kind of “umbrella” for our work in a number of other related proceedings, including, but not necessarily limited to, those indicated ....”

http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M158/K663/158663325.PDF
What could possibly go wrong?

Problems

1. Renewable integration challenges including over-generation
2. Greater complexity for the T&D grid
3. Investment in grid “assets” is expensive and growing
4. Institutional environment is disjointed and inflexible
What could possibly go right?

**Problems**

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**Solutions**

1. Price signals
2. Demand Management
3. Interconnection
4. Storage
5. Transportation Fuel Switching
6. Infrastructure as a Service
7. Public (and private) institutional reform
Align price signals with system needs

- Short-term price differentials (and volatility) may not provide a long-term investment signal
- Customers may not always respond economically
Aligning Time of Use Rates with Grid Conditions

Grid Conditions
- Over-generation and real-time negative energy prices will increase as more variable renewable resources are integrated into the system.

TOU Rates
- Super Off-Peak Prices during periods of over-generation
- Super Peak Prices during heavy ramping periods
Expand Targeted Energy Efficiency and Advanced Demand Response

• Flexible loads reduce renewable overbuild
• EE can be targeted at specific locations but biggest impact may be on time-of-day
• Automation must play a critical role
• Many different market solutions including ISO’s rule allowing aggregators to bid into the wholesale market
• Many potential variation to the business model for utilities and third parties
California can accelerate carbon reduction in the West by regionalizing the grid

- West-wide coordination enables increased reduction in carbon emissions
- Consumers across region will save millions of dollars per year
- A larger region benefits renewable integration
- PacifiCorp wants to join the ISO balancing area. Next steps:
  1. Determine policy and tariff changes required in new states
  2. Seek necessary authorizations from regulatory entities in host states
  3. Plan and implement software and market design changes
  4. Determine appropriate Governance changes
Storage is a game changer

- Not just batteries!
- The greatest need is for longer-duration storage
- Focus on value stacking, not just cost reduction

ENERGY STORAGE VALUES VARY DRAMATICALLY ACROSS LEADING STUDIES

**ISO/RTO SERVICES**
- Energy Arbitrage
- Frequency Regulation
- Spin / Non-Spin Reserves
- Voltage Support
- Black Start

**UTILITY SERVICES**
- Resource Adequacy
- Distribution Deferral
- Transmission Congestion Relief
- Transmission Deferral

**CUSTOMER SERVICES**
- Time-of-Use Bill Management
- Increased PV Self-Consumption
- Demand Charge Reduction
- Backup Power

Creating access for Distributed Energy Resources to new Revenue Streams

- ESDER enables distribution connected resources to participate in the ISO market
- Allows aggregations of distribution connect resources to participate as a single market resource
- Includes resources connected behind or in front of the end-use customer meter
-Avoids having each sub-resource engaged in a direct metering relationship with the ISO
- Consistent with development of a Distribution System Operator

DER, “distributed energy resources” means distributed renewable generation resources, energy efficiency, energy storage, electric vehicles, and demand response technologies.
Switching to Electric Vehicles will reduce emissions and can help stabilize the grid

Networked EVs can provide multiple grid services

- Absorb excess generation
- Improve local power quality
- Improve grid stability
- Reduce peak power flows
- Provide emergency backup power
- Speed recovery from grid outages

Opening up compensation for these grid services will reduce the total cost of vehicle ownership and speed adoption
Using DERs instead of investing in Utility Infrastructure can:

- Save ratepayers money
- Promote competition
- Increase flexibility
- Encourage innovation
- Engage customers

**Source:** SolarCity Grid Engineering: www.solarcity.com/gridx
How might the electricity industry evolve?

DER, “distributed energy resources” means distributed renewable generation resources, energy efficiency, energy storage, electric vehicles, and demand response technologies.
Address Institutional and Policy Barriers

Regulatory and Industry Reform – Topics to address:
• Market structure and asset ownership
• Planning and operational responsibilities
• Changes to Cost of Service regulation vs Performance-based or Market-based Income
• Utility roles in providing value-added services
• Openness of utility networks
• Role of mandates vs markets
• Regulatory processes
• Coordination between energy policy agencies

✓ Regulation must encourage new entrants
✓ Regulation should “support the race, but not pick winners"
Thank you!

Questions?

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