Clean Electricity Policy Initiatives
In California (Partial)

- Wholesale Renewables:
  - Renewables Portfolio Standard
  - Feet in Tariffs (RAM & ReMAT)
  - All source procurement (under development)

- Customer Renewable Generation
  - California Solar Initiative
  - Net Energy Metering
  - Green Tariffs

- Energy Efficiency
- Demand Response
- Rate Reform
- Storage
- Retirement of OTC plants
- Zero Energy Homes
- Electric Vehicles
- Cap and Trade
California by the Numbers: RPS

IOU Progress Towards 33% Renewables, Actual and Forecasted by Year

Source: CPUC Energy Division, February 2014

- Online
- In Development (Risk Adjusted)
- Expired

RPS Obligation
Overview of Customer-Side Solar

California has supported customer renewable generation with four interrelated state policies:

- Rebates (CSI Program and SGIP)
- Net Energy Metering (NEM),
- Interconnection policies
- Rate structures (e.g. tiered rates, time of use rates)

Customer Generation Solar in California:

- 2,100+ MW installed PV at 227,000+ locations statewide
- California is over 2/3rds of nation’s solar market and nation’s largest rebate program

Other Customer Generation Technologies:

- Fuel Cells: 104 MW | Wind Turbines: 54 MW
Investor-Owned Utilities Historic & Forecasted System Average Rate Versus CPI, 2003-2019
Germany by the Numbers

• In 2013 total renewable production in Germany was 21% of total load
  – Prices were between $0.30 and $0.39 per kWh

• In 2013 total renewable production in California was 19% of total load
  – Average prices were $0.15 per kWh
Policy Risks Going Forward: Integration

The Duck Shape is Not Representative of the Entire Year
The Duck Shape is Not Representative of the Entire Year
Flatting the Duck

- Target energy efficiency to hours when ramping occurs
- Demand Response
- Electricity storage
- Electric Vehicles
- Retail ratemaking (Targeted demand charges, price signals that value flexibility)
- Retire less-flexible plants
- Manage energy inter-regionally to capitalize on diversity (EIM)
New Flexible Capacity Resource Adequacy Requirements

- **2013** – adopted methods for assessing monthly flexibility need and determining “effective flexible capacity” values for resources.
  - Need is the maximum 3-hour ramp, plus reserve (determined by CAISO study).
  - Resource must ramp and sustain energy output for 3+ hours to qualify.
  - Voluntary LSE reporting of 2014 flexible resource procurement

- **2014** – adopted 2015 flexibility need and procurement requirements
  - LSEs must demonstrate ownership or contracts with flexible RA resources for the forthcoming year

- **CAISO** is developing corresponding “must offer obligations” (MOO).
  - FRACMOO initiative to ensure that flexible RA resources make their capacity available for economic dispatch via market bids (no self-scheduling).
Unbalanced Growth in Technologies

Renewable Resource Mix, Actual and Forecasted by Year

Source: CPUC Energy Division, February 2014
Every project is ranked relative to its benefit to the State in relation to its cost.

This ranking process is called Least Cost & Best Fit (LCBF)

Least-Cost
- Integration Costs
- Energy and Capacity Costs
- Interconnection Cost

Best-Fit
- Contract Terms
- Location
- Societal (Jobs, Environment etc.)
Integrating Variable Energy Resources (VERs)

- De-ramp/Shutdown costs
- Incremental Reserve Capacity
- “Overgeneration” - Cycling Costs/Declining System Prices

Source: Energy, Environment and Economics
Addressing the Challenge

The CPUC is addressing the integration challenge in two key areas:

1. Model used for long-term system planning is being updated to account for the relative cost of integrating renewable resources as saturation levels increase
   - Determines future procurement authorizations for flexible resources
   - Informs transmission planning process at CAISO

2. The Commission-mandated methodology for comparing and selecting renewable resources by utilities’ in their annual solicitations is being updated to incorporate i) the cost of integration and ii) declining resource values
   - Dynamic versus static valuation methodology that takes into account the change in renewable penetration levels over time
   - Integration costs will change based on operational impact of increasing levels of renewables; this cost will be reflected in the relative value of a resource.
Thank you!
Back Up Slides
<table>
<thead>
<tr>
<th>RPS Programs</th>
<th>Program Size (MW)</th>
<th>Participating Buyers and Sellers</th>
<th>Eligible RPS Technologies and Project Size</th>
<th>CPUC Status</th>
<th>Market Opportunity</th>
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</thead>
<tbody>
<tr>
<td>Annual RPS RFO</td>
<td>Defined in annual procurement plan</td>
<td>3 large IOUs</td>
<td>All technologies, all sizes</td>
<td>Authorized by CPUC approval of annual RPS procurement plan</td>
<td>Annual RFO</td>
</tr>
<tr>
<td>Bilateral Contracts</td>
<td>As negotiated</td>
<td>3 large IOUs</td>
<td>All technologies, all sizes</td>
<td>Authorized by CPUC approval of annual RPS procurement plan</td>
<td>As negotiated</td>
</tr>
<tr>
<td>Feed In Tariff (AB 1969)</td>
<td>500</td>
<td>3 large IOUs</td>
<td>All technologies Up to 1.5 MW</td>
<td>Fully Implemented (D.07-07-027)</td>
<td>Contracts accepted until cap reached</td>
</tr>
<tr>
<td>Revised FIT / ReMAT (SB 32)</td>
<td>Expands AB1969 FIT to 750 MW</td>
<td>IOUs and municipal utilities</td>
<td>All technologies Up to 3 MW</td>
<td>Rules adopted last year (D.12-05-035), Full Implementation pending</td>
<td>Contracts accepted until cap reached</td>
</tr>
<tr>
<td>RAM</td>
<td>1,299</td>
<td>3 large IOUs</td>
<td>All technologies 3 MW to 20 MW</td>
<td>Fully Implemented (D.10-12-048)</td>
<td>RAM4: June 2013</td>
</tr>
<tr>
<td>SCE Solar PV Program (SPVP)</td>
<td>250</td>
<td>125 MW UOG 125 MW IPP</td>
<td>Solar PV (Primarily rooftop 1-2 MW)</td>
<td>Fully Implemented (D.09-06-049, Resolution E-4299)</td>
<td>1 auction per year</td>
</tr>
<tr>
<td>PG&amp;E Solar PV Program</td>
<td>500</td>
<td>250 MW UOG 250 MW IPP</td>
<td>Solar (Primarily ground-mount 1-20 MW)</td>
<td>Fully Implemented (D.10-04-052, Resolution E-4368)</td>
<td>1 auction per year</td>
</tr>
<tr>
<td>SDG&amp;E Solar PV Program</td>
<td>26 MW</td>
<td>26 MW UOG</td>
<td>Solar PV Primarily ground-mount 1-5 MW</td>
<td>Fully implemented (D.10-09-016, Approved AL 2210-E)</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Overgeneration is the Most Significant Integration Challenge

+ Chart shows increasing overgeneration above 33%
  - Overgeneration is very high on some days under the 50% Large Solar case
  - Fossil generation is reduced to minimum levels needed for reliability

+ Renewable curtailment is a critical strategy to maintain reliability
  - Reduces overgeneration
  - Mitigates ramping events