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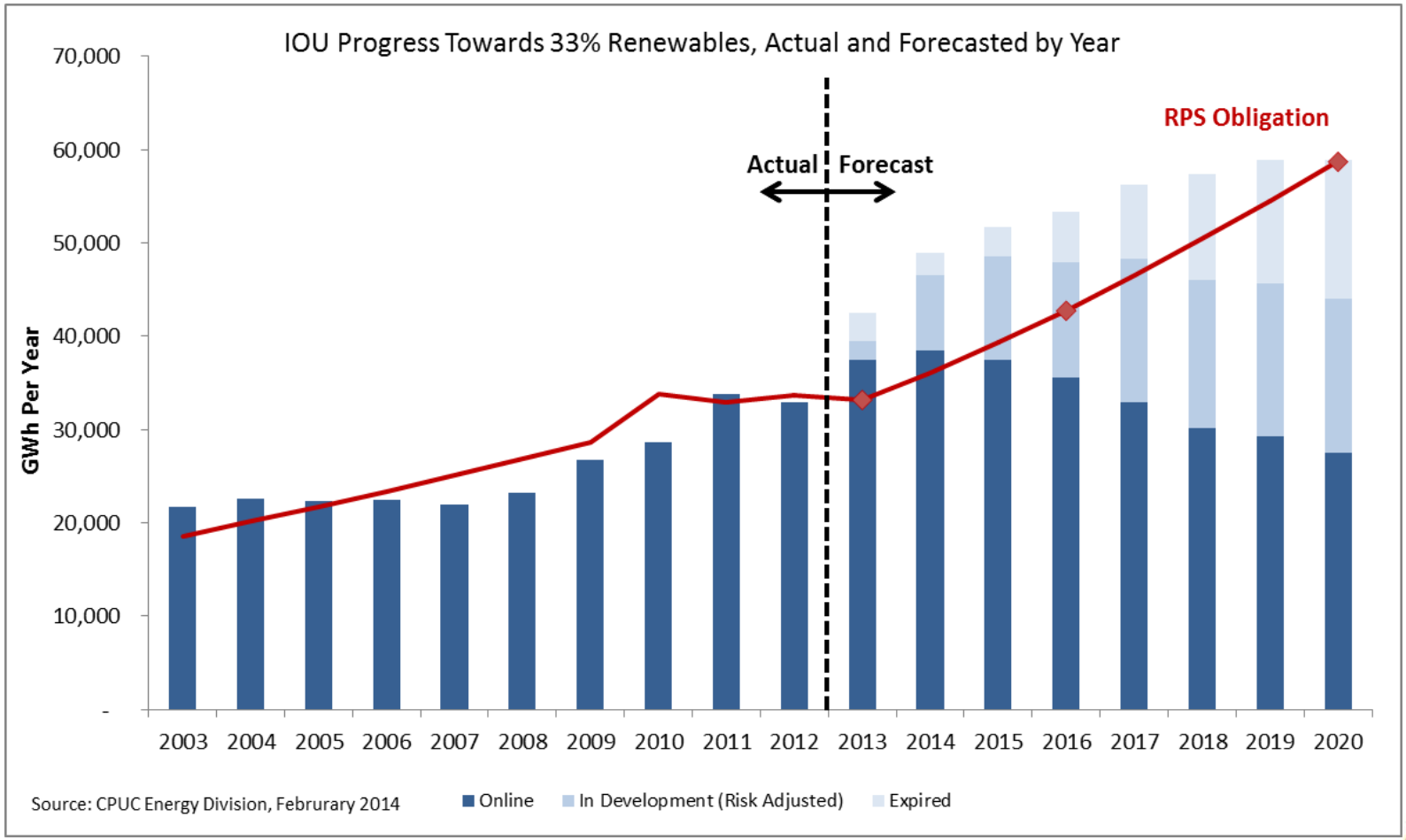
Clean Electricity Policy Initiatives In California (Partial)

- **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



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

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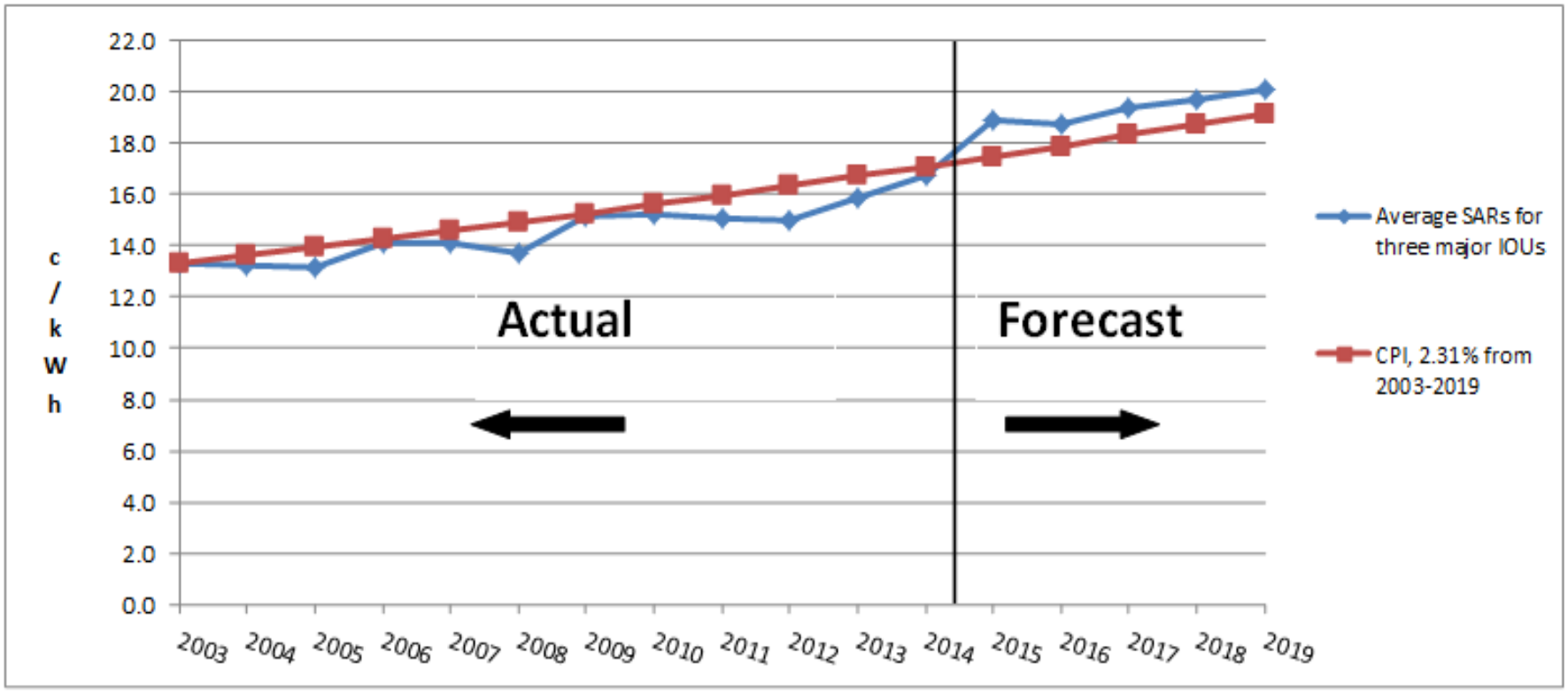
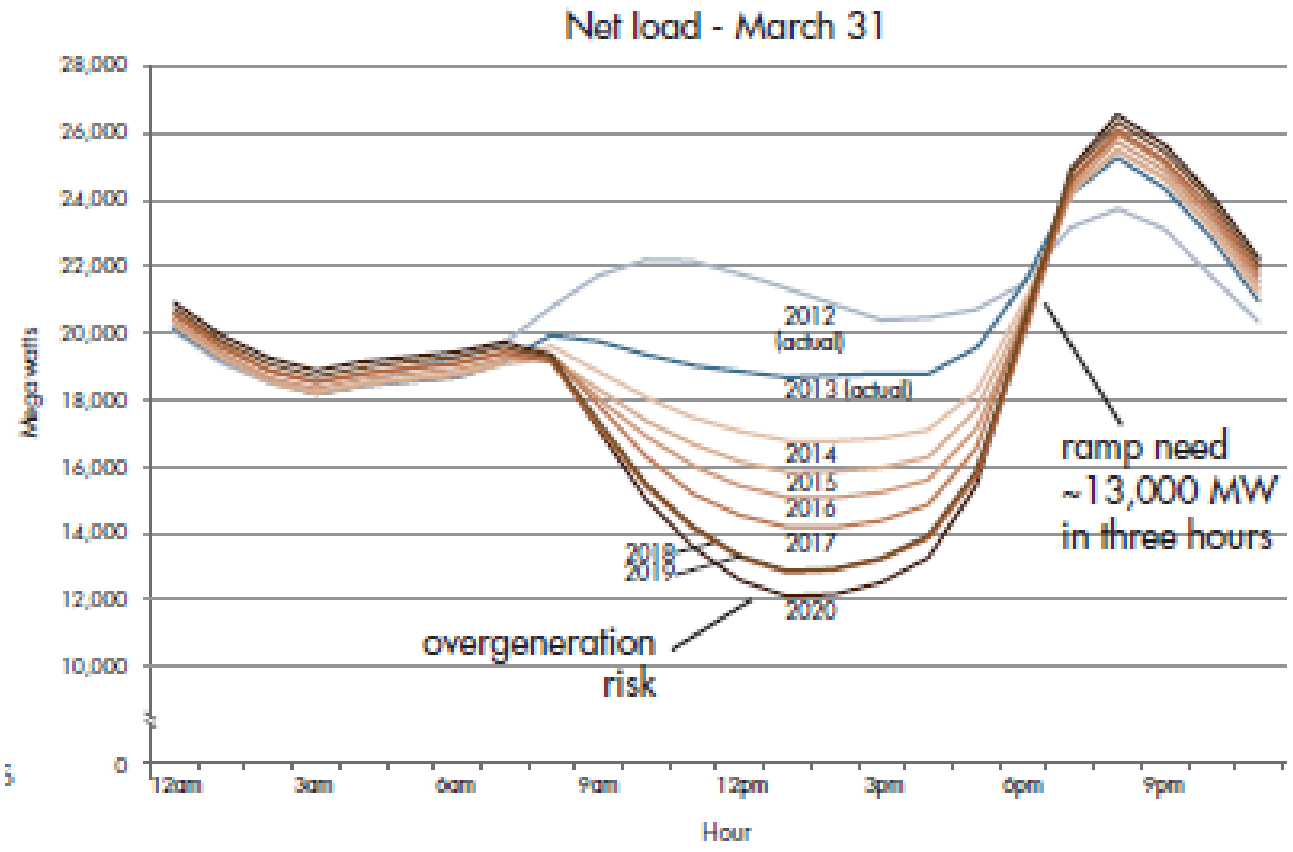
Investor-Owned Utilities Historic & Forecasted System Average Rate Versus CPI, 2003-2019



Germany by the Numbers

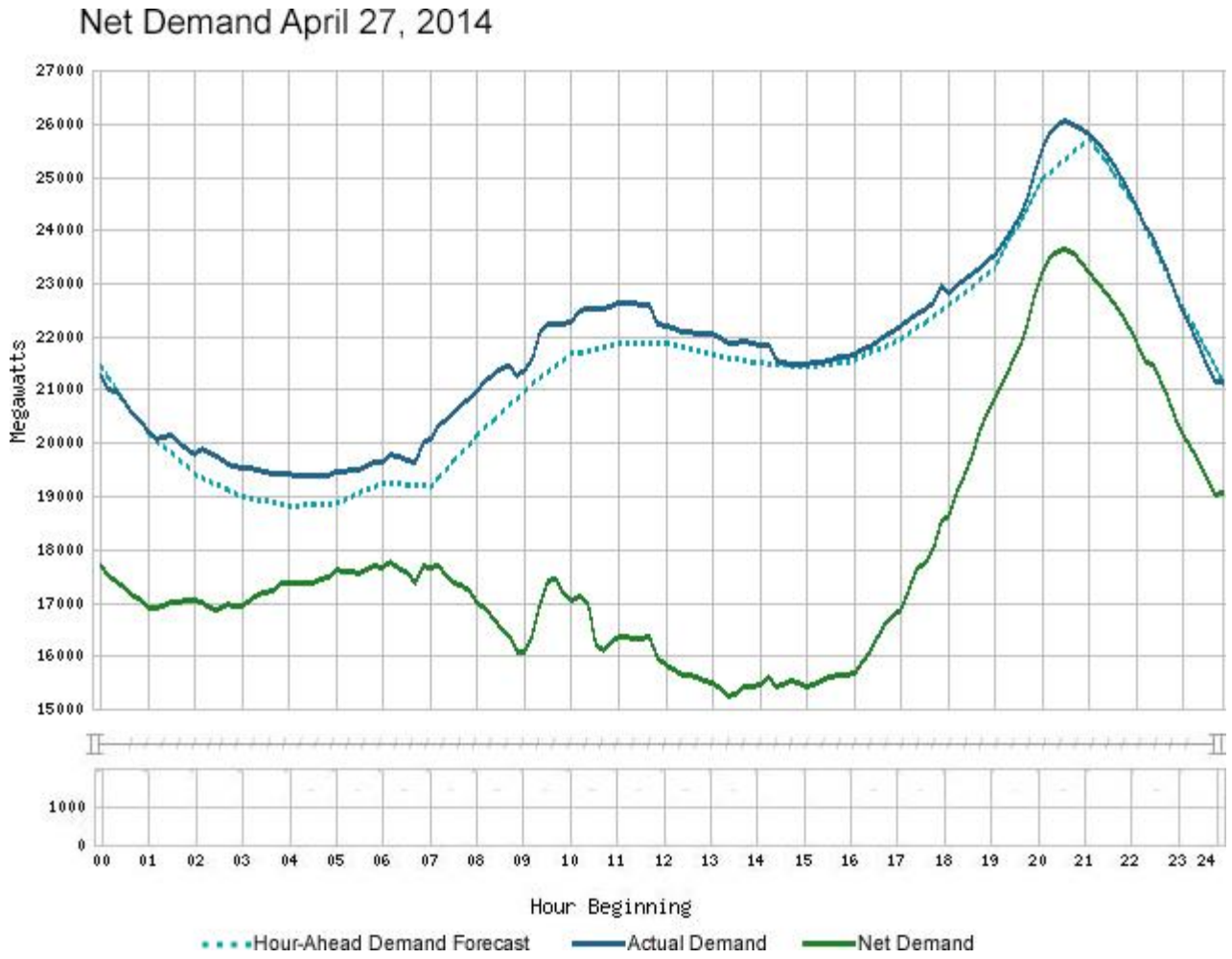
- In 2013 total renewable production in Germany was 21% of total load
  - Prices were between $0.30 and $0.39 per kWh
- In 2013 total renewable production in California was 19% of total load
  - Average prices were $0.15 per kWh

Policy Risks Going Forward: Integration



Note scale on Y-axis is not contiguous. The CAISO "Duck Chart" is available at www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf.

The Duck Shape is Not Representative of the Entire Year



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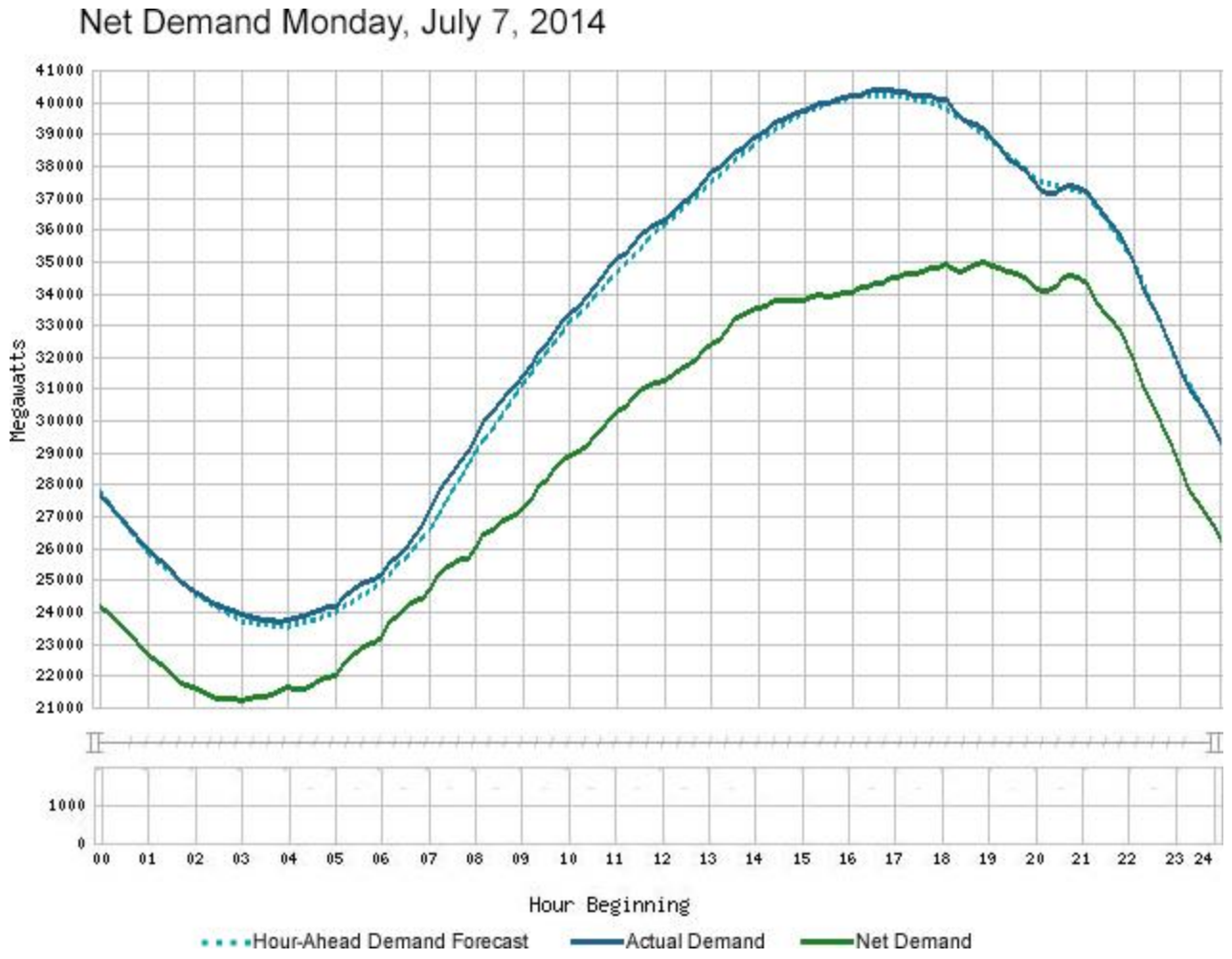


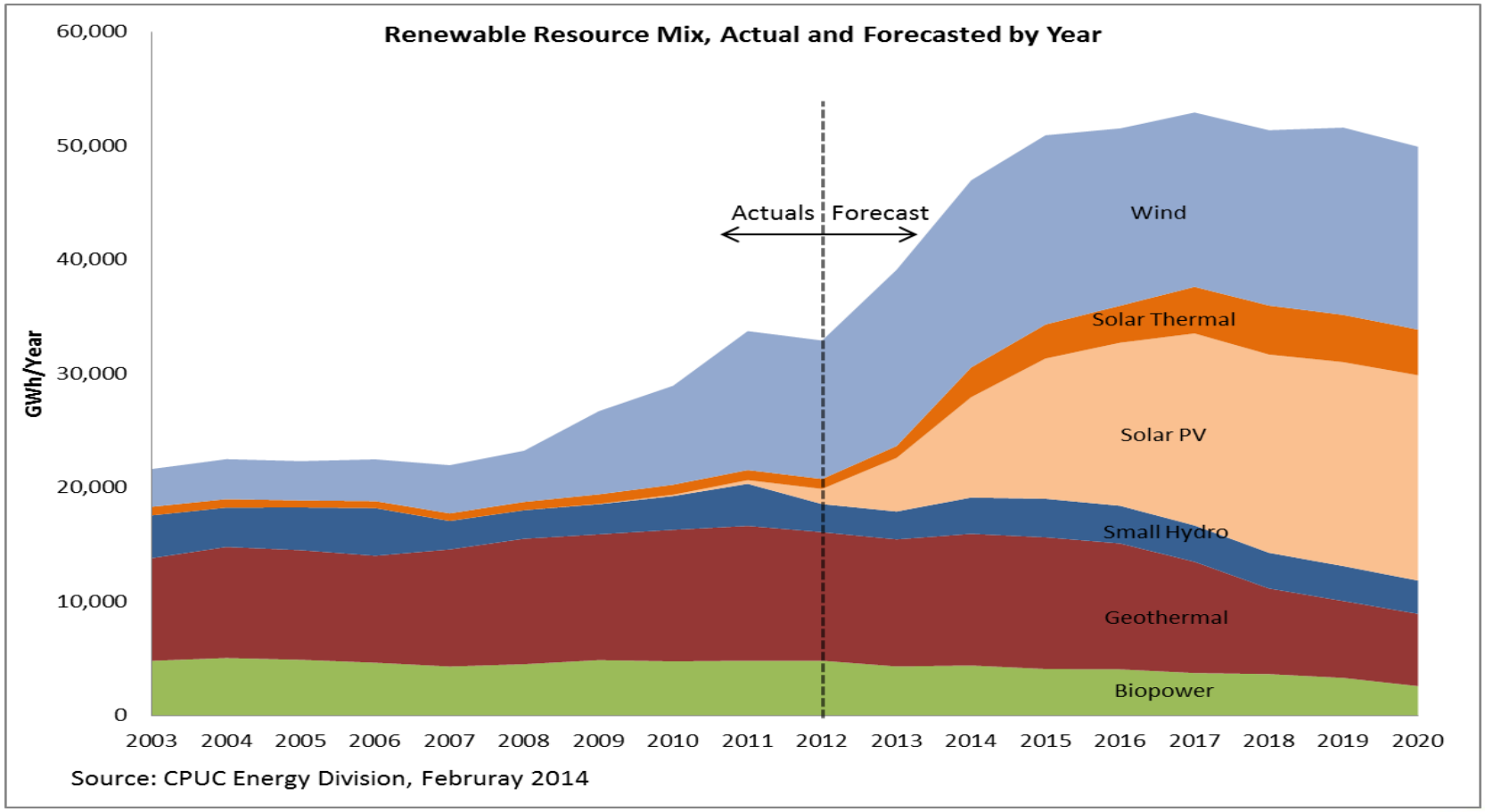
Flatting the Duck

- 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).

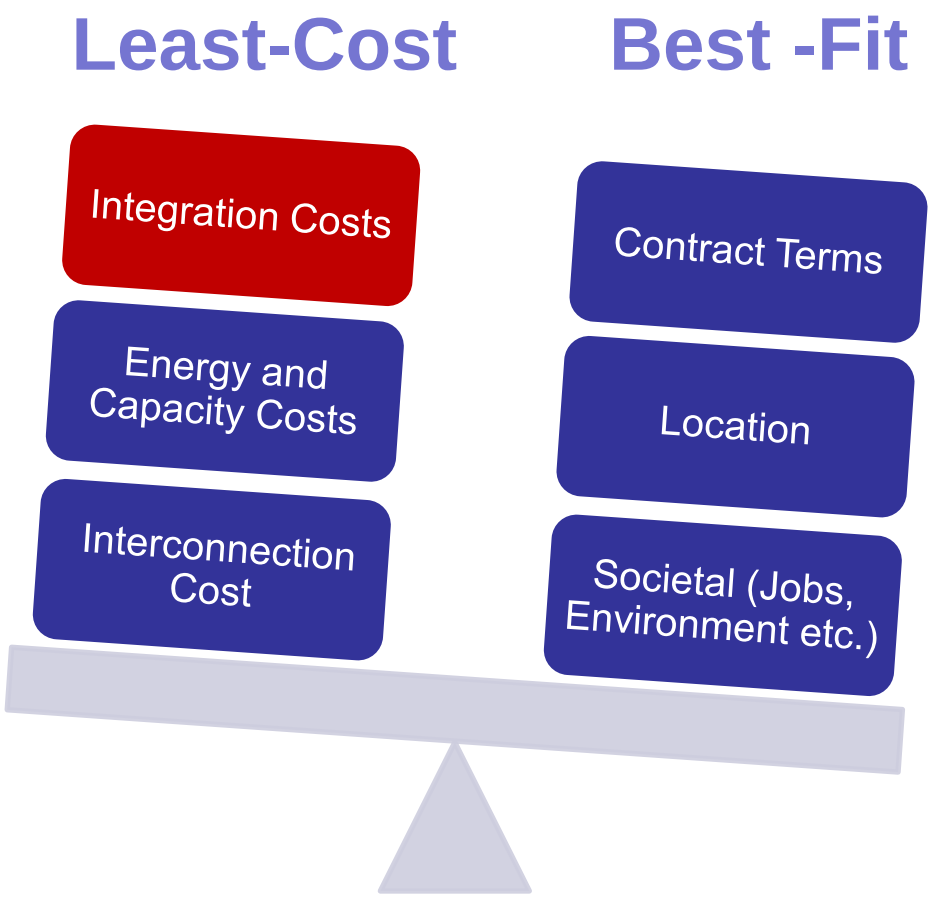
Unbalanced Growth in Technologies



Ranking Renewables – Cost/Benefit Analysis

Every project is ranked relative to its benefit to the State in relation to its cost

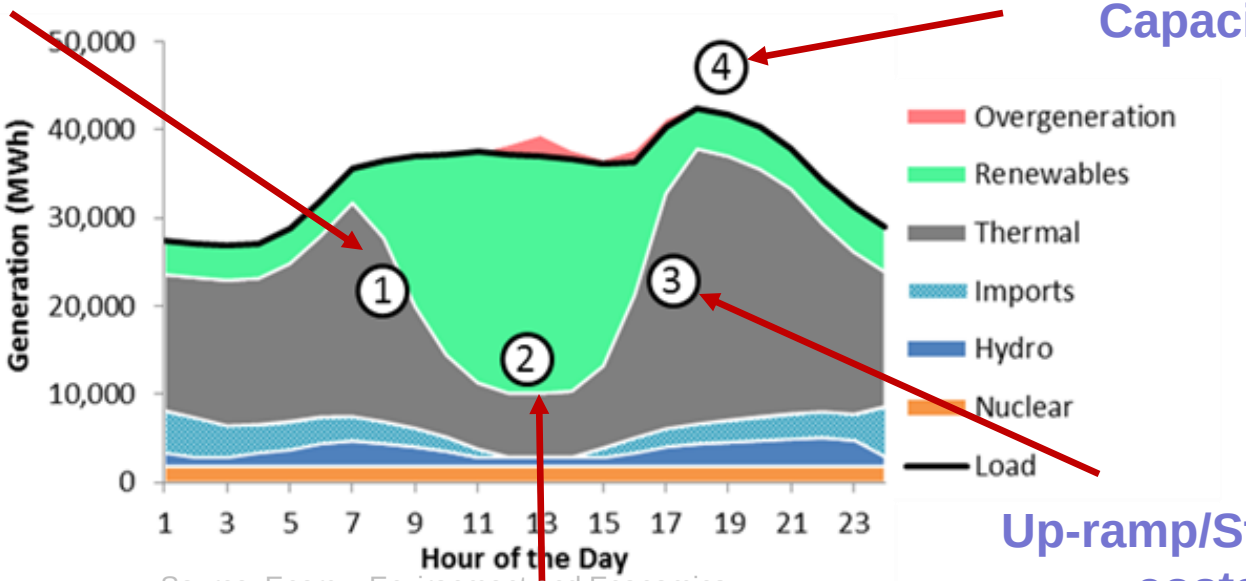
This ranking process is called Least Cost & Best Fit (LCBF)



Integrating Variable Energy Resources (VERs)

De-ramp/Shutdown costs

Incremental Reserve Capacity



Source: Energy, Environment and Economics

Up-ramp/Start-up costs

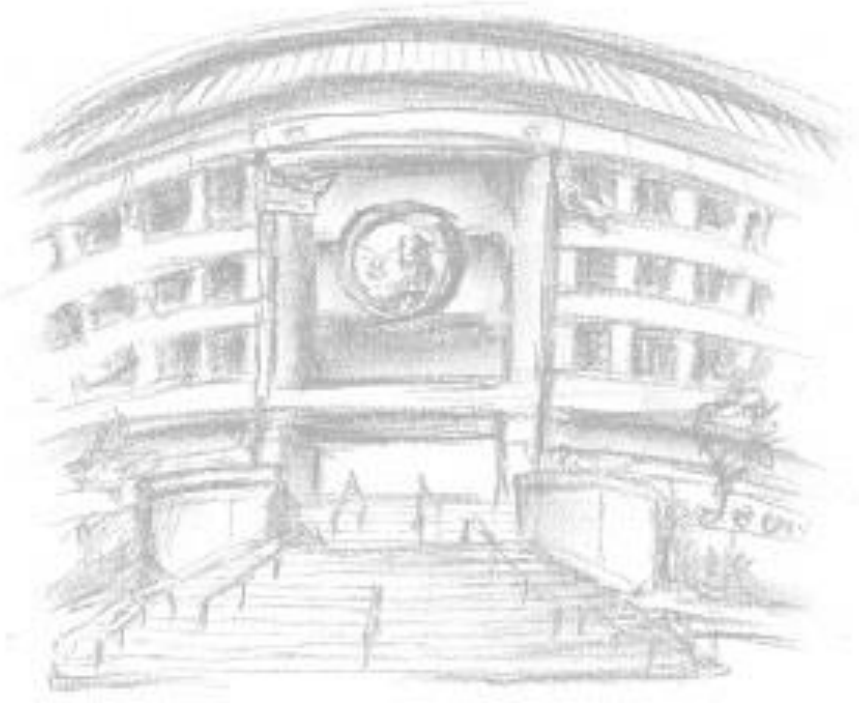
"Overgeneration" - Cycling Costs/Declining System Prices

Addressing the Challenge

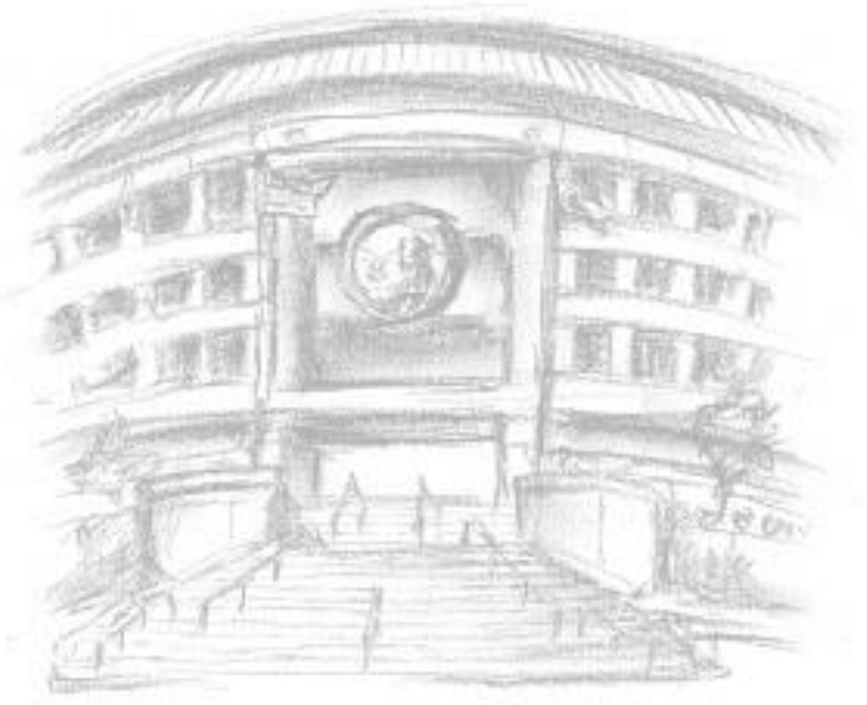
- **The CPUC is addressing the integration challenge in two key areas:**

  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



RPS Programs

	Program Size (MW)	Participating Buyers and Sellers	Eligible RPS Technologies and Project Size	CPUC Status	Market Opportunity
Annual RPS RFO	Defined in annual procurement plan	3 large IOUs	All technologies, all sizes	Authorized by CPUC approval of annual RPS procurement plan	Annual RFO
Bilateral Contracts	As negotiated	3 large IOUs	All technologies, all sizes	Authorized by CPUC approval of annual RPS procurement plan	As negotiated
Feed In Tariff (AB 1969)	500	3 large IOUs	All technologies Up to 1.5 MW	Fully Implemented (D.07-07-027)	Contracts accepted until cap reached
Revised FIT / ReMAT (SB 32)	Expands AB1969 FIT to 750 MW	IOUs and municipal utilities	All technologies Up to 3 MW	Rules adopted last year (D.12-05-035), Full Implementation pending	Contracts accepted until cap reached
RAM	**1,299**	**3 large IOUs**	**All technologies 3 MW to 20 MW**	**Fully Implemented (D.10-12-048)**	**RAM4: June 2013**
SCE Solar PV Program (SPVP)	250	125 MW UOG 125 MW IPP	Solar PV (Primarily rooftop 1-2 MW)	Fully Implemented (D.09-06-049, Resolution E-4299)	1 auction per year
PG&E Solar PV Program	500	250 MW UOG 250 MW IPP	Solar (Primarily ground-mount 1-20 MW)	Fully Implemented (D.10-04-052, Resolution E-4368)	1 auction per year
SDG&E Solar PV Program	26 MW	26 MW UOG	Solar PV Primarily ground-mount 1-5 MW	Fully implemented (D.10-09-016, Approved AL 2210-E)	n/a

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

Example April Day