California's Renewables Portfolio Standard
Progress & Challenges

5th Eilat-Eilot Renewable Energy Conference
International Perspective on Renewable Energy Panel

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Arthur L. Haubenstock

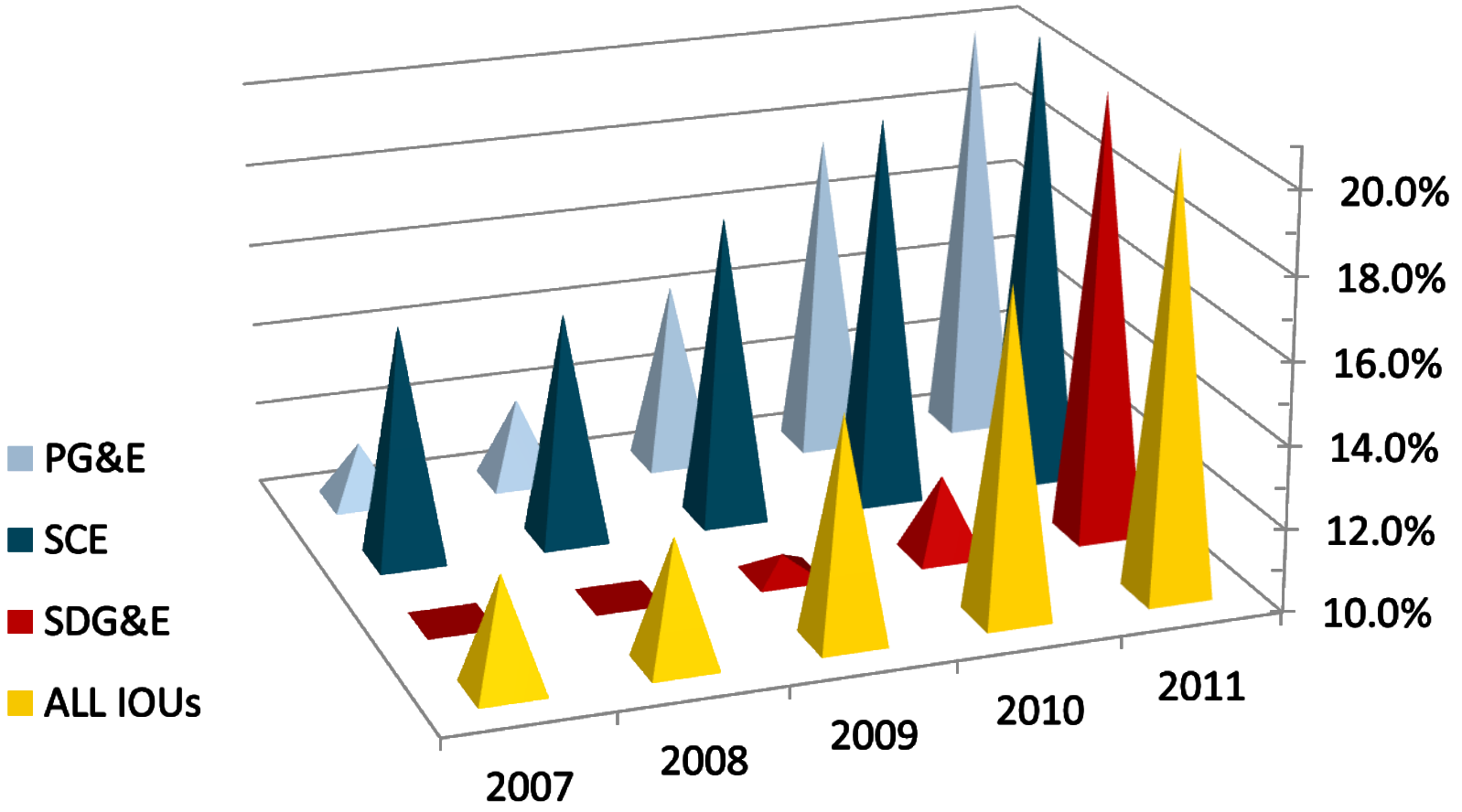
Perkins Coie

California Renewables Portfolio Standard

Evolution of the California RPS:

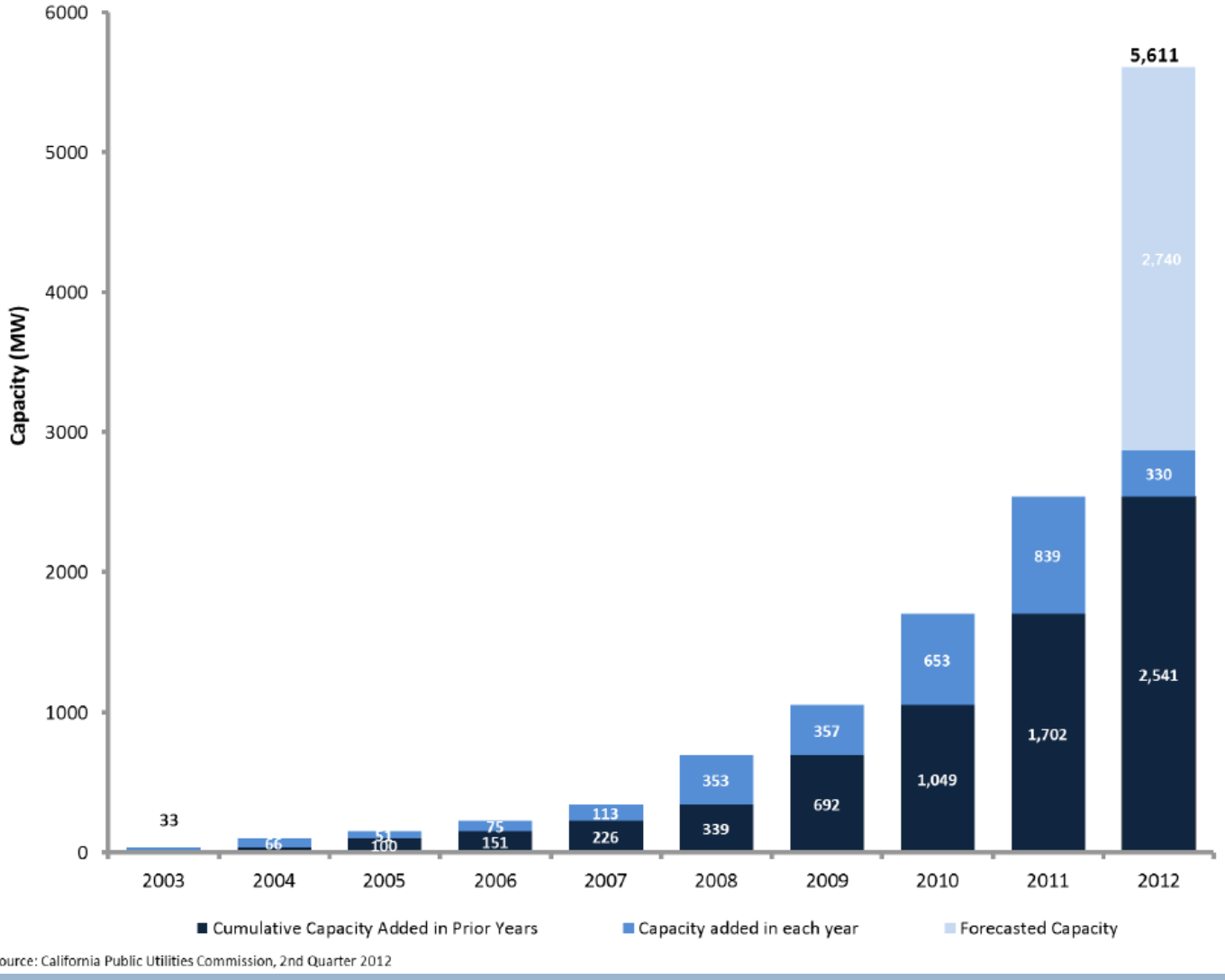
- 2002: SB 1078 establishes 20% RPS, to be achieved by 2017
- 2003: Energy Action Plan establishes goal of 20% RPS by 2010
- 2005: Energy Action Plan considers 33% RPS by 2020
- 2006: SB 107 codifies 20% RPS by 2010 into law
- 2008: Gov. Schwarzenegger issues Executive Order establishing goal of 33% RPS by 2020
- 2009: Gov. Schwarzenegger issues Executive Order requiring 33% RPS by 2020 under AB 32, California's GHG law
- 2011: SB 2 sets 20% RPS by 2013, and sets 33% RPS by 2020

Progress Towards 20% RPS

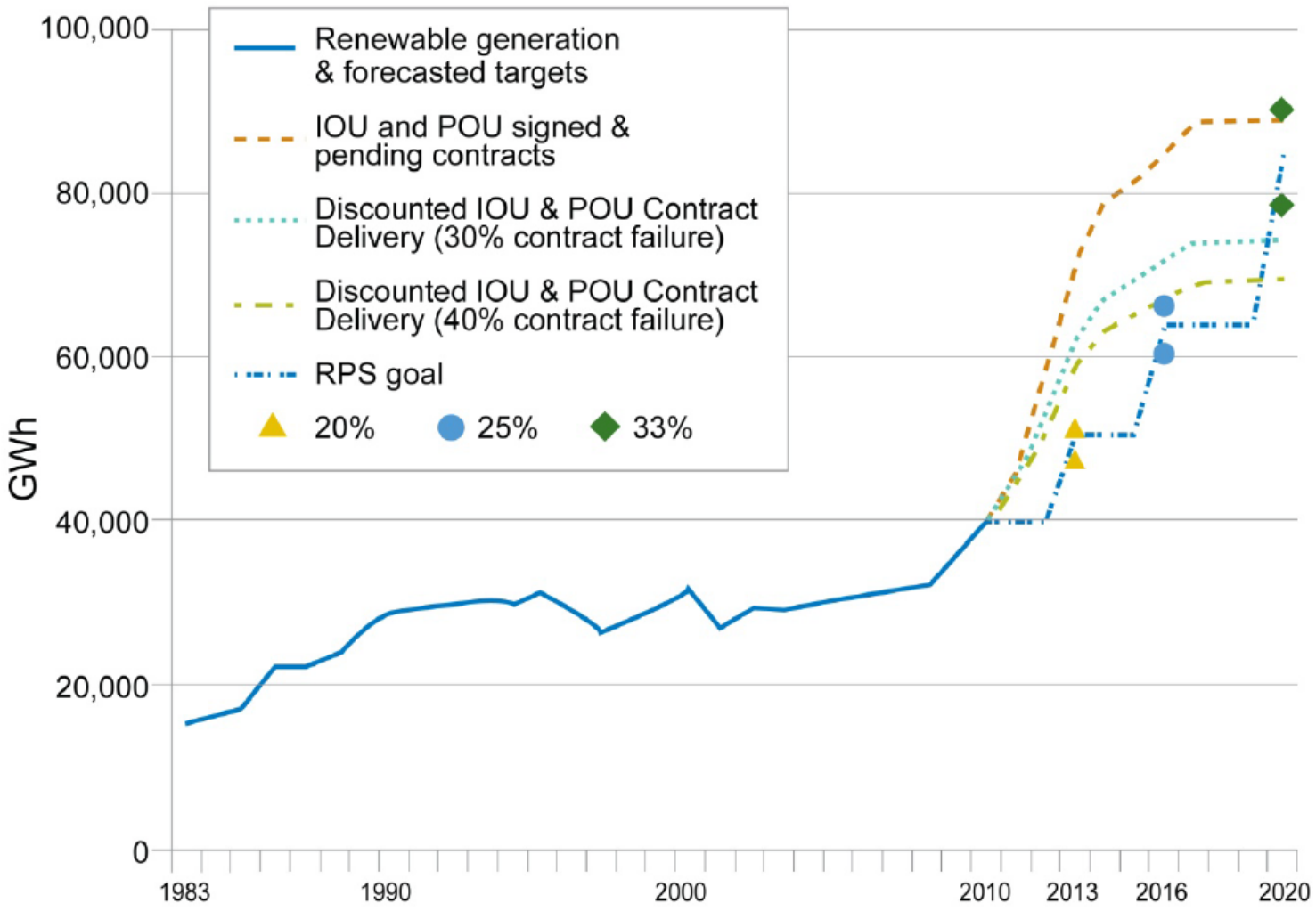


California Public Utilities Commission, Reports to the Legislature, 2008-2012

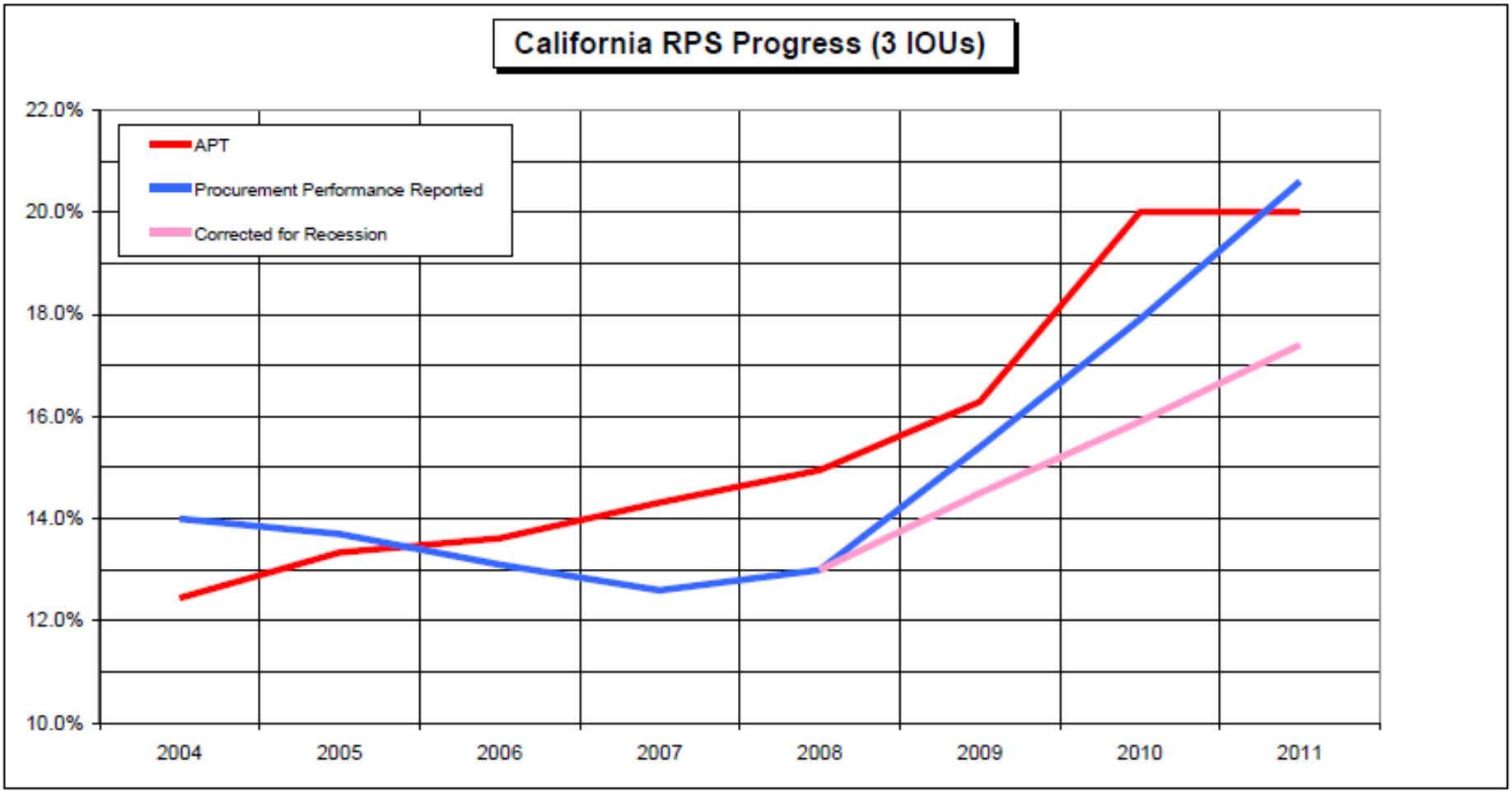
California Installed RPS Capacity



Progress Towards 33% RPS



RPS Progress – Adjusted for Recession



Gregg Morris, Green Power Institute, Nov. 2012

Need & Opportunity to Correct Course

- **Transmission:**
  - Will we have the ability to reach renewable resource areas and reliably deliver from diverse areas?
- **Energy Supply:**
  - Will we have the right mix of resources?
- **Permitting:**
  - Will we be able to permit large renewable energy and transmission projects on time, and with less controversy and litigation?

Progress on Transmission for RPS

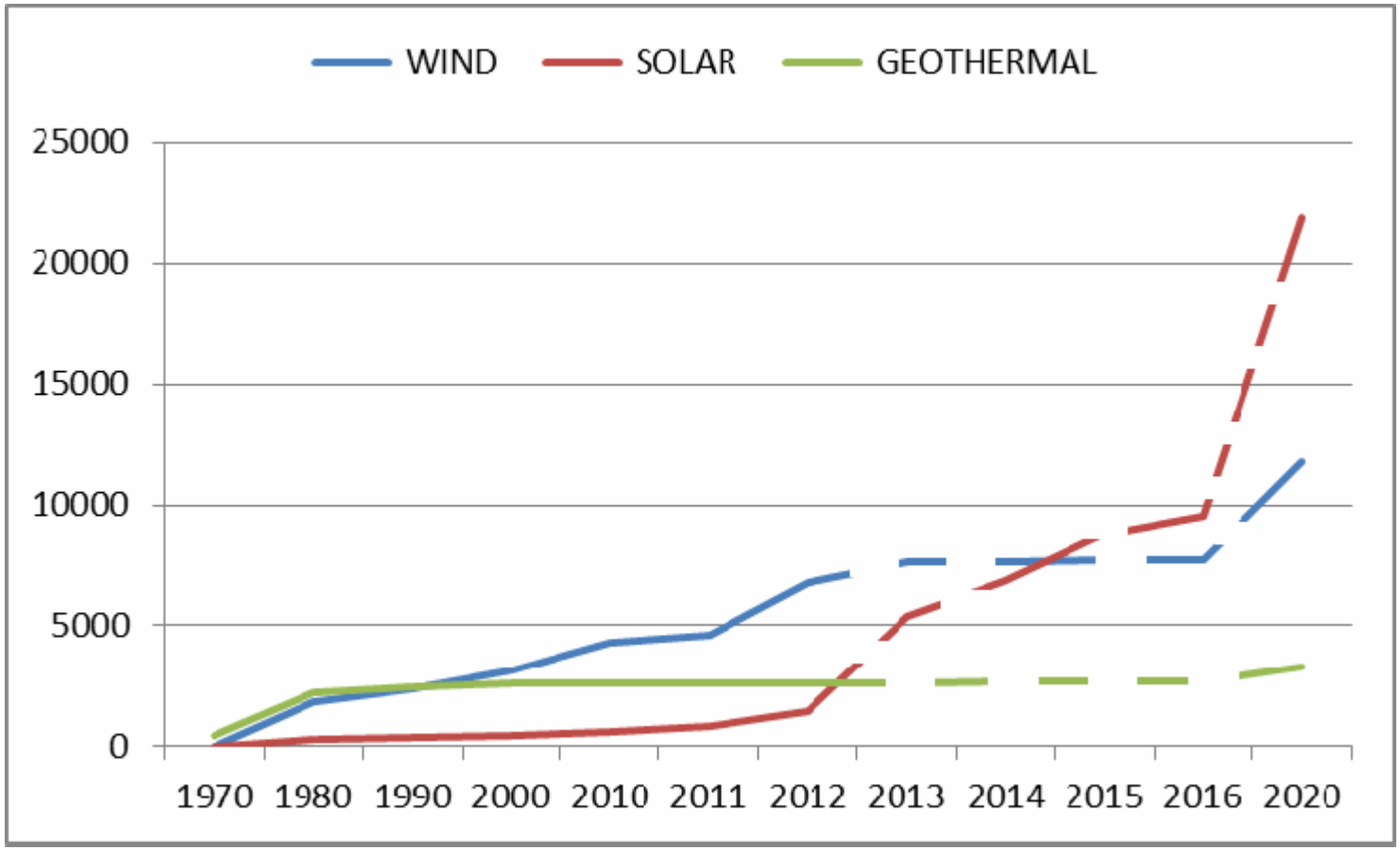
Transmission upgrade	Status		Renewable Potential		Expected Online
	ISO	CPUC	MW	TWh/Yr	
1 Carrizo-Midway	Pending LGIA	Not yet filed	900	2.1	2012
2 Sunrise Powerlink	Approved	Under construction	1,700	4.1	2012
3 Eldorado-Ivanpah	LGIA	Pre-construction	1,400	3.6	2013
4 Pisgah-Lugo	LGIA	Not yet filed*	1,750	4.1	2017
5 Valley-Colorado River	Approved	Approved•	4,700	8.6	2013
6 West of Devers	LGIA	Not yet filed			2018
7 Tehachapi	Approved	Under construction	4,500	15.2	2015
8 Tehachapi Wind/Solar Diversity	N/A	N/A	1,000	3.0	2015
9 Cool Water-Lugo	LGIA	Not yet filed	600	1.4	2018
10 South Contra Costa	LGIA	Not yet filed	300	0.8	2015
11 Borden-Gregg	LGIA	Not yet filed	800	2.0	2015
12 Path 42	Approved	Not yet filed	1,400	3.5	2015
Other-Outside of ISO Grid	N/A	N/A	3,300	8.4	
		Total:	**22,350**	**56.8**	
TWh/year needed in ISO area to meet 33% goal:				**44**	

* Large Generator Interconnection Agreement
• Petition to modify CPCN pending.

California Clean Energy Future, Dec. 2011

RPS Generation Mix

MW



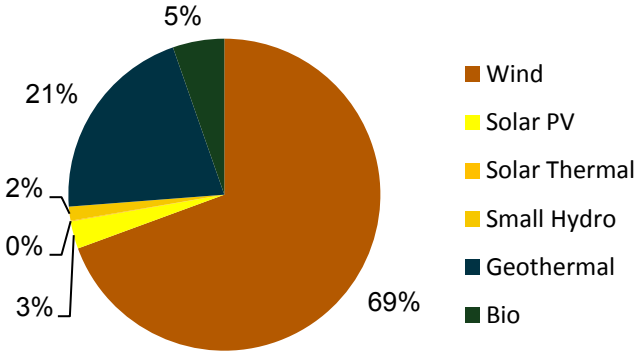
Center for Energy Efficiency & Renewable Technology (CEERT), Oct. 2012

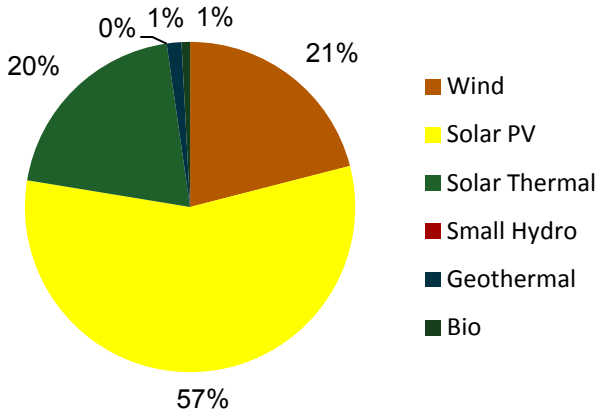
RPS Generation Mix

Approved, Operating Projects

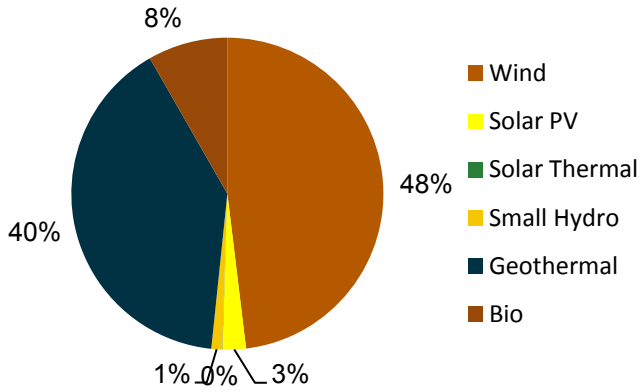
In Development & Pending

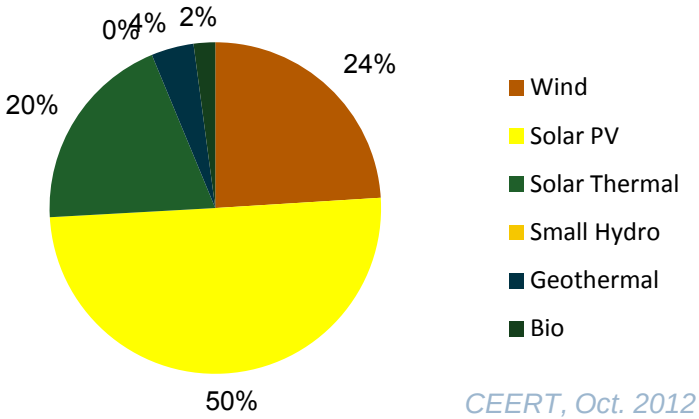
MW





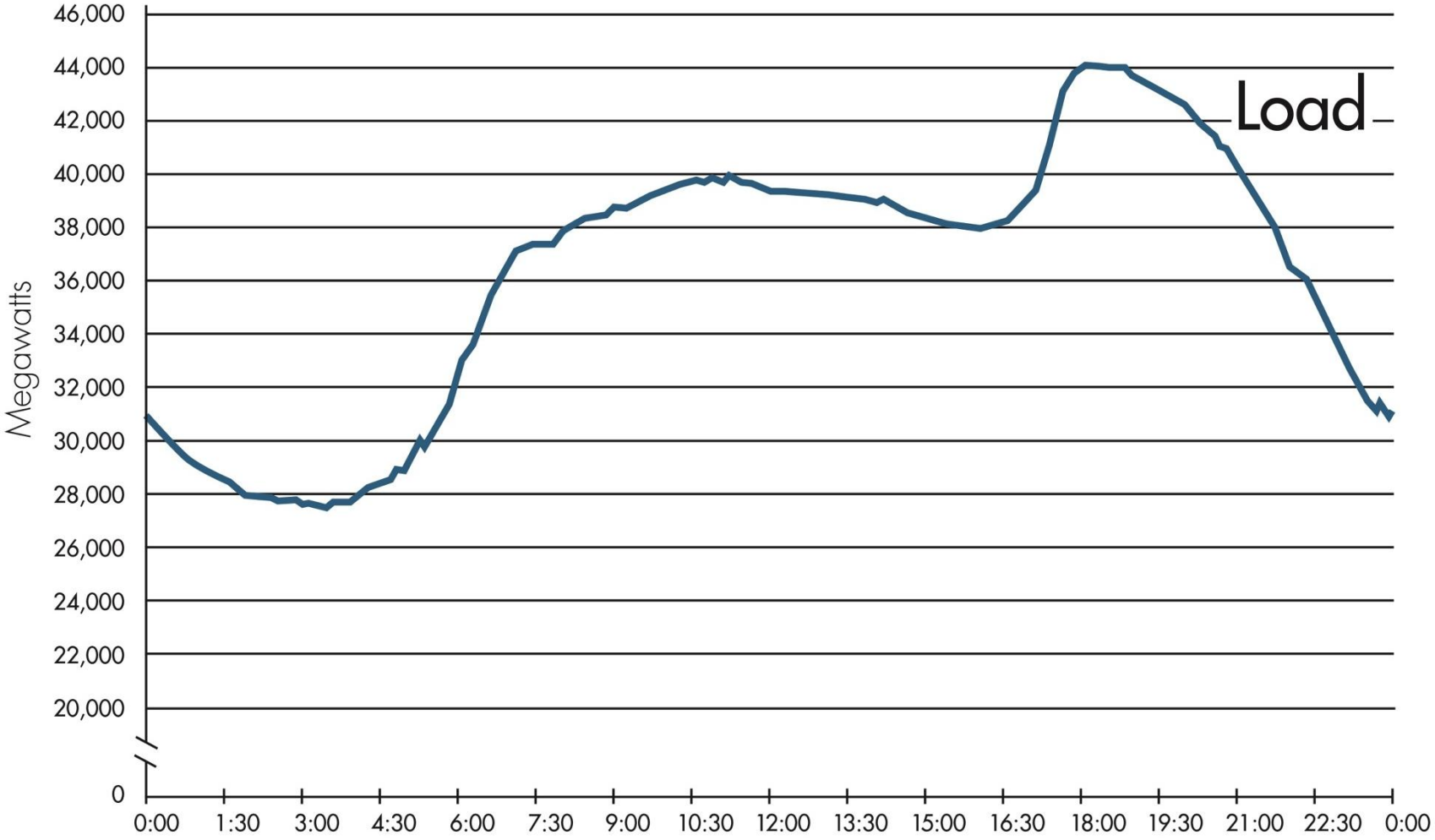
Energy



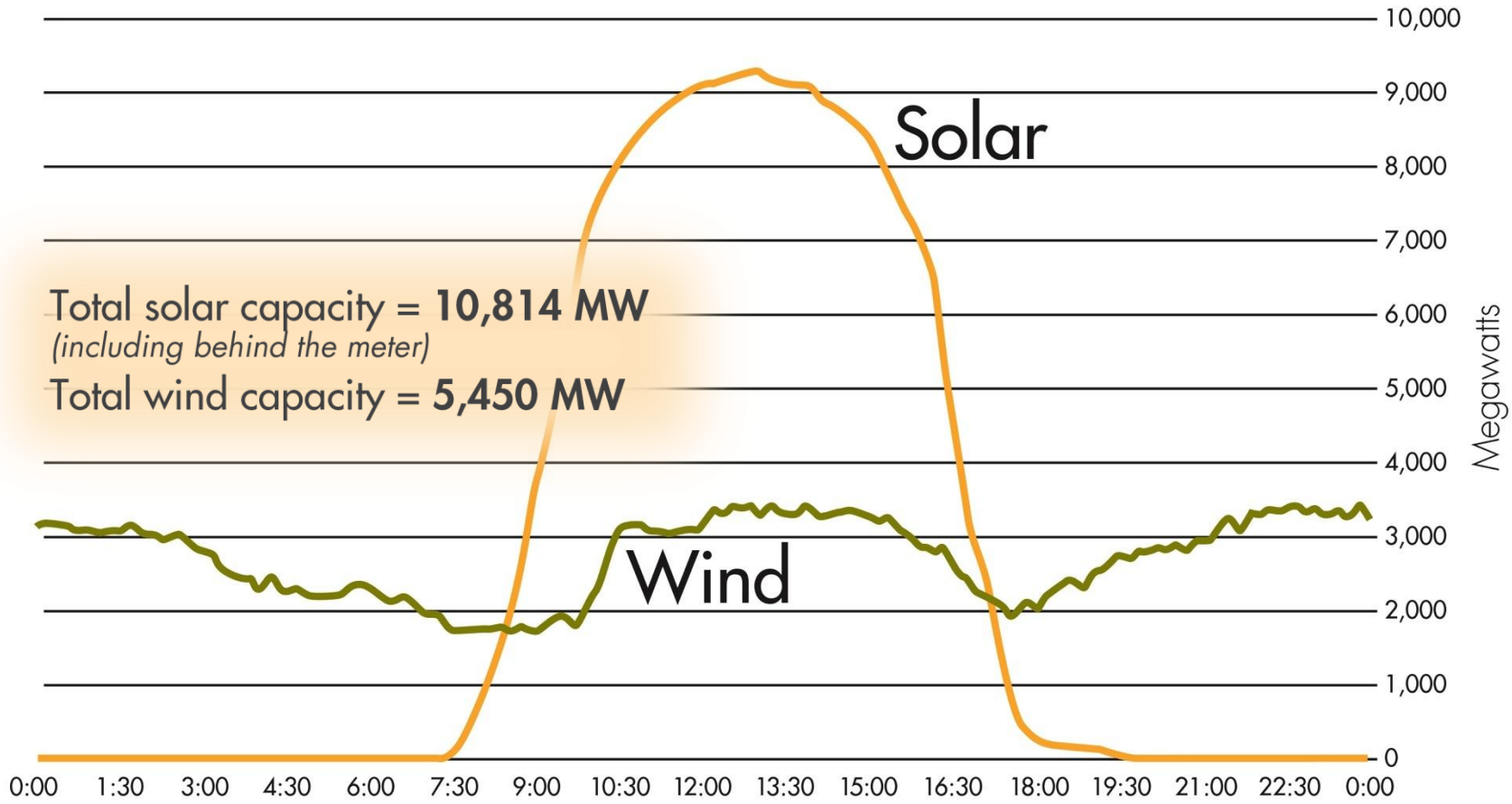


CEERT, Oct. 2012

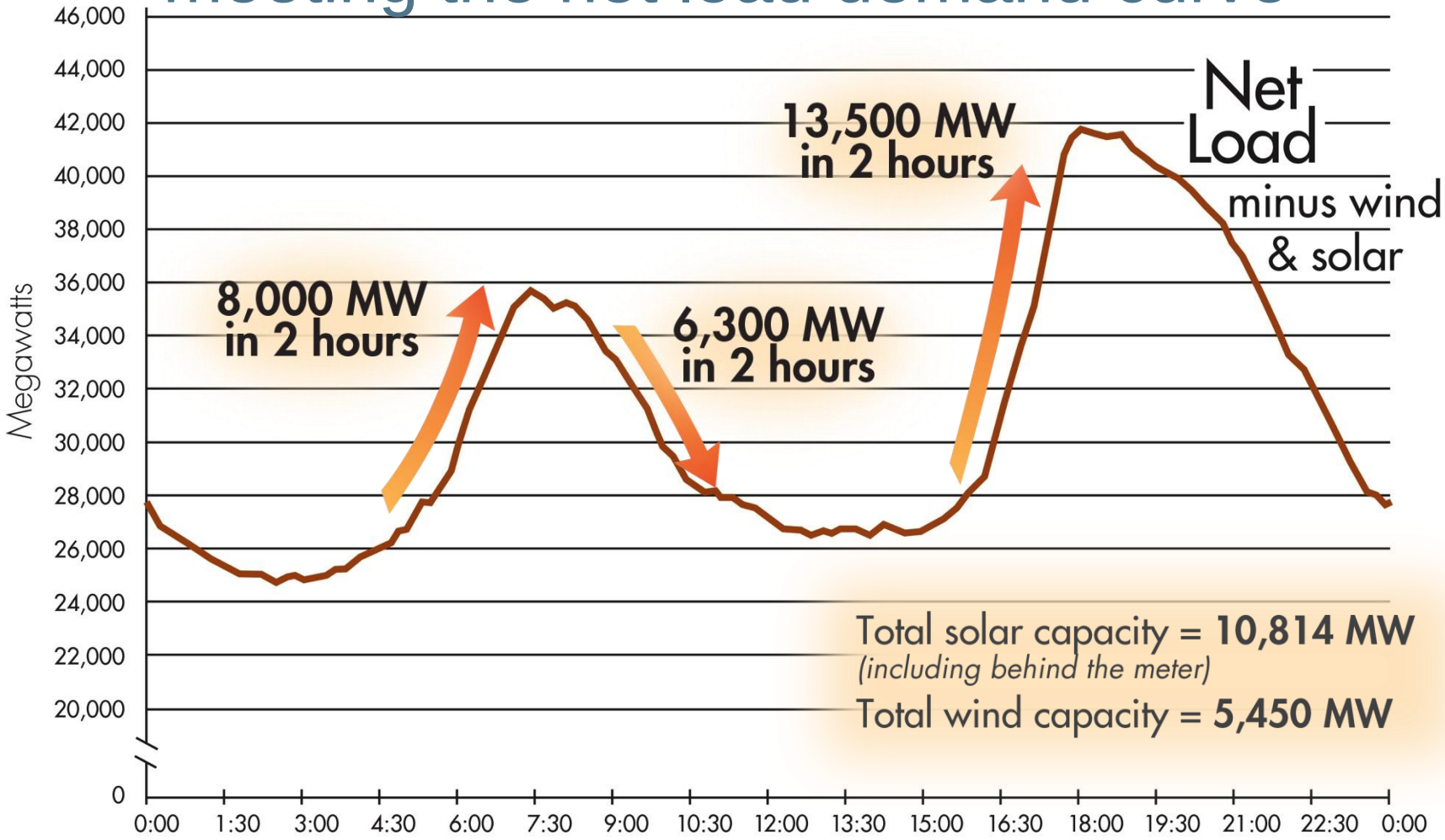
Load profile — sample winter day in 2020



Wind & solar profiles — sample winter day in 2020

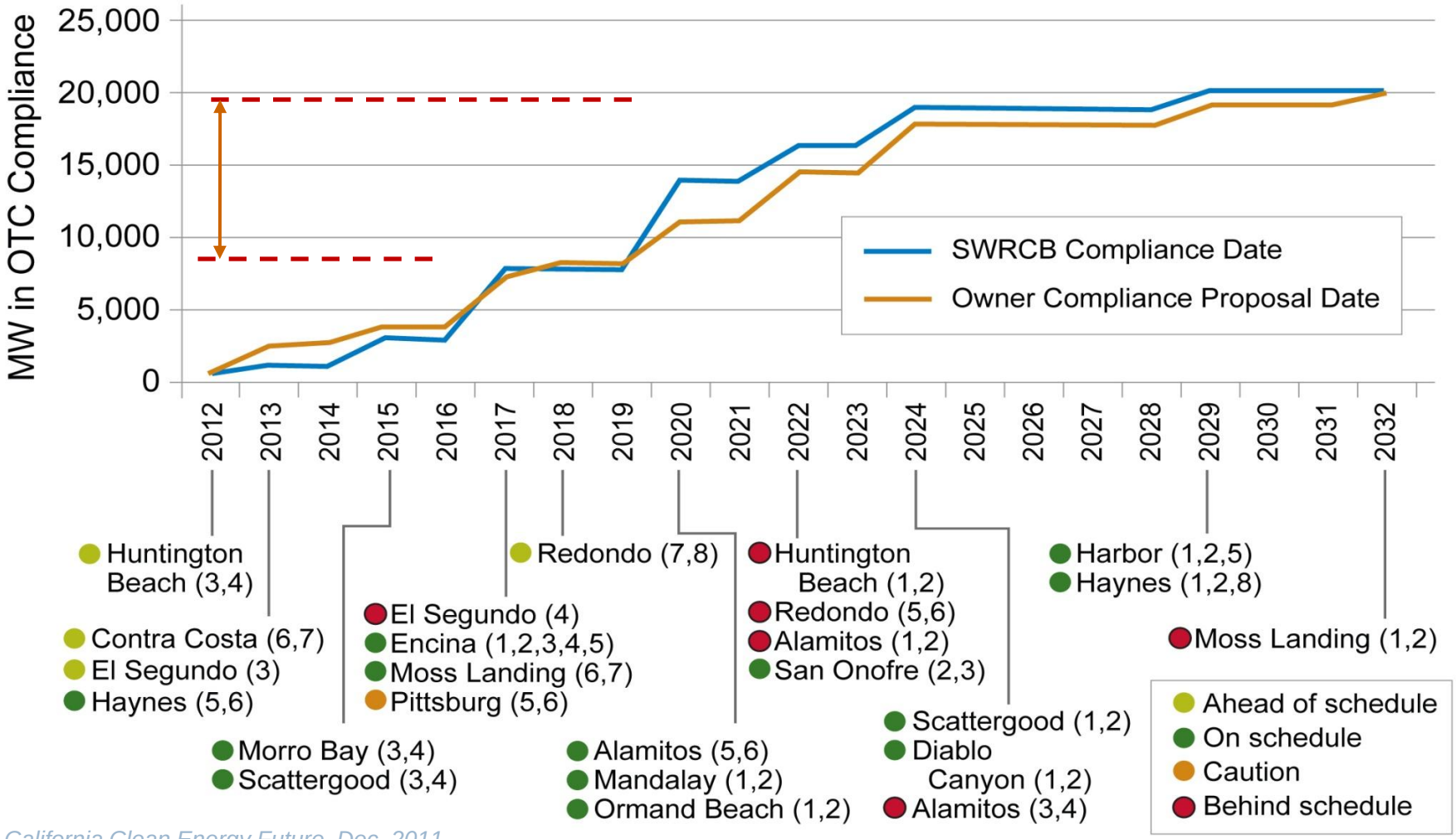


Flexible resources will be essential to meeting the net load demand curve

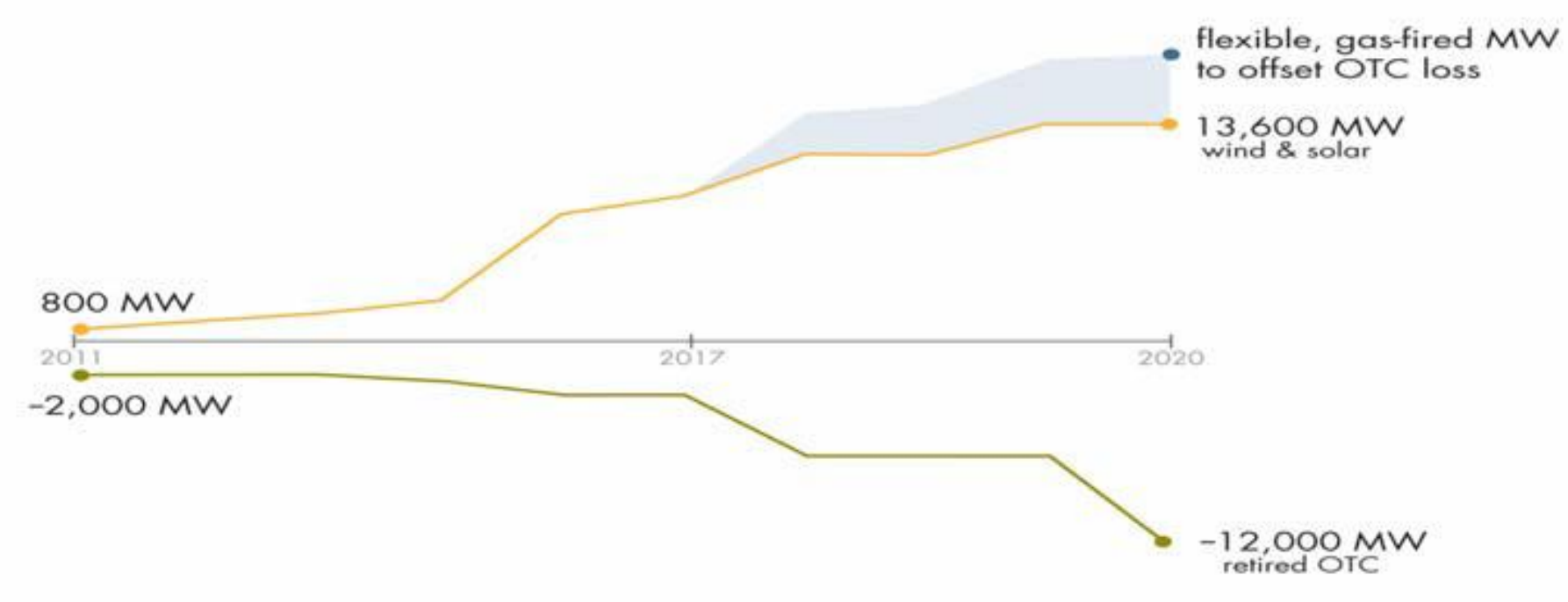


Sample winter day in 2020

Once-Through-Cooling Phase-out Compliance



Growing Need Flexible for Capacity



California Independent System Operator Corporation (CAISO), July 2012

Assessing Existing & Future Fleet

Generator Characteristics:

- Ramp rates (not all of existing fleet can efficiently ramp over range)
- Startup, Minimum & Maximum run times
- Power Qualities of Synchronous Generators:
  - Reactive power support
  - Dynamic voltage support
  - Voltage control
  - Inertia response
  - Primary frequency control
  - Frequency and voltage ride-through

Preliminary Conclusions:

- “Flexibility contributions differ between technologies, and within technologies”
- “The sum of flexibility requirements, rather than a single individual requirement, could be the binding factor”

Flexible, Dispatchable Renewables: Solar Thermal with Storage

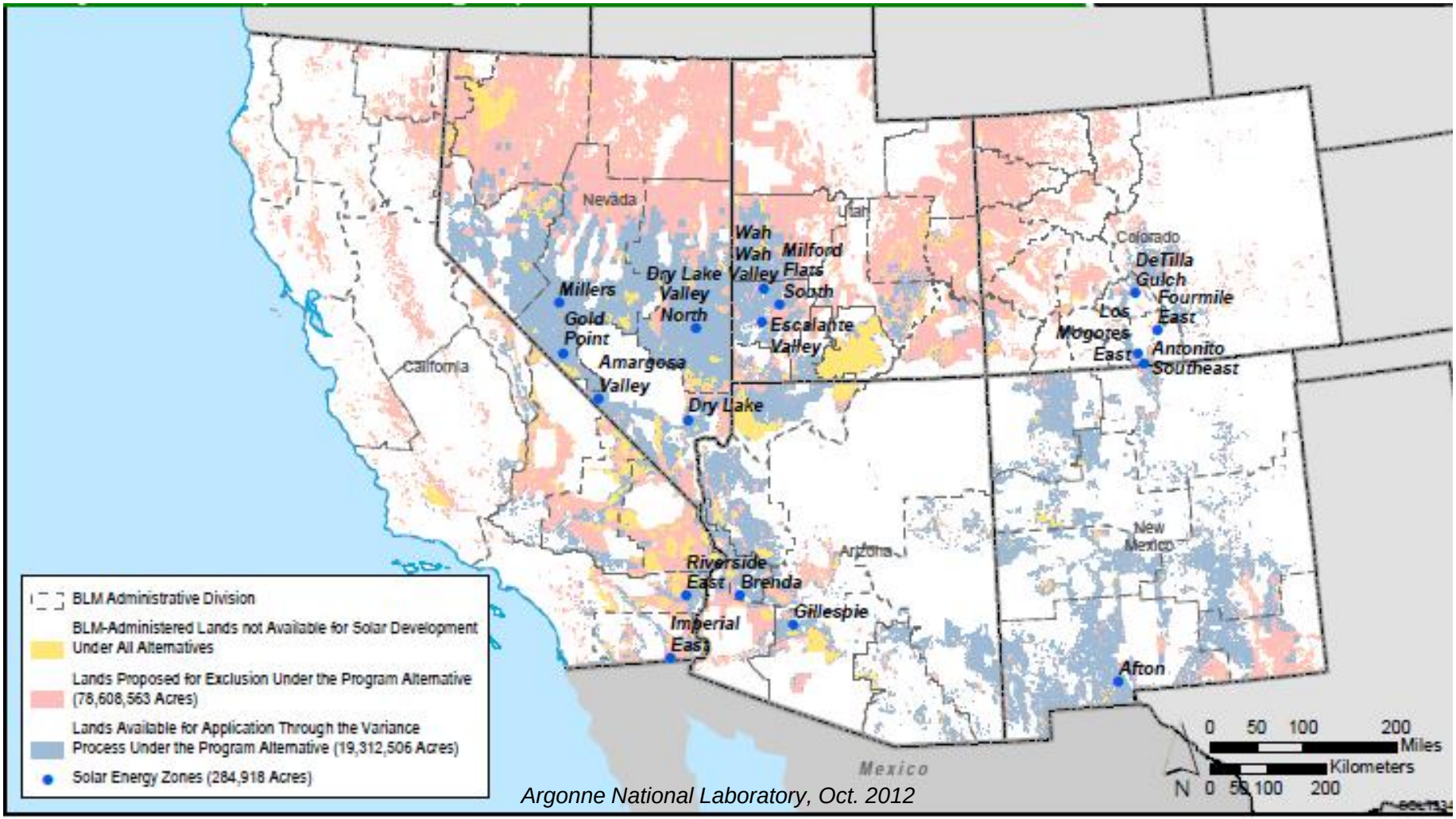
- Dispatchability against wholesale energy market prices
- Provision of Regulation and Spinning Reserves
- Increased and sustained Resource Adequacy Value
- As grid capacity needs change, stored thermal energy can follow
- Reduced system integration costs
- Improved GHG emissions, with dispatchable clean energy displacing cycling conventional back-up
- Other reliability & emissions benefits, such as:
  - Provision of frequency response without dumping solar energy
  - Reduction in criteria air pollutants

Solar Programmatic Environmental Impact Statement (Solar PEIS)

Solar development plan on Federal Lands in six western states (Arizona, California, Colorado, Nevada, New Mexico and Utah)

- **Establishes priority Solar Energy Zones (SEZs):**
  - 17 SEZs, covering 285,000 acres
  - Transmission and permitting incentives (building on progress made with federal stimulus projects)
- **"Variance" lands:**
  - 19 million acres available for development outside of SEZs
- **Exclusion Areas:**
  - 79 million acres (protected wilderness, slope > 5%, insolation < 6.5 kWh/m2/day)
- **"Pending projects" grandfathered**

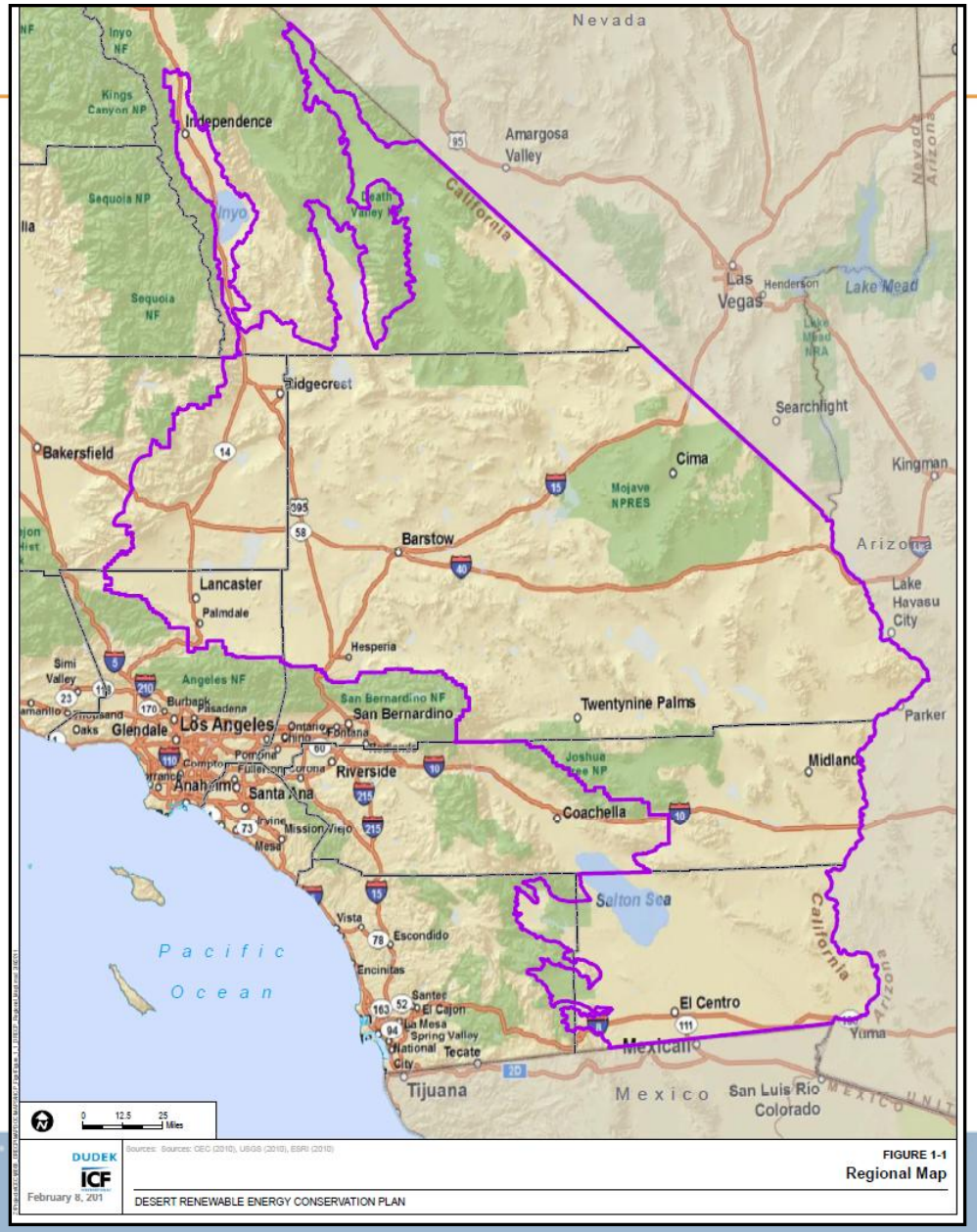
Solar PEIS Map



Argonne National Laboratory, Oct. 2012

California Desert Renewable Energy Conservation Plan

- 22 million acre plan for all renewable energy in the California desert
- Programmatic federal & California endangered species permits
- Streamlined permitting of renewable energy generation and transmission projects
  - Transmission upfront funding
  - Regional conservation & mitigation “banks”



Thank you

Arthur L. Haubenstock
Perkins Coie, LLP
+1.415.344.7022
ahaubenstock@perkinscoie.com