

Water & Energy Consulting



Lon W. House, Ph.D.

530.409.9702 (cell)

lonwhouse@waterandenergyconsulting.com
www.waterandenergyconsulting.com

10645 N. Oracle Rd. Ste. 121-218
Oro Valley, AZ 85737
o: 520.297.2643

2795 East Bidwell Street, Ste 100-176
Folsom, CA 95630
o: 530.676.8956

The Impact of Renewable Generation - Experience From the Southwest



July 27, 2017

Lon W. House, Ph.D.
office: 01.530.676.8956
cell:01.530.409.9702

lonwhouse@waterandenergyconsulting.com
www.waterandenergyconsulting.com

Dr. House has a Bachelors, two Masters, and a Ph.D. in Engineering and Economics from U.C. Davis. He is a Certified Energy Manager (CEM) and a Certified Sustainable Development Professional (CSDP) with the Association of Energy Engineers. He taught engineering in Graduate School at U.C. Davis for a number of years, is the founder of Hydropower group for the U.C. Davis Energy Institute and is the hydro renewable energy consultant for the Energy Trust of Oregon. He worked for the California Energy Commission for five years as a utility planner, and he was the chief utility planner for the California Public Utilities Commission for five years. In 1990, he went out into the consulting business, starting his own business (Water and Energy Consulting). He is the California Rural Water Association (CRWA) energy specialist, representing over 1,100 rural water and wastewater systems and is the energy and efficiency trainer for the National Rural Water Association and the Rural Water Association of Arizona and was the Association of California Water Agencies (ACWA) energy consultant for 25 years. Dr. House has over 30 years' experience before the California Public Utilities Commission, over 35 years before the California Energy Commission, and has testified numerous times California Power Authority, California Independent System Operator, California State Legislature, State Water Resources Control Board, the Federal Energy Regulatory Commission, and the U.S. Senate, as well as in numerous court cases. Dr. House also works for the California Public Utilities Commission as an expert witness on transmission issues and is their water-energy expert, and for the California Energy Commission as a researcher. He is an investment management expert consultant in the water and energy areas for: Gerson Lehman Group-GLG Scholar Program, eWork Markets, Price Waterhouse-Vantage Marketplace, Roundtable Group, Standard & Poor's—Society of Industrial Leaders, Coleman Research, Guidepoint Advisors, and DeMatteo Monness.

He has been involved in the assessing, evaluating, and recommending energy efficiency, demand response opportunities, and renewable energy projects for water agencies, electric utilities, and private parties over the last 20 years and has been involved in numerous utility regulatory cases. Dr. House has been responsible for training and installation of over 25 small hydroelectric projects in Southeast Asia.



What This Class Will Cover

- - Factors precipitating TOU period changes in retail rates.
- - The “duck curve”: what is it, how is it changing
- - Policy guidelines for TOU period changes
 - - the California Public Utilities Commission TOU decision (D17-01-006)
 - - the California Independent System Operator
- - California utility TOU period changes
 - - PG&E
 - - SCE
 - - SDG&E
- - Arizona utility TOU period changes
 - - SRP
 - - APS
 - - TEP
- - Impact of TOU period changes on solar generation value
- - TOU period winners and losers
- - Actions that customers can take to ameliorate some to the TOU period change impacts

Renewable Energy - California ISO

April 27, 2017

24-Hour Renewables Production

Renewable Resources	Peak Production Time	Peak Production (MW)	Daily Production (MWh)
Solar Thermal	13:16	365	2,202
Solar	12:43	8,831	77,909
Wind	3:25	3,581	71,917
Small Hydro	7:56	653	12,717
Biogas	14:18	160	3,547
Biomass	16:21	159	3,563
Geothermal	6:54	934	22,274
Total Renewables			194,128

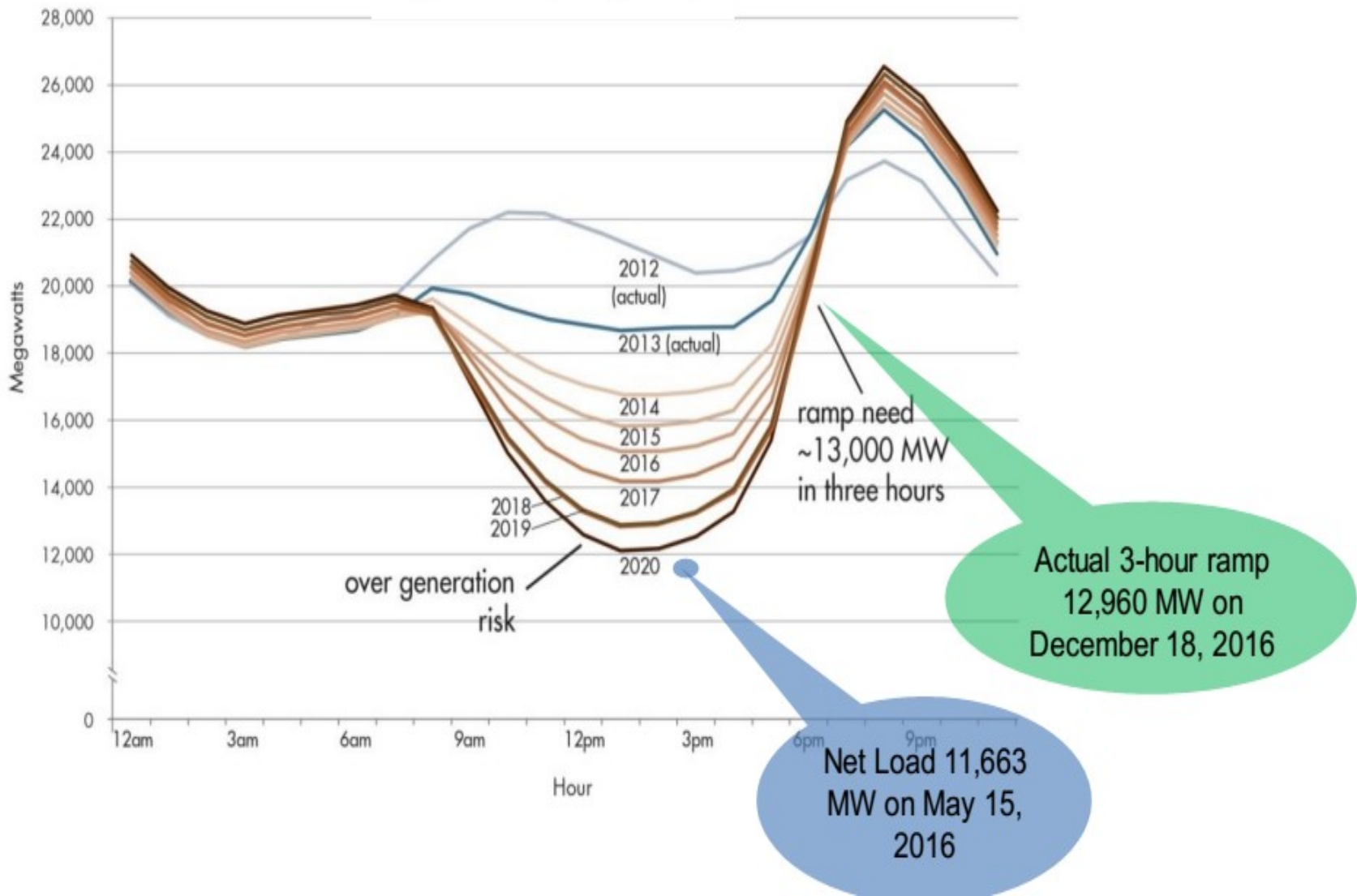
Total 24-Hour System Demand (MWh):

582,625

This table gives numeric values related to the production from the various types of renewable resources for the reporting day. All values are hourly average unless otherwise stated. Peak Production is an average over one minute. The total renewable production in megawatt-hours is compared to the total energy demand for the ISO system for the day.

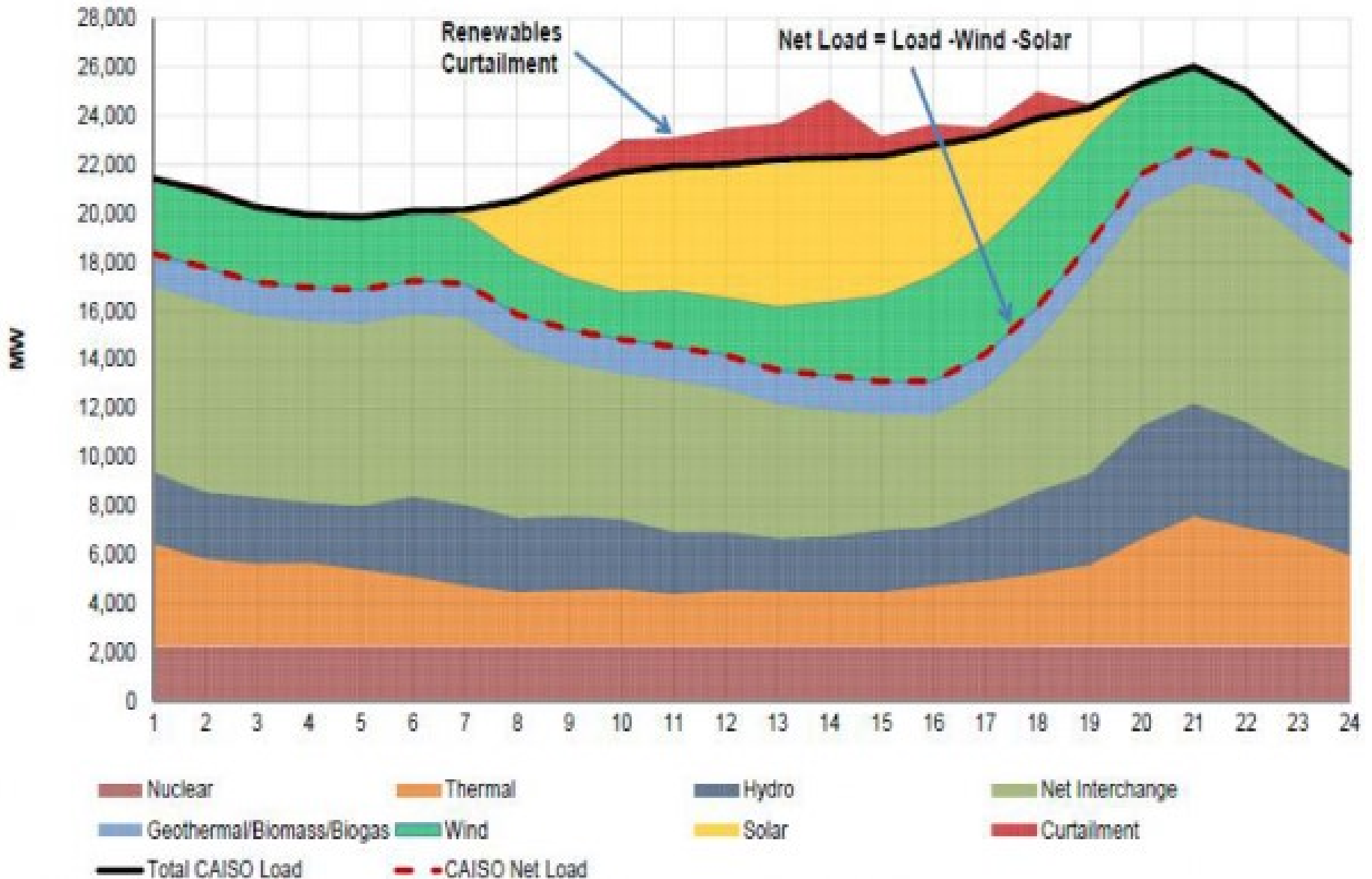
California Demand and Renewable Generation



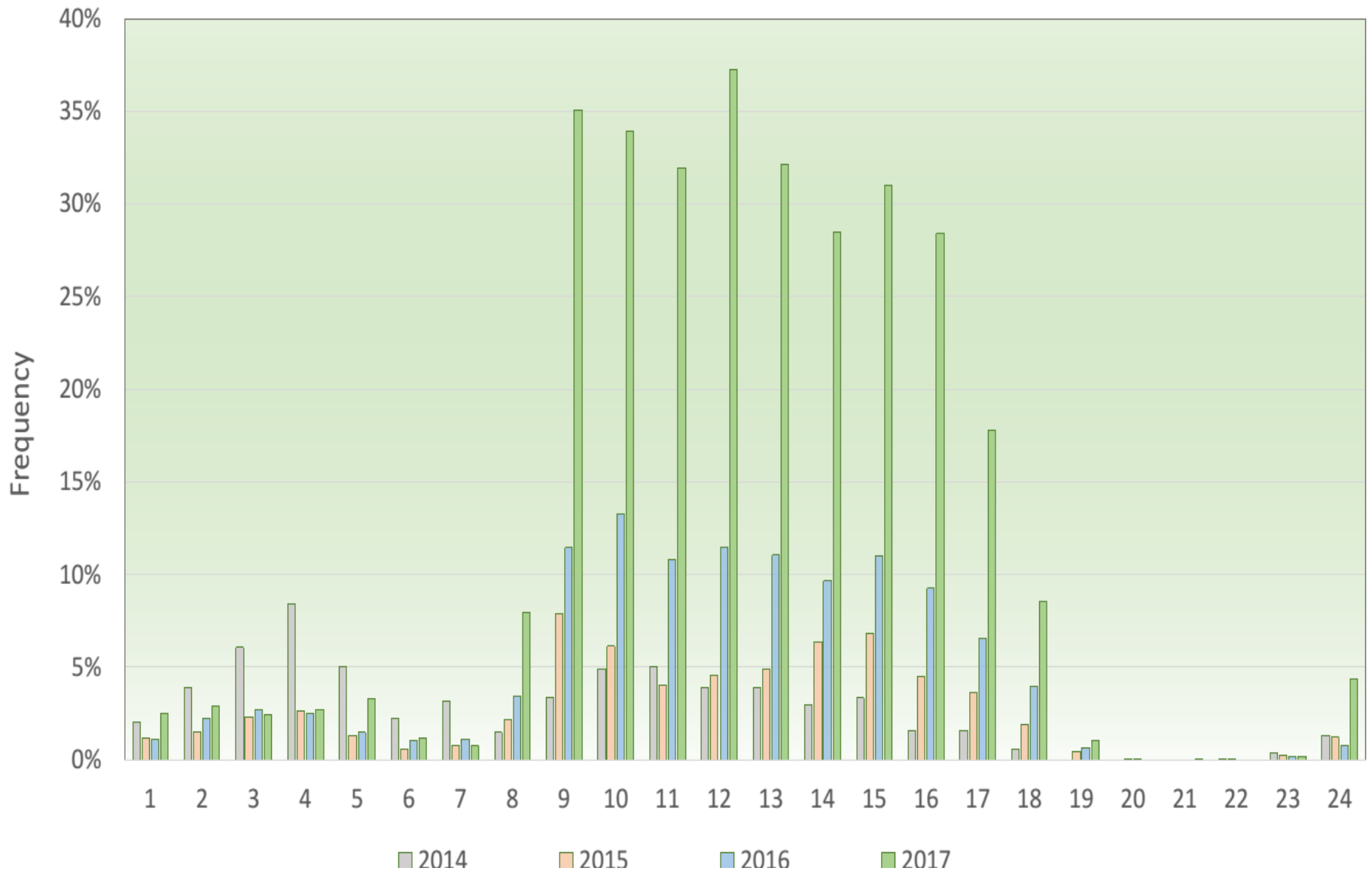


The "Duck Curve"

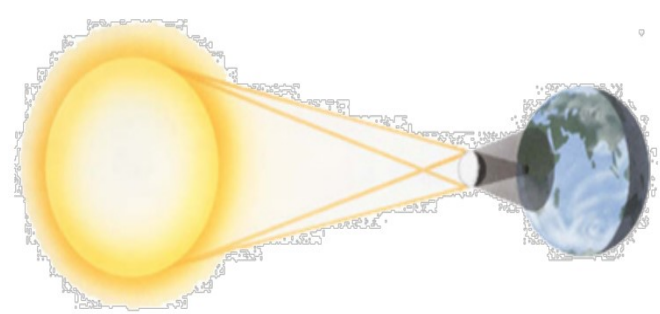
The Result – Curtailment of Renewables



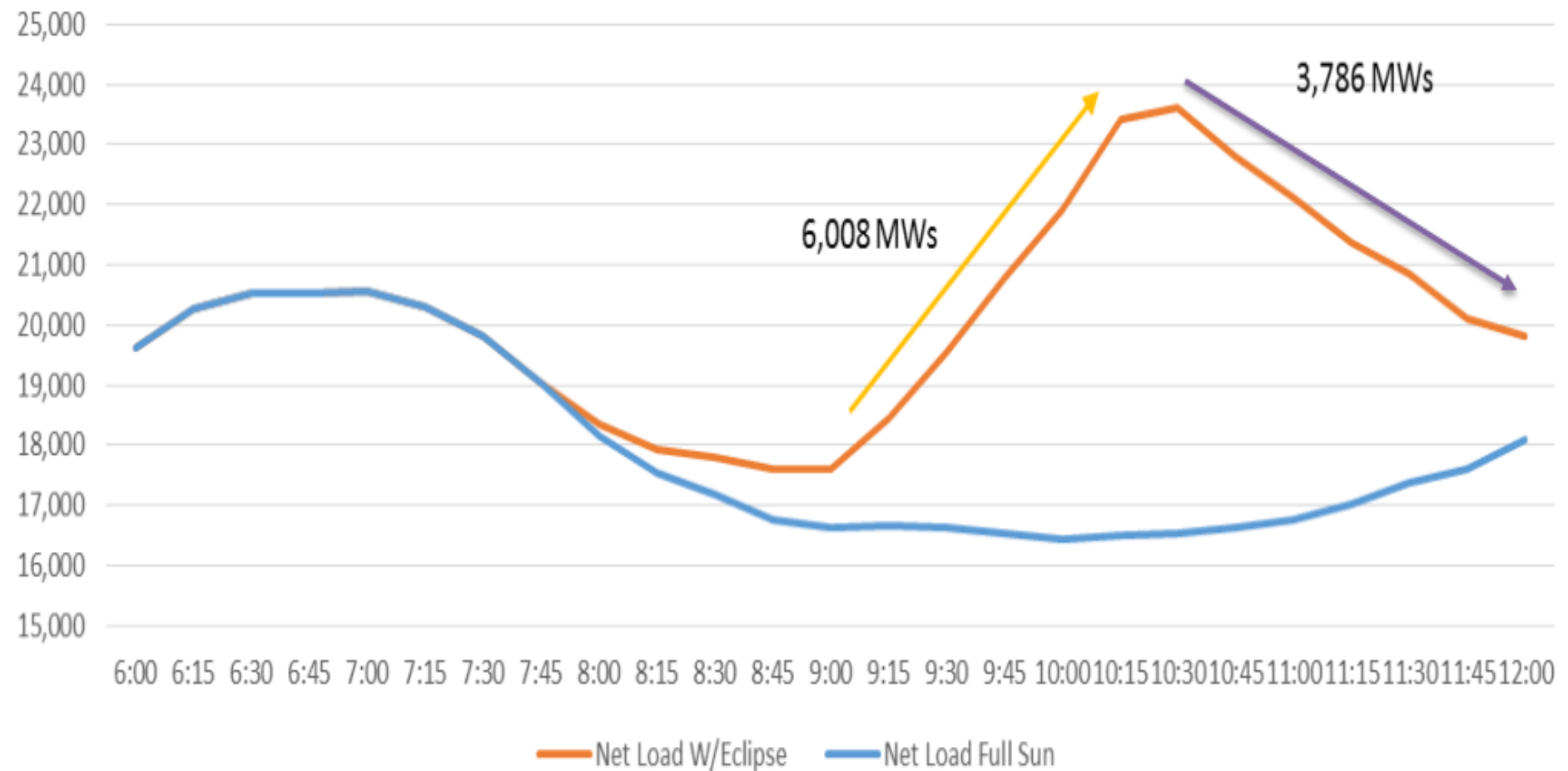
The Result - Negative System Prices



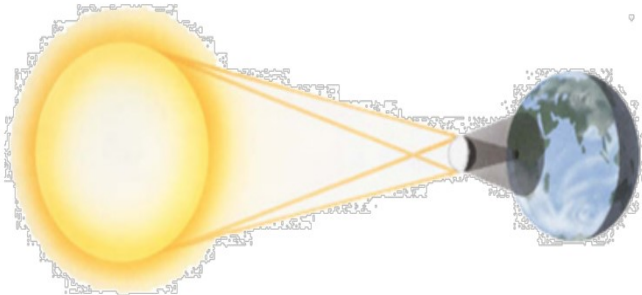
Solar Eclipse



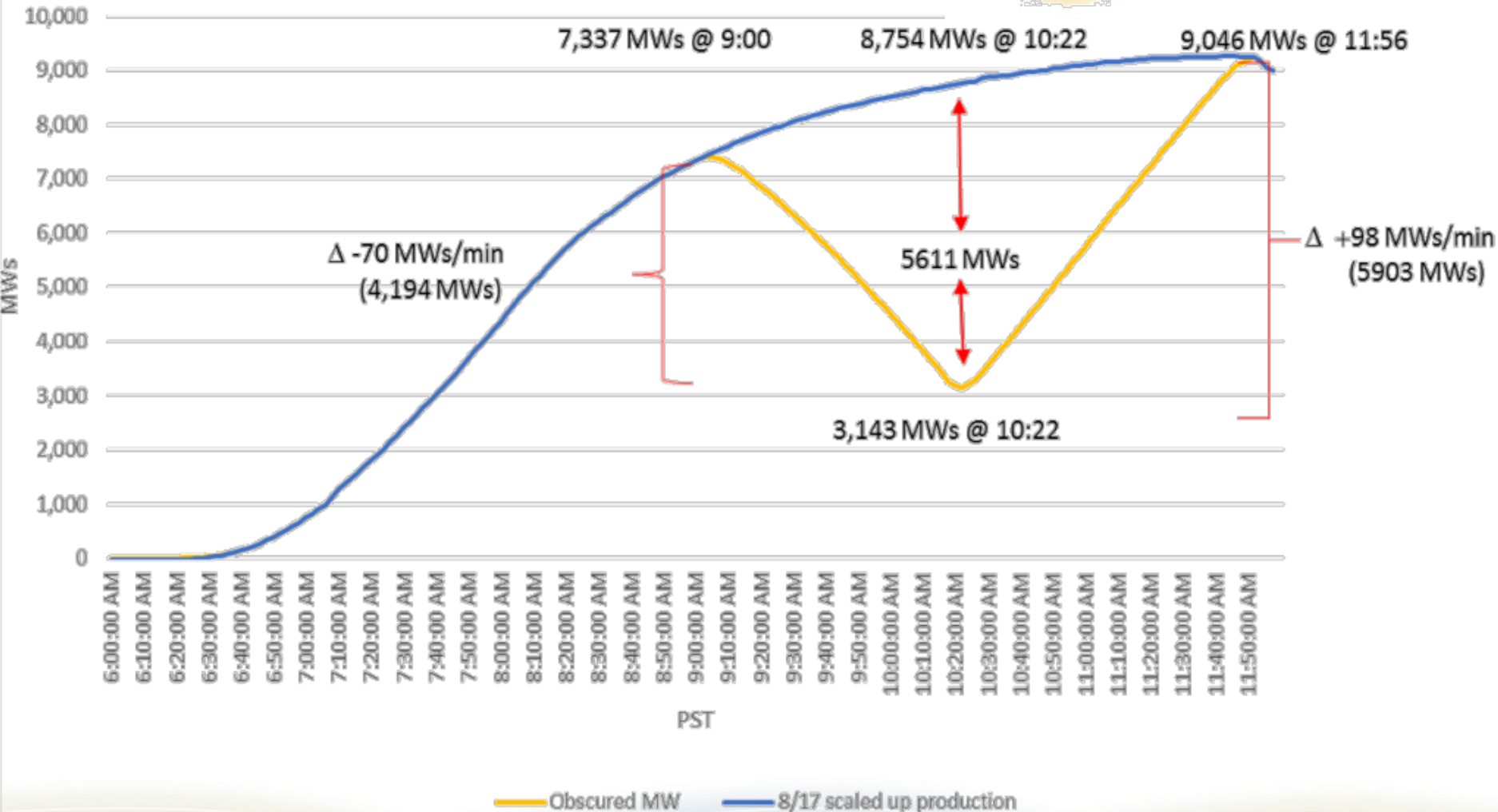
Estimated Net Load for 8/21/2017



August 21, 2017 - California



Anticipated Solar Production



CPUC TOU Proceeding: D17-01-006

- TOU periods based on utility-specific marginal costs (energy and capacity initially, distribution and transmission eventually)
- Base TOU periods fixed for 5 years
- Menu of TOU rates options should be developed
- Solar generation grandfathered on existing TOU periods for 10 years from initial operation date

WEEKDAYS



WEEKENDS



CA ISO TOU Periods

SCE TOU Period Proposed Changes

	Season	Existing	Proposed
On-Peak	Summer	Weekdays: 12:00 p.m. - 6:00 p.m.	Weekdays: 4:00 p.m. - 9:00 p.m.
Mid-Peak	Summer	Weekdays: 8:00 a.m. - 12:00 p.m.; 6:00 p.m. - 11:00 p.m.	Weekends: 4:00 p.m. - 9:00 p.m.
	Winter	Weekdays: 8:00 a.m. – 9:00 p.m.	Weekdays and Weekends: 4:00 p.m. - 9:00 p.m.
Off-Peak	Summer	Weekdays: 11:00 p.m. – 8:00 a.m. Weekends: All hours	Weekdays and Weekends: All hours except 4:00 p.m. – 9:00 p.m.
	Winter	Weekdays: 9:00 p.m. - 8:00 a.m. Weekends: All hours	Weekdays and Weekends: 9:00 p.m. - 8:00 a.m.
Super Off-Peak	Winter	N/A	Weekdays and Weekends: 8:00 a.m. – 4:00 p.m.

California Utility TOU Period Proposals

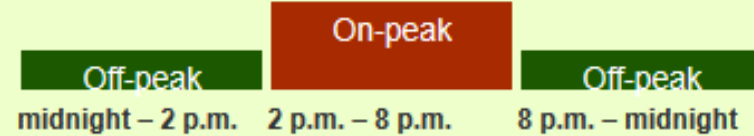
Proposed Rate Changes

Utility and Application	Customer Class	Proposed seasons
San Diego Gas & Electric General Rate Case (A.15-04-012)	Commercial and Residential Rate Changes	<ul style="list-style-type: none"> - 4 to 9PM on peak - Super off-peak: 12AM to 2PM (weekends); 12AM to 6AM (weekdays)
Pacific Gas & Electric General Rate Case (A.16-06-013)	Commercial Rate Changes	<ul style="list-style-type: none"> - 5PM to 10PM on peak period all year, every day - 3PM-5PM; 10PM-12AM (all days of week) summer partial peak period - Shortened Summer (June-September) - "Spring" season with Super off Peak period 10AM to 3PM (March through May all days of week)
Southern California Edison Rate Design Window Case (A.16-09-003)	Commercial Rate Changes	<ul style="list-style-type: none"> - 4PM to 9PM on peak during summer weekdays - 4PM to 9PM mid-peak for summer weekends and for winter weekdays and weekends. - 8AM to 4PM super off-peak period for winter weekdays and weekends

TEP TOU Periods



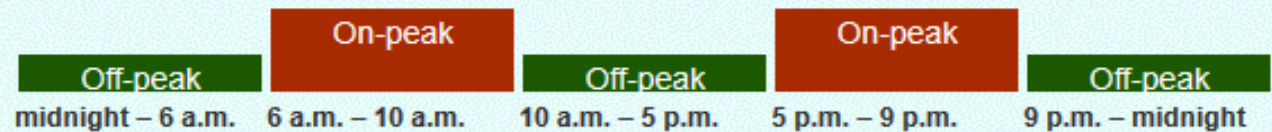
Time-of-Use Time Periods Summer: May – Sep | Weekdays



Weekdays except Memorial Day, Independence Day (July 4), and Labor Day. If Independence Day falls on Saturday, the Weekend schedule applies on the preceding Friday, July 3. If Independence Day falls on Sunday, the Weekend schedule applies on the following Monday, July 5.

All weekends are off-peak.

Time-of-Use Time Periods Winter: Oct – Apr | Weekdays



Weekdays except Thanksgiving Day, Christmas Day, and New Year's Day. If Christmas Day and New Year's Day fall on Saturdays, the Weekend schedule applies on the preceding Fridays, December 24 and December 31. If Christmas Day and New Year's Day fall on Sundays, the Weekend schedule applies on the following Mondays, December 26 and January 2.

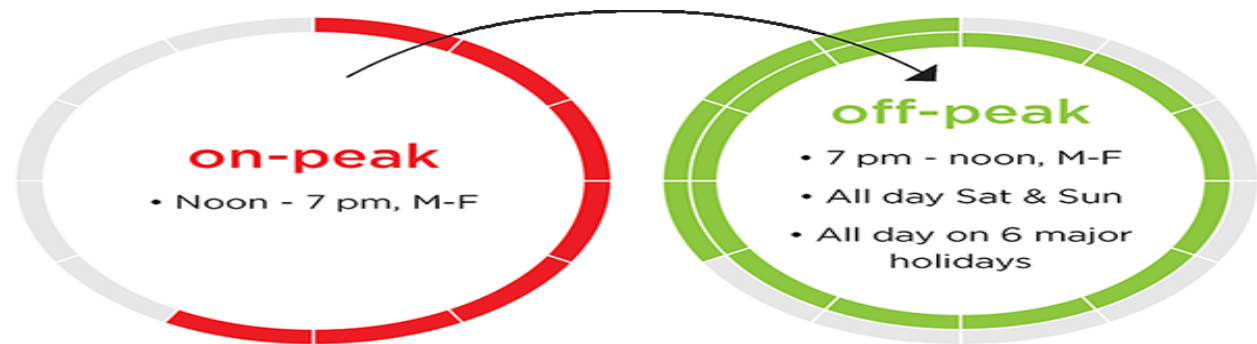
All weekends are off-peak.

APS TOU periods



aps

- Residential on-peak: noon to 7 pm weekdays



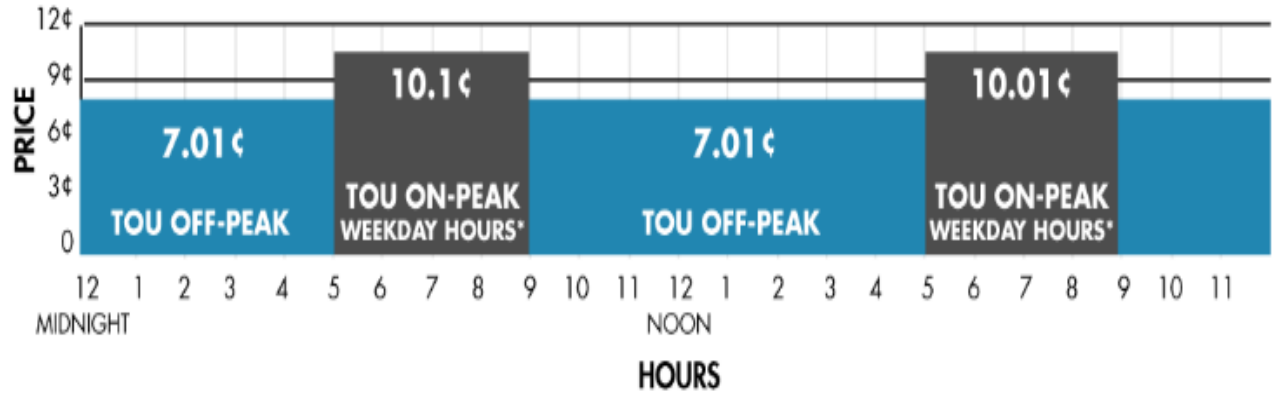
- Business on-peak: 11 am – 9 pm weekdays



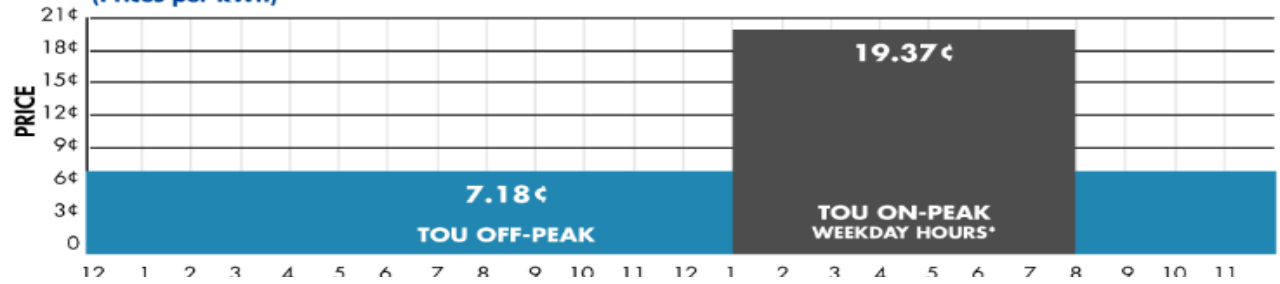
SRP TOU Periods



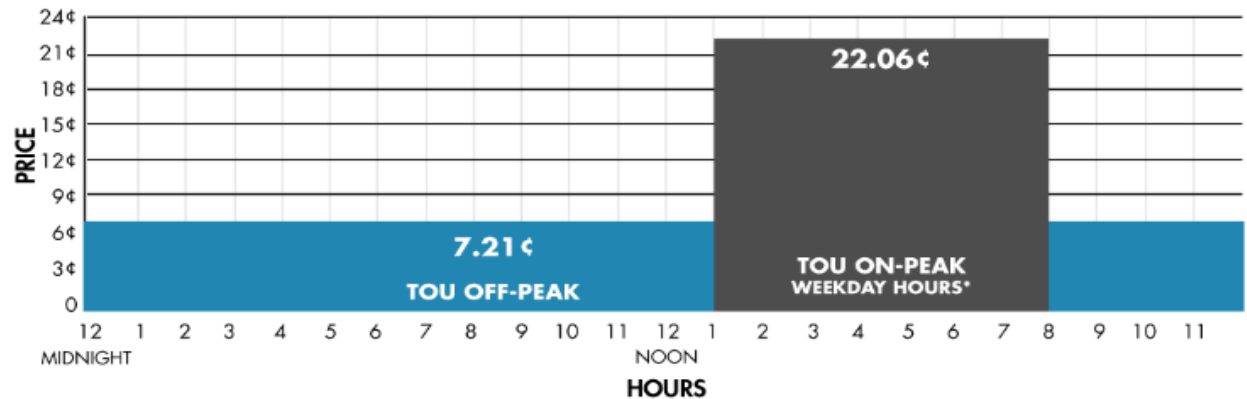
Winter
November through April
(Prices per kWh)



Summer
May, June, September, October
(Prices per kWh)



Summer Peak
July, August
(Prices per kWh)



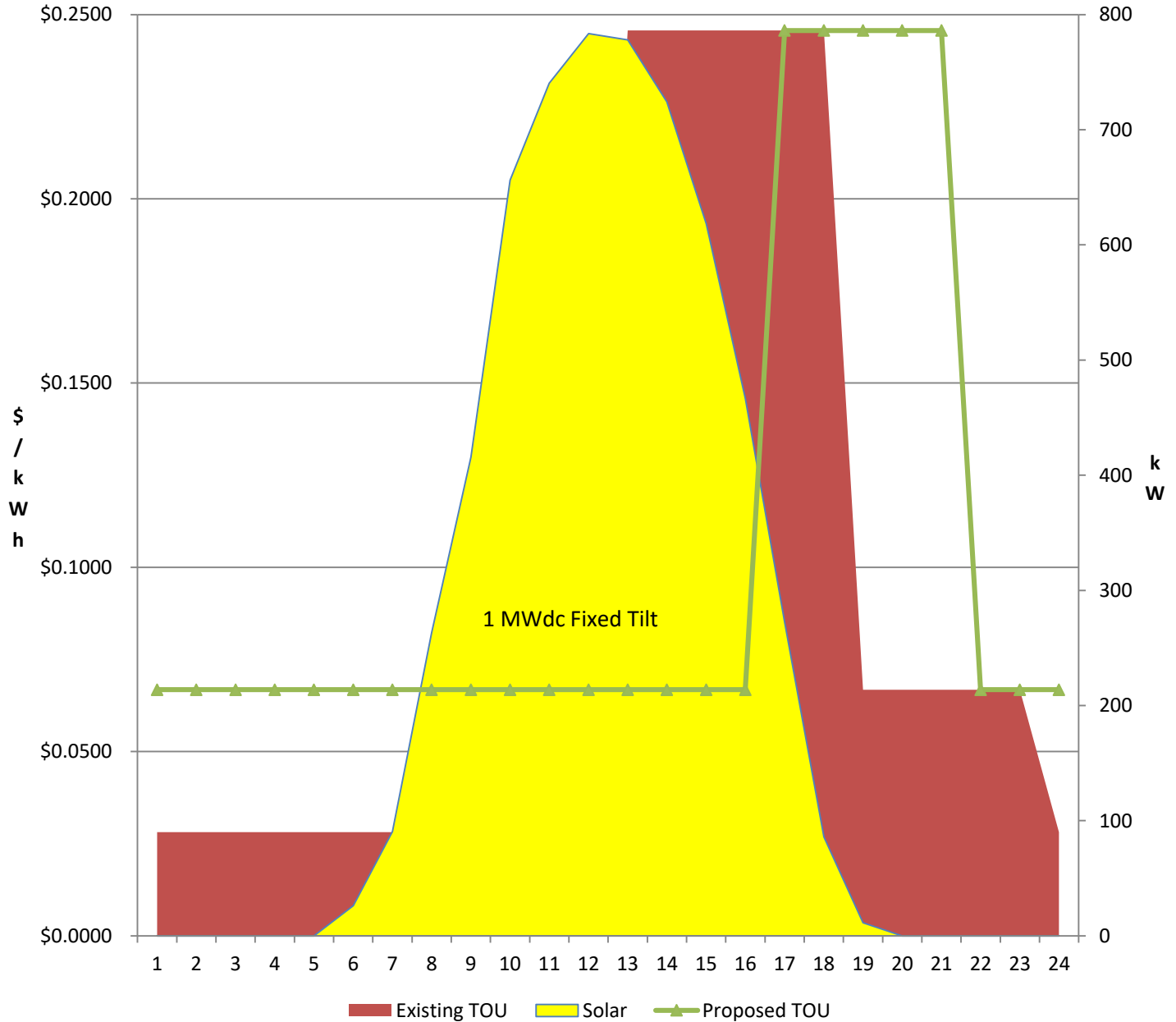
TOU Period Change Winners and Losers



- Winners
 - High afternoon loads – high AC loads
 - Operating hours that reduce in evening
 - Schools
 - Offices
 - Some Retail Businesses
- Losers
 - High evening loads
 - Some Retail Businesses
 - Water Agencies
 - Residential that work away from home
 - Solar generation

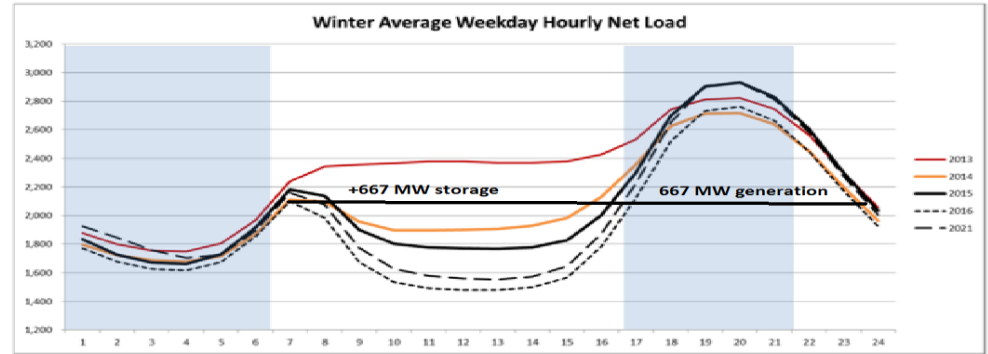
SCE Summer Solar Generation: Option A Tariff Energy Prices Weekday

TOU
Period
Change
Losers -
NEM Solar
Projects
Exporting
to Grid

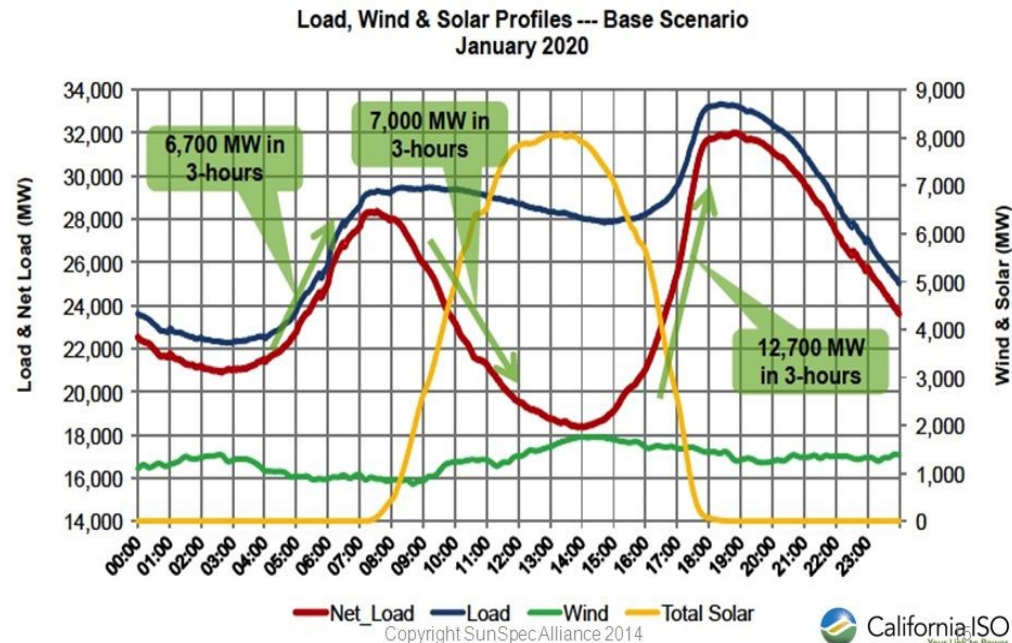


Solutions to Duck Curve

- Energy Storage
- Increased load in afternoon
- Increased generation in evening
- Fast ramping (regulation up and down)
- Regional sharing – Western Imbalance Market



California ISO: Status Quo Does Not Work

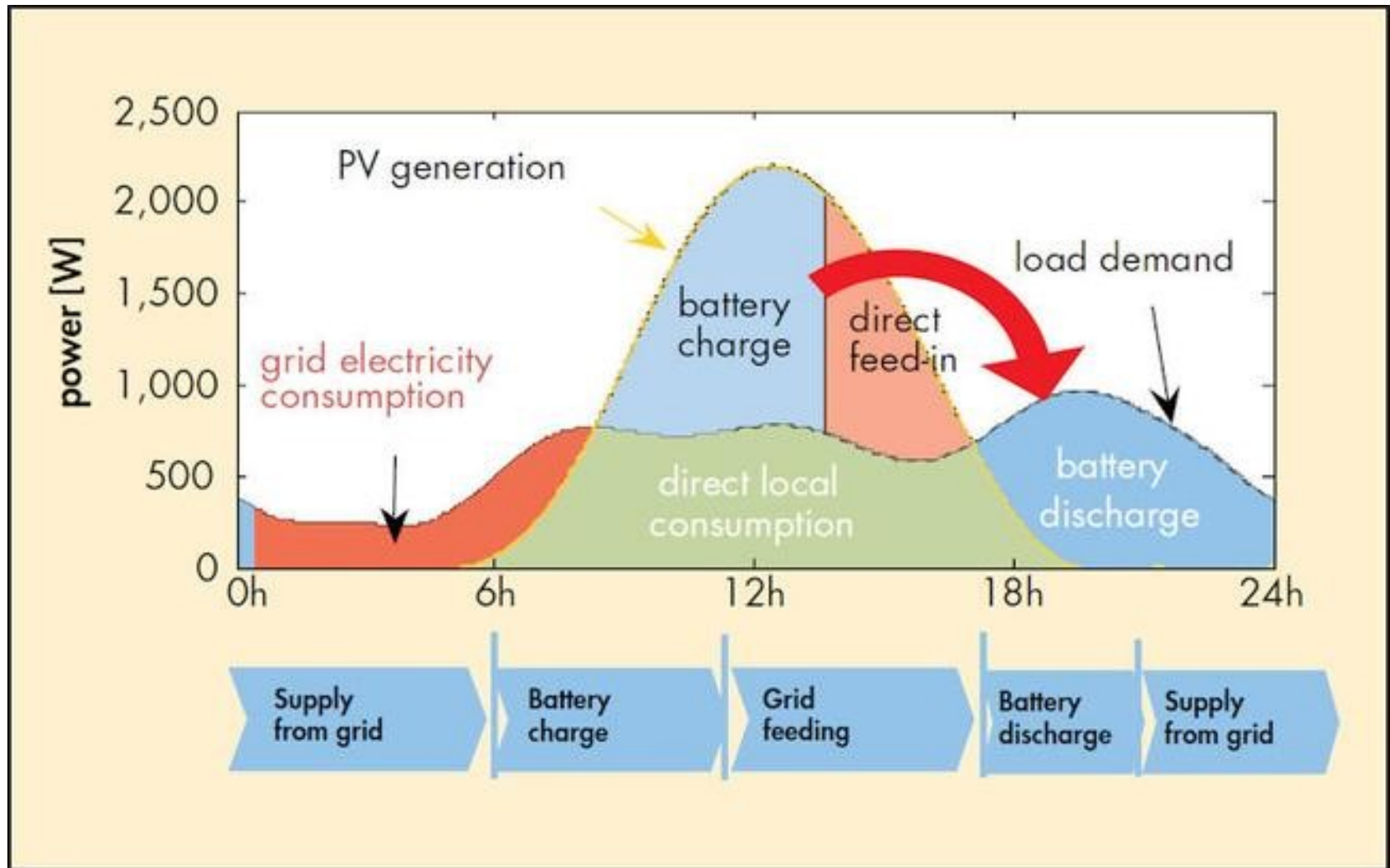


Customer Adaptations to TOU Period Shifts

- Try a different tariff
 - many utilities have non-TOU, non demand charge options (particularly for residential and small commercial)
- Add energy storage
 - With or without solar
- Shift demand
- Investigate microgrids



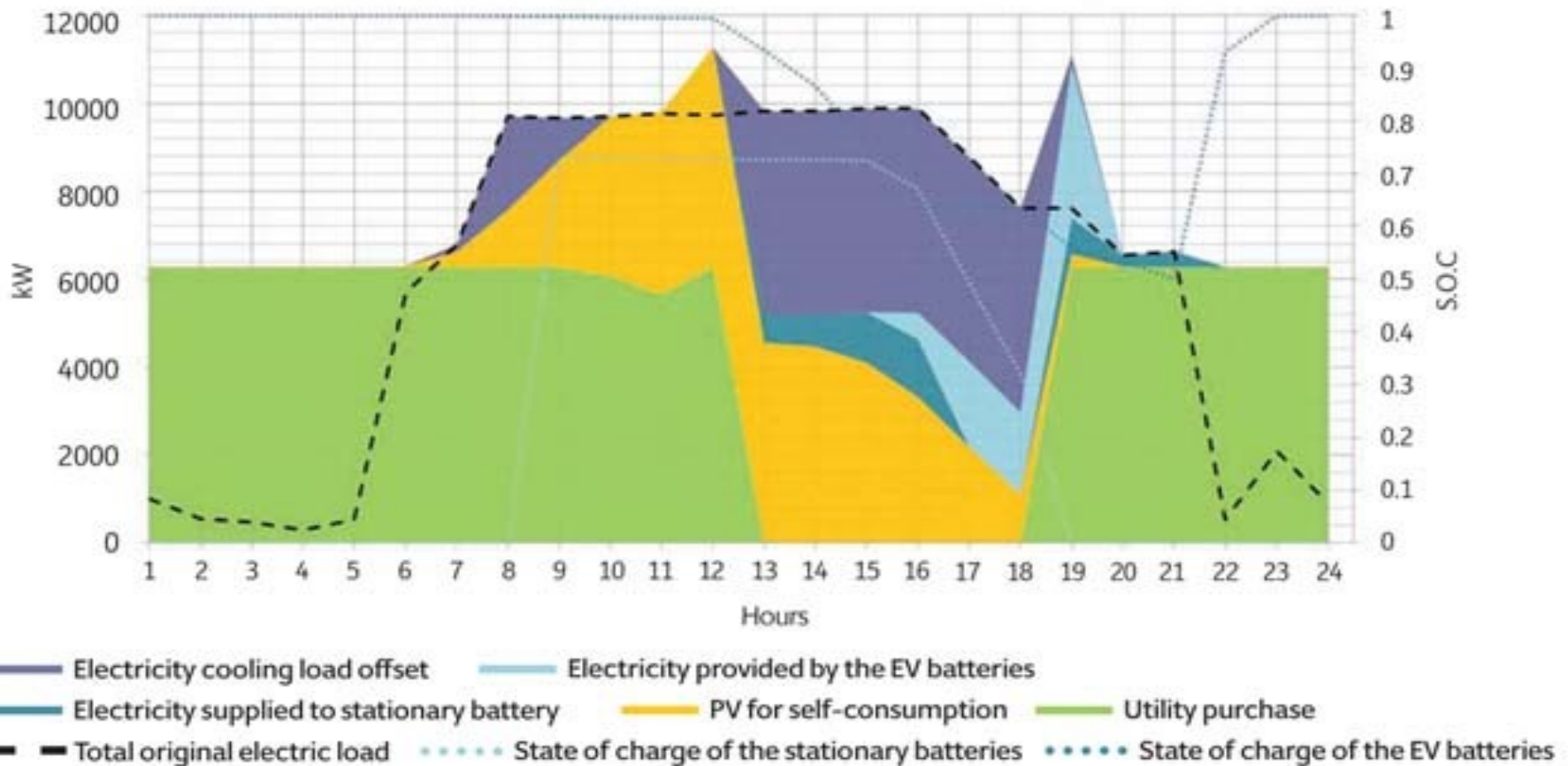
Adding Storage to Solar System



Solar, Storage, and Electric Vehicles

Optimal dispatch

Optimal dispatch for electricity technologies (July-week)



Recommendations

- Pay attention to utility rate changes
 - TOU period shifts
 - Default utility tariffs – TOU and demand charges
- Review your bills based upon tariff changes
 - Utility customer account rep will sometimes do this
 - Consultants provide this service
- Evaluate alternatives economics
 - Shifting operations
 - Adding storage
 - Adding solar and storage
 - Microgrid for your system



Contact Info

Website: www.waterandenergyconsulting.com

Phone number: 530.409.9702

Email: lonwhouse@waterandenergyconsulting.com