CAISO Proposed Day-Ahead Market with 15 Minute Resolution – Why this is Good for Renewables

ESIG Session 7 – Advances in Forecast Applications and Market Design

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Purpose and Key Objectives

- Purpose:
  - Discuss proposed Day Ahead (DA) market changes to a 15 minute granularity, why does the need exist?
- Key Objectives:
  - Effect of Hourly Average vs 15 Minute Average in DA
  - Current Weather Input Granularity
    - Renewable Forecasting (Wind, Solar, Behind the Meter Solar).
    - Demand (Load) Forecasting

Background

- Day-Ahead market enhancements address net load curve and uncertainty previously left to real-time market
  - 15-minute scheduling granularity
  - Day-Ahead imbalance reserve product (DA Flexible Ramp Product (FRP))
  - Combined Integrated Forward Market and Residual Unit Commitment

Imbalance reserves can be used for all services in the real-time market

Day-Ahead Market	Bid-in Demand	ISO Net-Load Forecast	Contingency Reserves	Regulation	Corrective Capacity	Imbalance Reserves (DA FRP)	
	Financial	Reliability	6.3% of the load forecast	Forecast error between RTD and Actual	System able to meet line limits after contingency	Forecast difference between IFM and FMM for all day-ahead market products	
Real-Time Market	Bid-in Demand	ISO Net - Load Forecast	Contingency Reserves	Regulation	Corrective Capacity	FRP Forecasted Movement	FRP Uncertainty Awards
	Not Applicable	Imbalance energy	Incremental	Incremental	Re-dispatch, if necessary	Ramp between market intervals in the same run	Forecast difference between binding and advisory intervals between runs

Data analysis uses reliability forecast to determine imbalance between DAM and RTM

Data to Determine ISO Reliability Forecast		
	HE8	HE9
IFM	20,000	22,000
RUC Delta	+ 1,000	+ 1,000
Net Virtuals	-500 (supply)	-500 (supply)
VER Forecast Delta	-800	-800
ISO Reliability Forecast	19,700	21,700

Create 15-minute reliability forecast by linearizing between hourly mid points

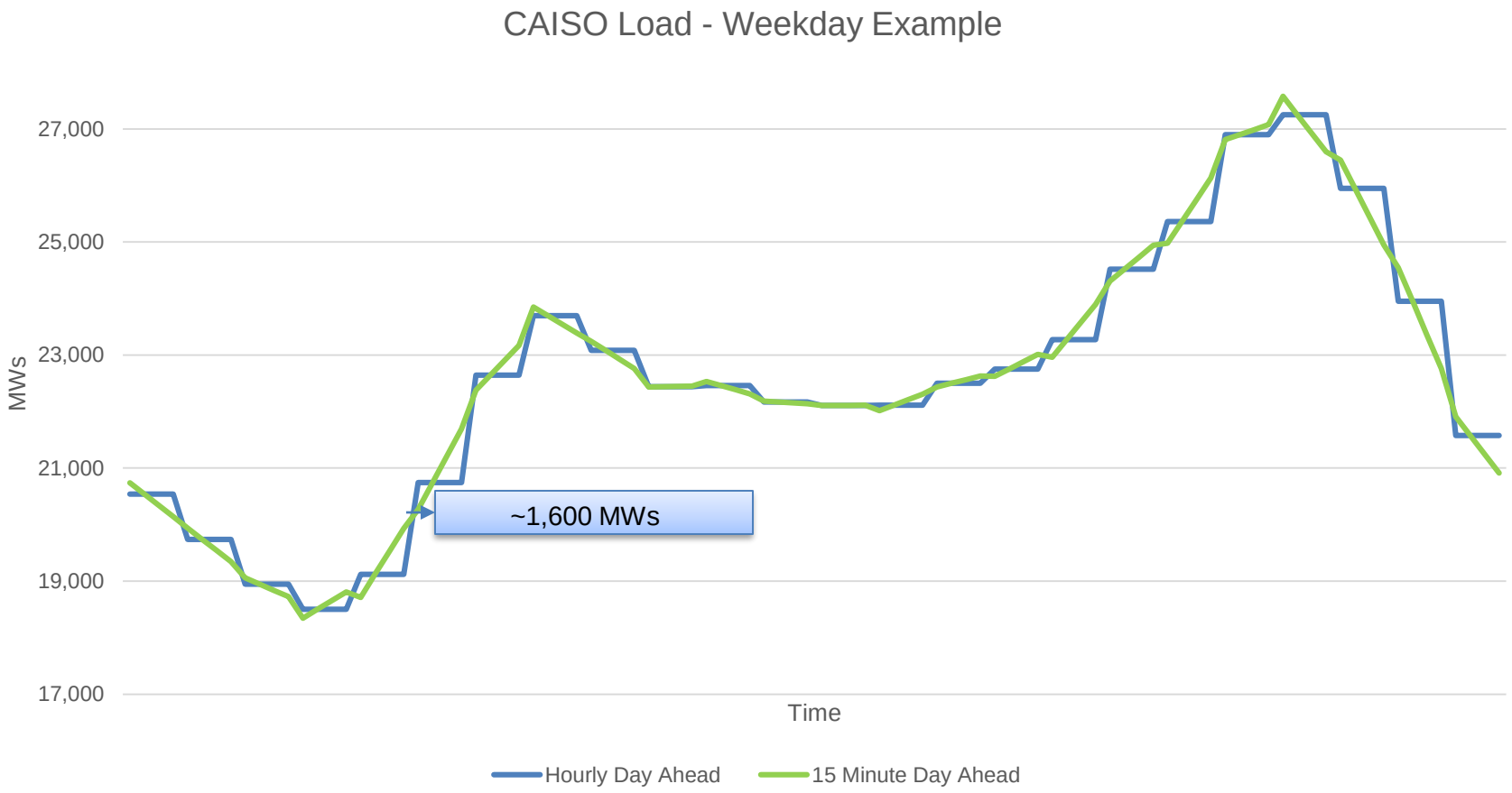
Observed imbalance reserve need is calculated for each 15-minute interval

1. FMM load - reliability forecast
   - If positive, increases upward imbalance need
   - If negative, increases downward imbalance need
2. Adjust for EIM transfers
   - If EIM transfers in, increases upward imbalance need
   - If EIM transfer out, increases downward imbalance need
3. Add FMM flexible ramping product requirement
   - If 1+2 upward imbalance need, then add FRU
   - If 1+2 downward imbalance need, then add FRD

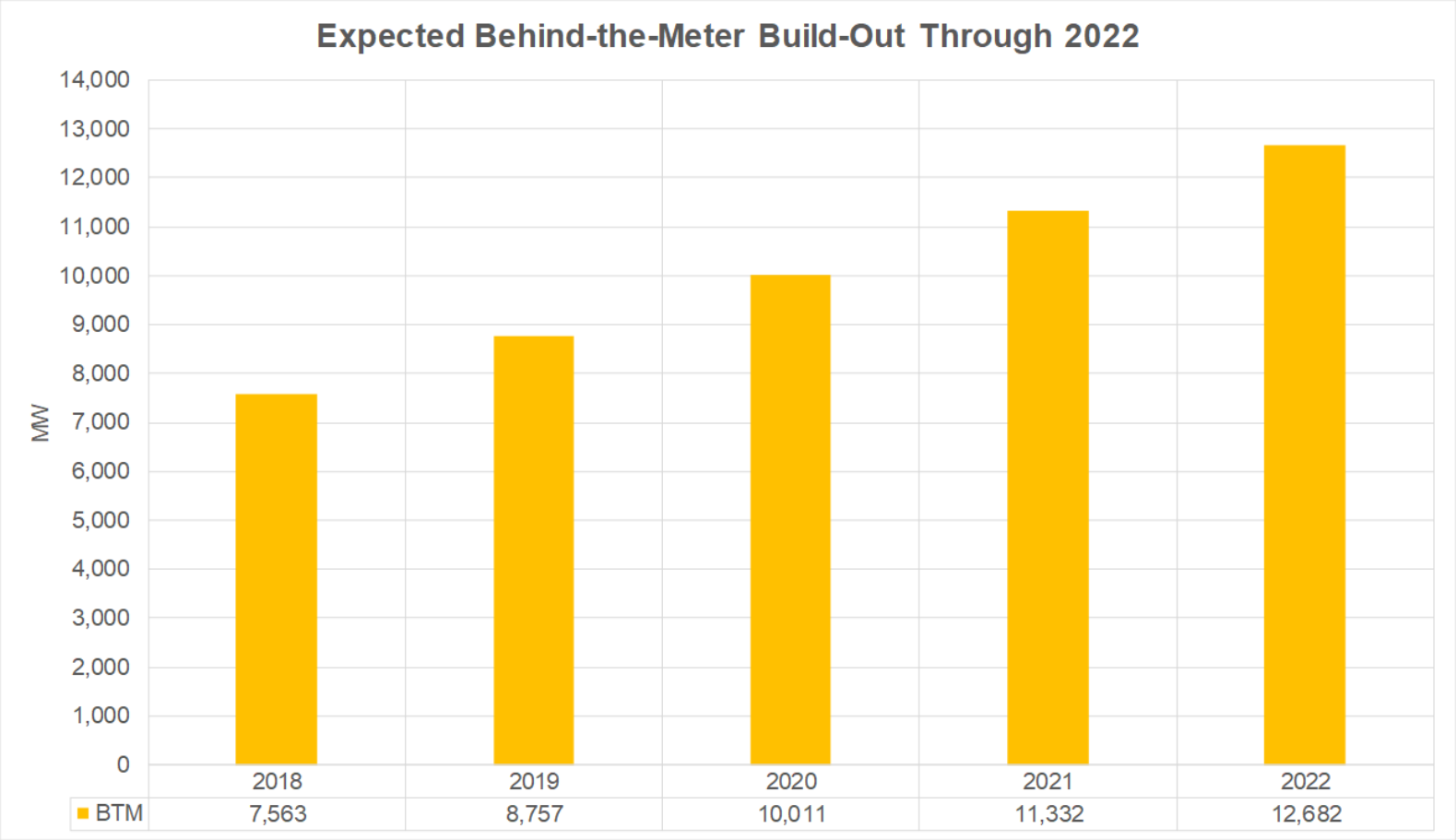
Captures load, VER IFM forecast difference, and convergence bids

The CAISO's current Day Ahead Market is limited due to day-ahead hourly scheduling:

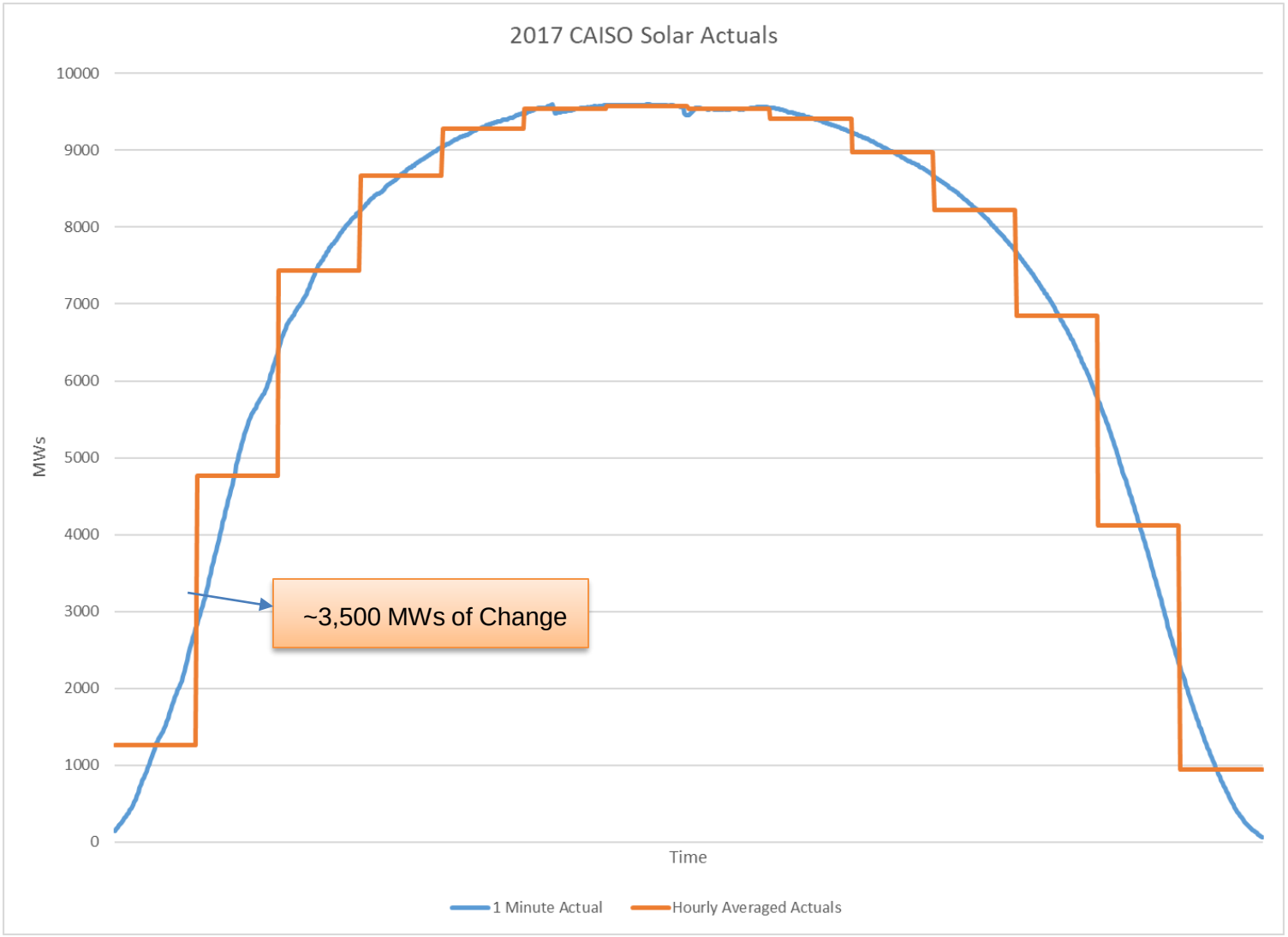
Demand (Load) Forecasting - Weekday



Estimate of Behind the Meter Solar PV Capacity Build-Out

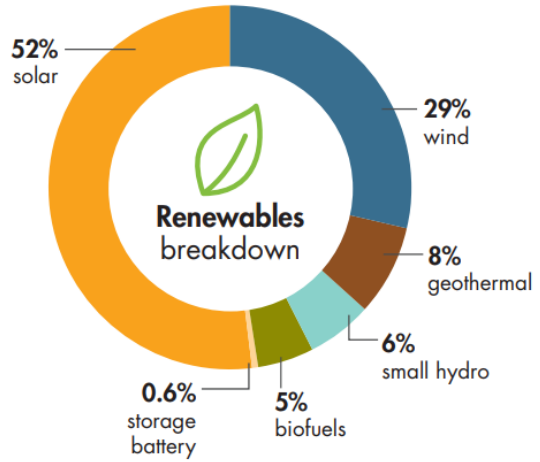


Renewable - Solar



ISO renewable resource mix

Installed renewable resources *(as of 04/09/2018)*



	Megawatts
Solar	11,439
Wind	6,295
Small hydro	1,238
Geothermal	1,790
Biofuels	997
Storage battery	134*
TOTAL	**21,893**

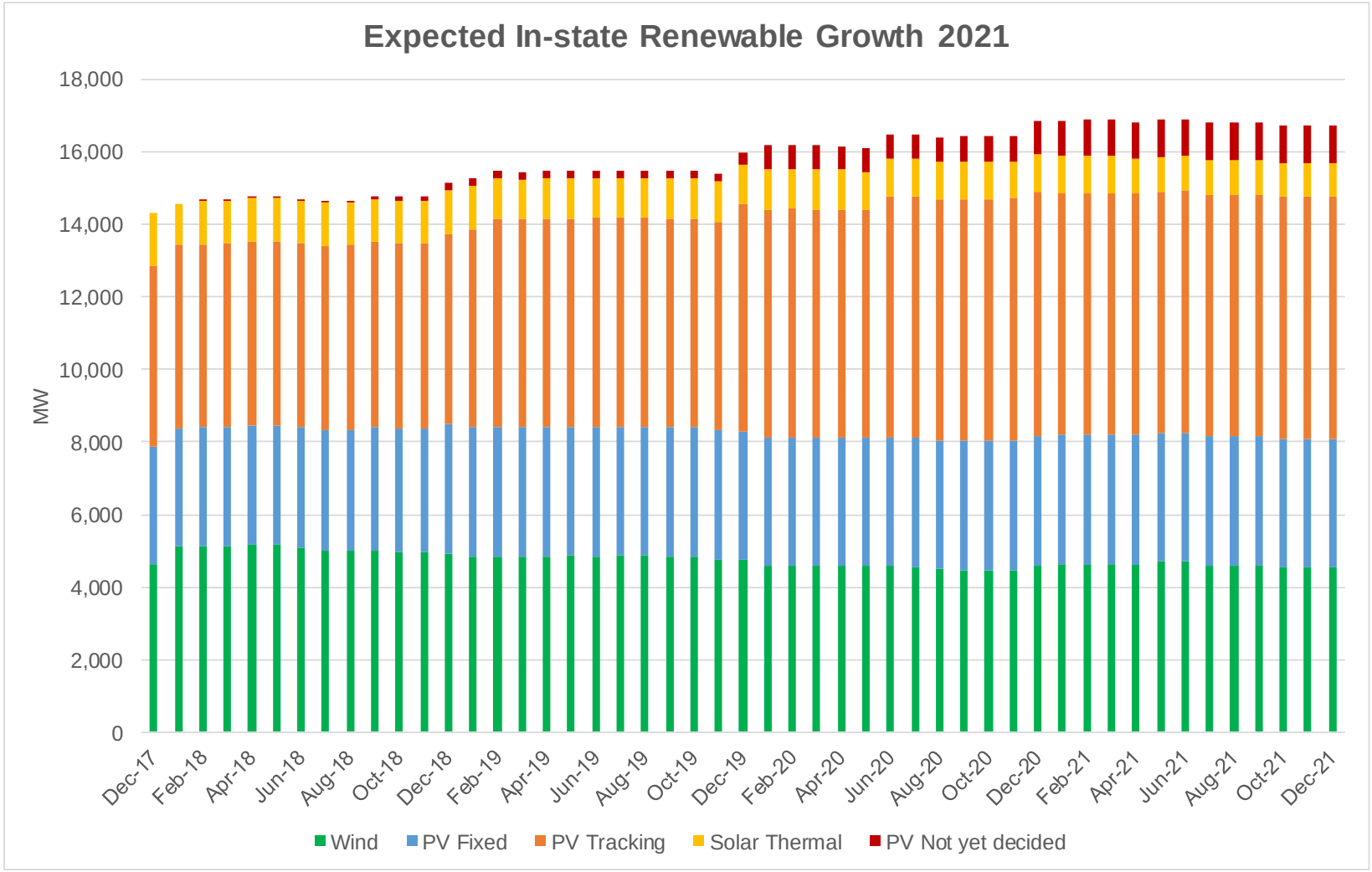
Record peaks

SOLAR
10,412 MW
March 5, 2018, 10:18 a.m.

WIND
4,985 MW
May 16, 2017, 5:26 p.m.

PREVIOUS SOLAR RECORD 9,914 MW set on June 17, 2017, 12:13 p.m.

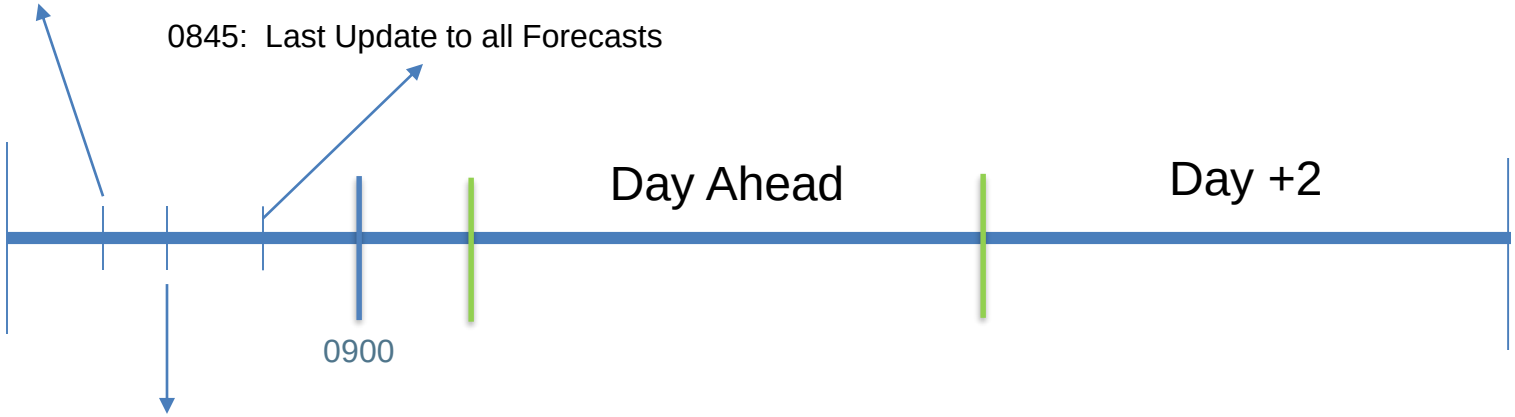
Renewable build-out through December 2021



When do we prepare Day Ahead Forecasts?

Day Prior Preparations

0600: First Look at Weather Information

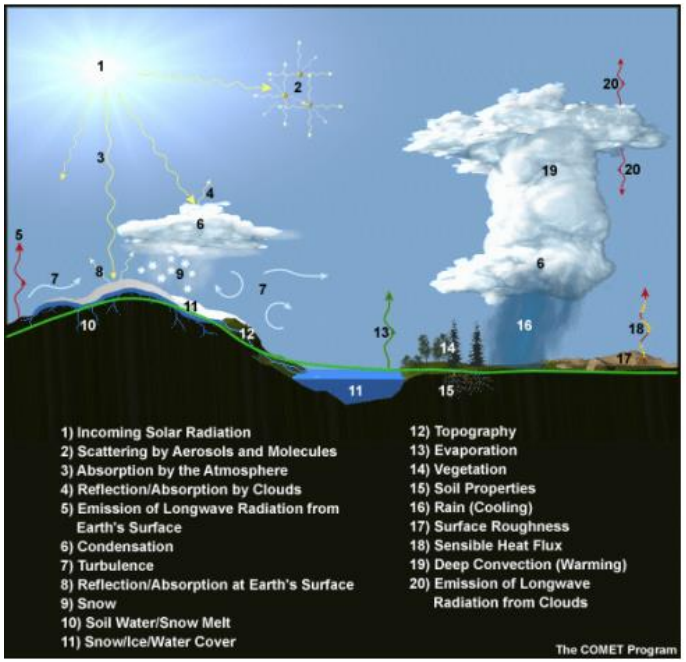


39 Hours of Forecast Information Needed

63 Hours of Forecast Information Needed

Current Weather Input Granularity – Load & Renewables

- Weather Actual Information – Hourly
- Weather Forecast Information – Hourly
- Numerical Weather Prediction Model Output Granularity
  - ECMWF – 6 Hour
  - GFS – 3 Hour
  - NAM – 1 Hour
  - HRRR – 15 Minute
    - At this time doesn't have long enough horizon for CAISO Day Ahead Market.



Summary and Next Steps

- DA Market Enhancements Stakeholder Initiative
  - Stakeholder Workshop/Meeting June 19th
  - CAISO Board of Governors Meeting November 14th-15th, 2018
- Forecasting
  - Continue to analyze granularity that is needed for actuals and forecast information to obtain the best accuracy of 15 minute forecasts for Load, Wind, and Solar for Day Ahead and Day +2.
  - Work with weather community to communicate needs.