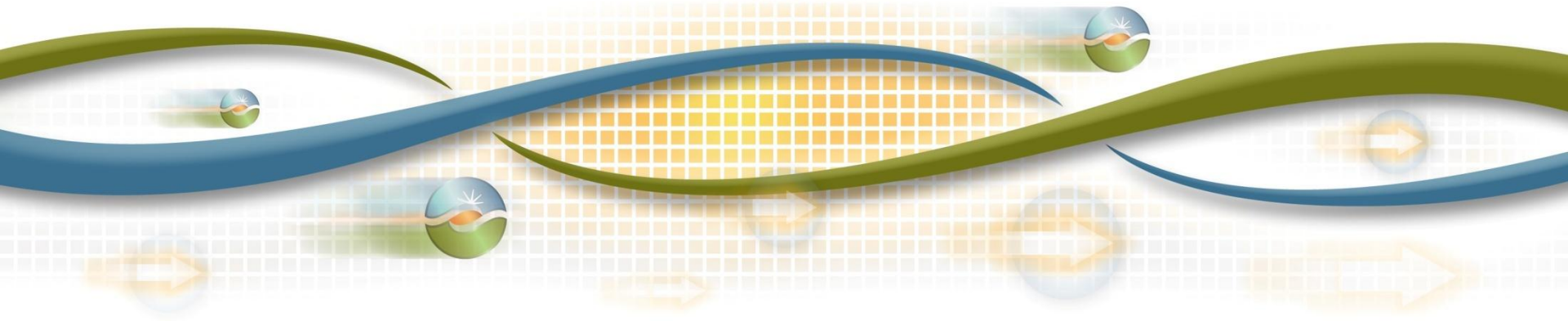


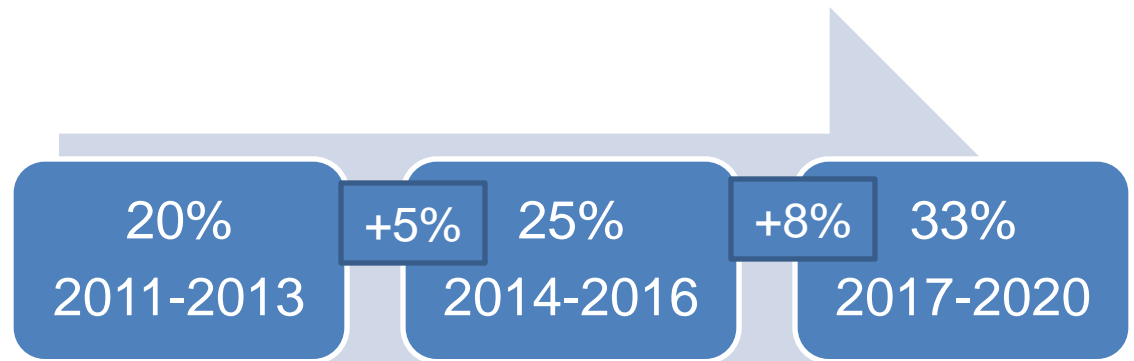
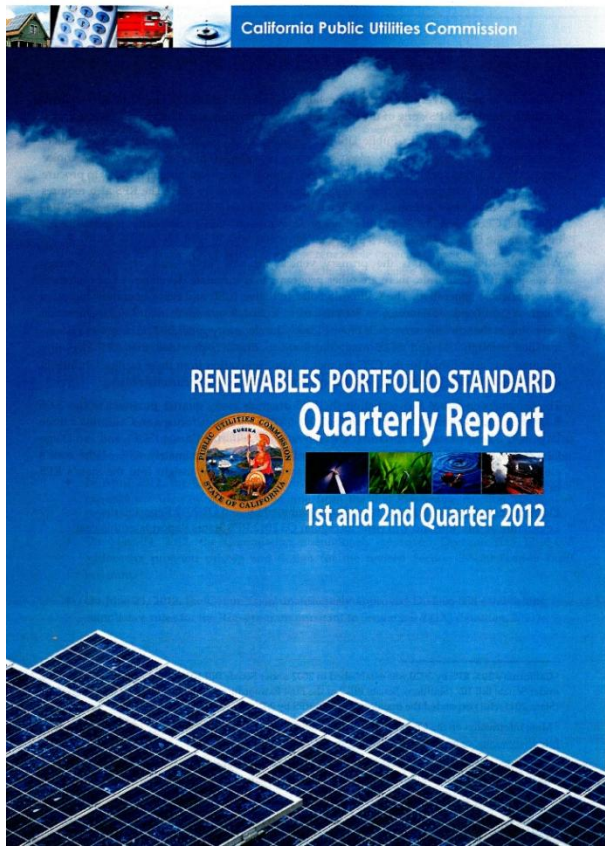
System Flexibility for Integrating 33% Renewable Generation in California ISO

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California has set a high Renewable Portfolio Standard.



“In 2012, 2,500 MW is scheduled to come on line before the end of the year. That compares with 2,871 MW of new renewables capacity to come on line since the RPS program started in 2003.”

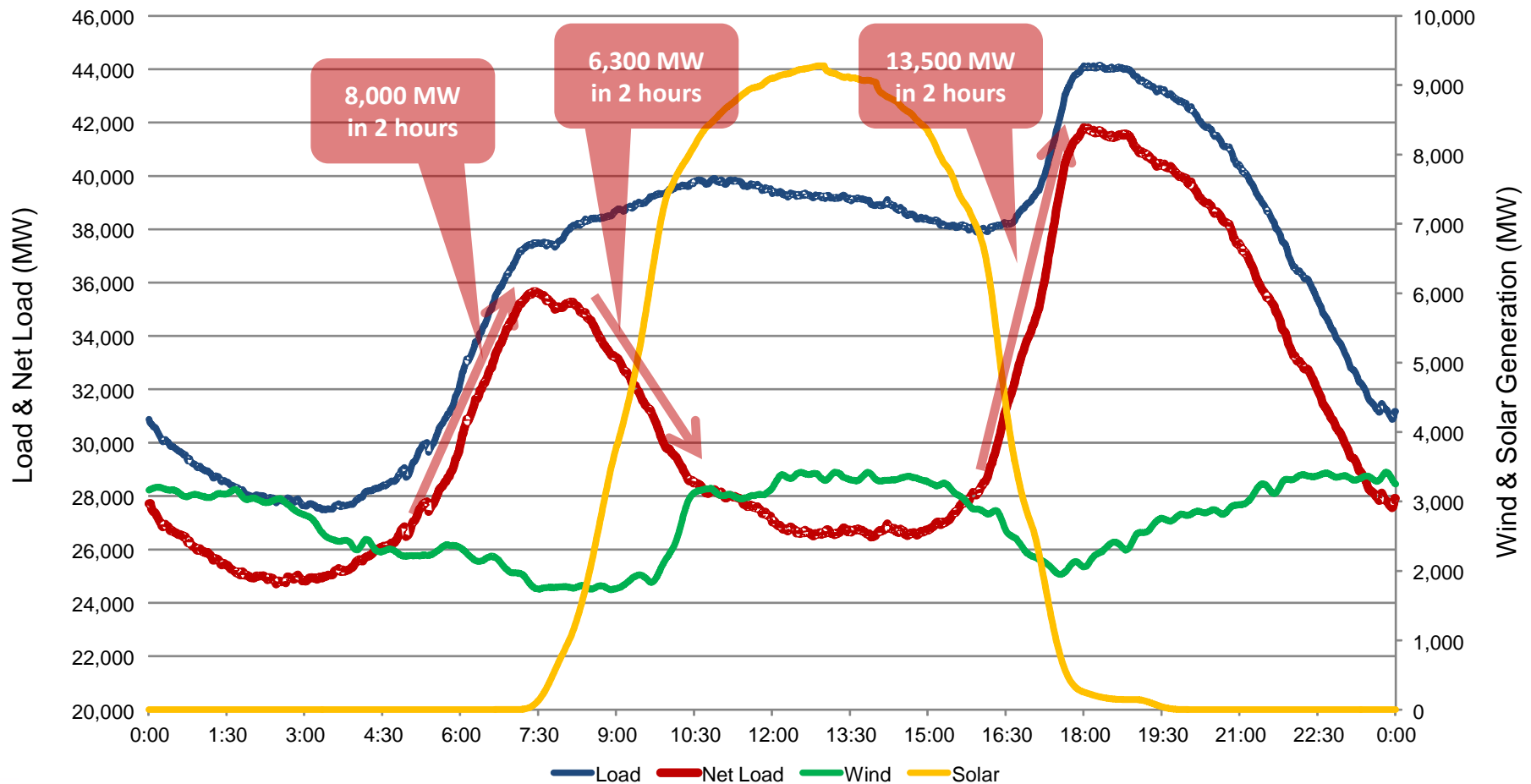
The CAISO faces operational challenges over the next 10 years.

- Supply volatility from over 20,000 MW of renewable capacity
- Uncertainty in the 12,000 MW of once-through cooling thermal capacity retirement or repower
- Less predictable load due to distributed generation and plug-in electric vehicles
- Reduced energy revenue to support conventional generation resources

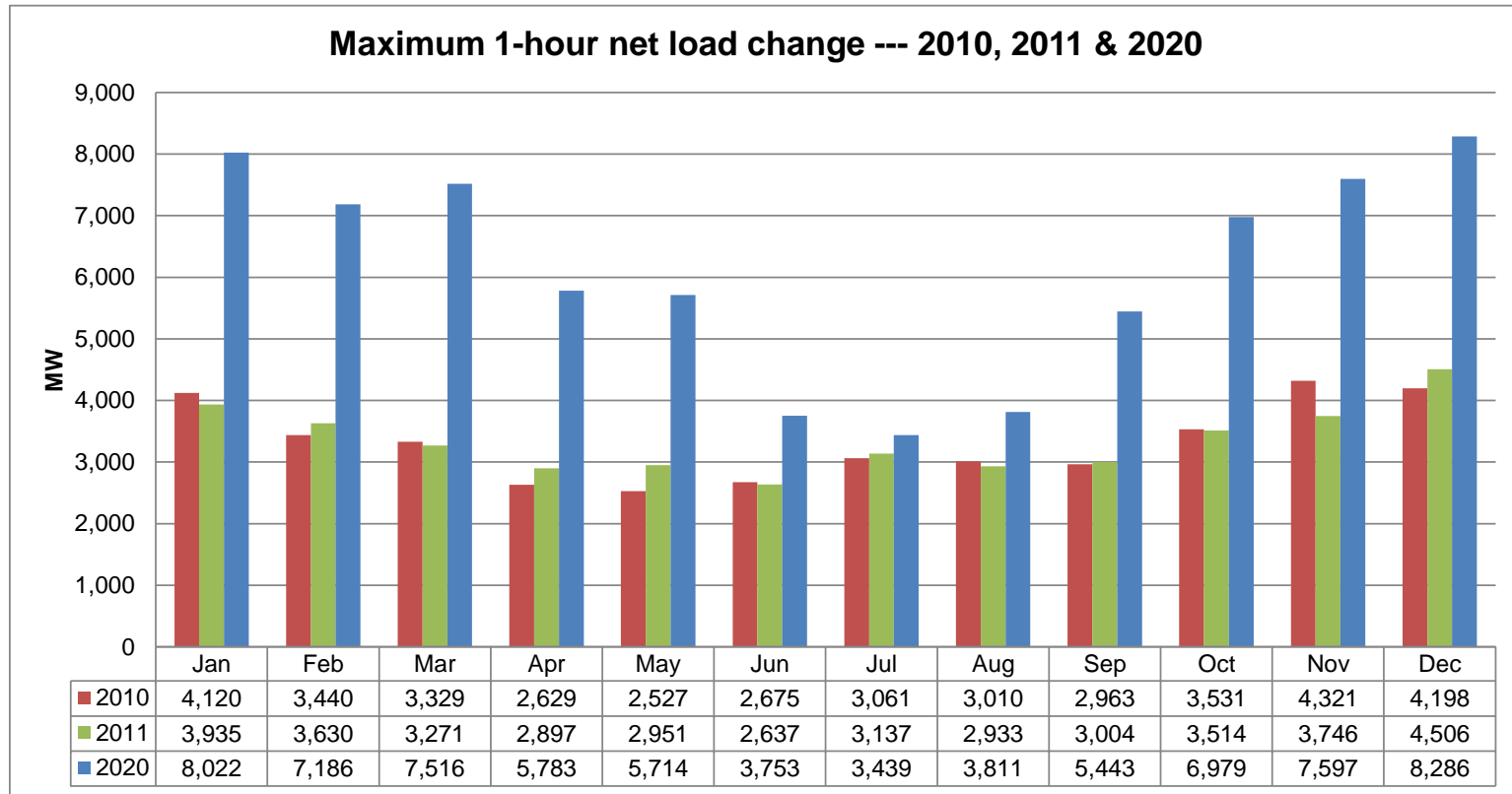


It will require more flexible capacity to follow the net-load curve.

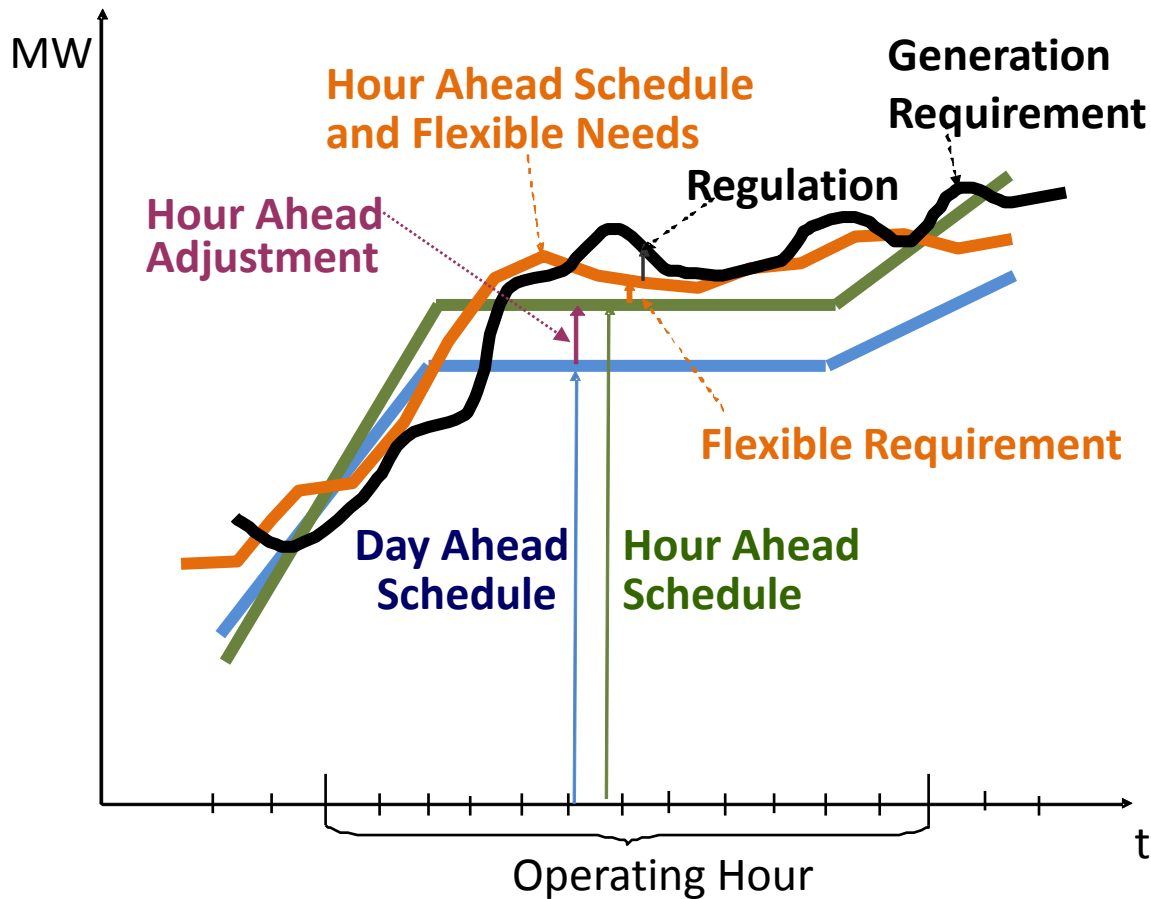
A typical day in winter/spring 2020



Maximum 1-hour net-load change - 2010 & 2011 actual vs. 2020 estimated



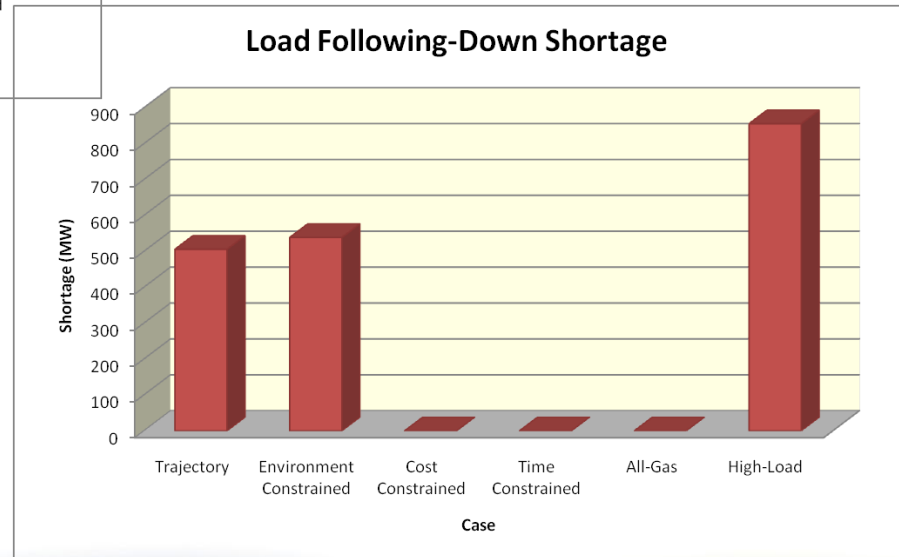
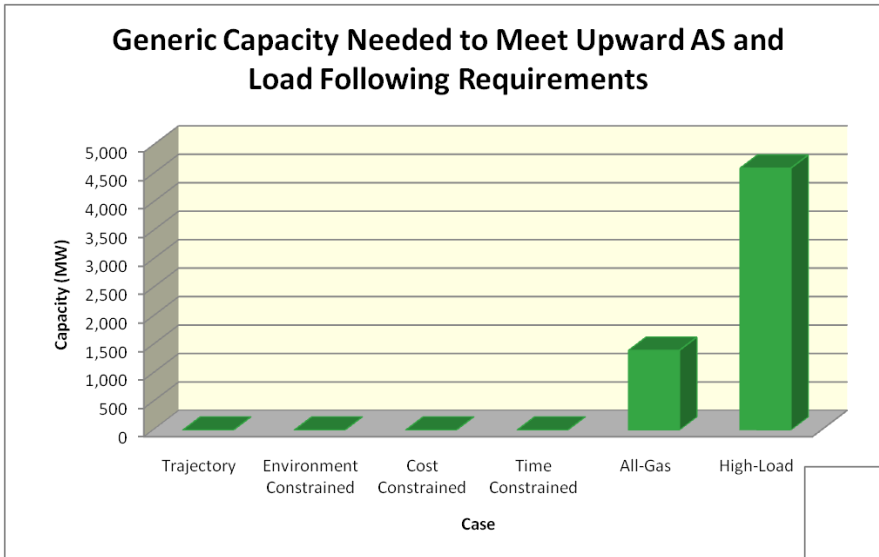
Flexibility capacity is also needed to mitigate intra-hour variations and provide contingency reserves.



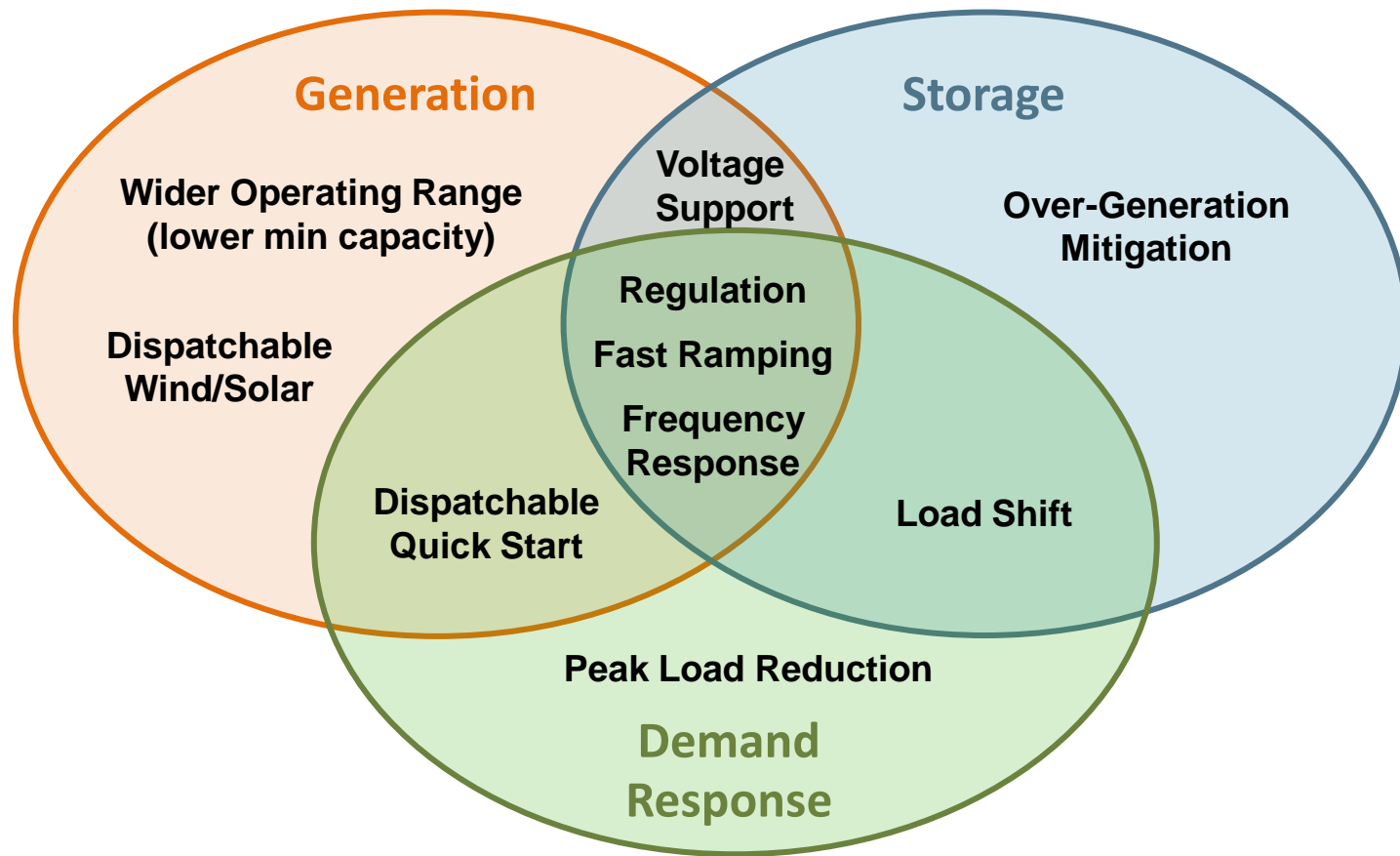
The CAISO has conducted various studies to assess impacts of 33% renewable generation on operation, including:

- Dynamic Transfer
- Frequency Response
- Distributed Generation Visibility and Control
- Renewable Integration and the CPUC LTPP
 - Load Following & Regulation Requirement
 - Production Simulations
 - Stochastic Simulations

The Renewable Integration Study preliminary results show need for additional flexible capacity by 2020.



Various types of resources can provide the needed flexibility capacity.



The CAISO is improving its market design for integration of 33% renewable generation.

- Resource Adequacy resource flexibility requirement
- Flexible capacity procurement – risk of retirement
- Dynamic scheduling
- Flexible ramping capacity
- Lower energy bid price floor