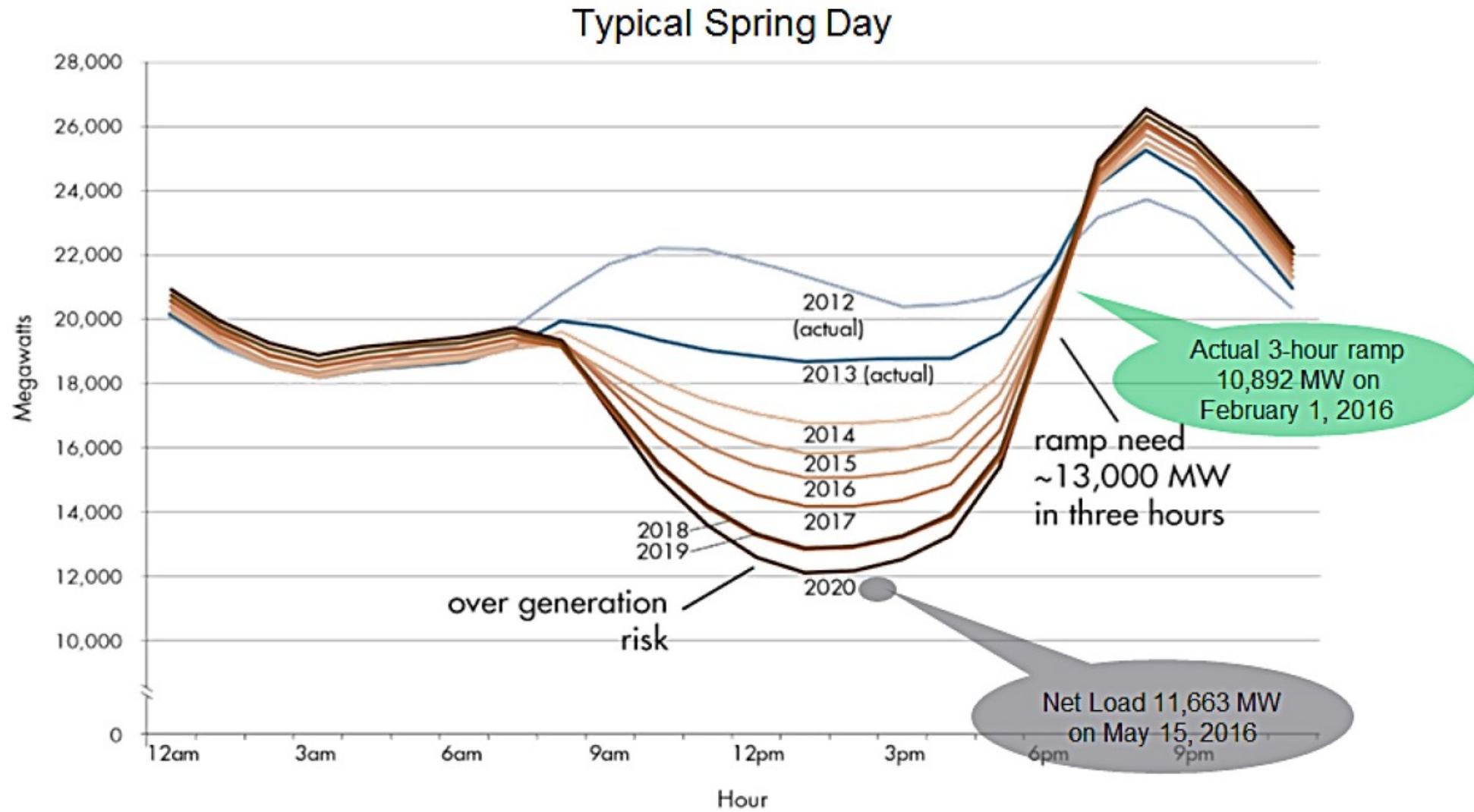


# Lapping the leader on clean energy

or

what we can learn from California  
to make “50 by 30” a success

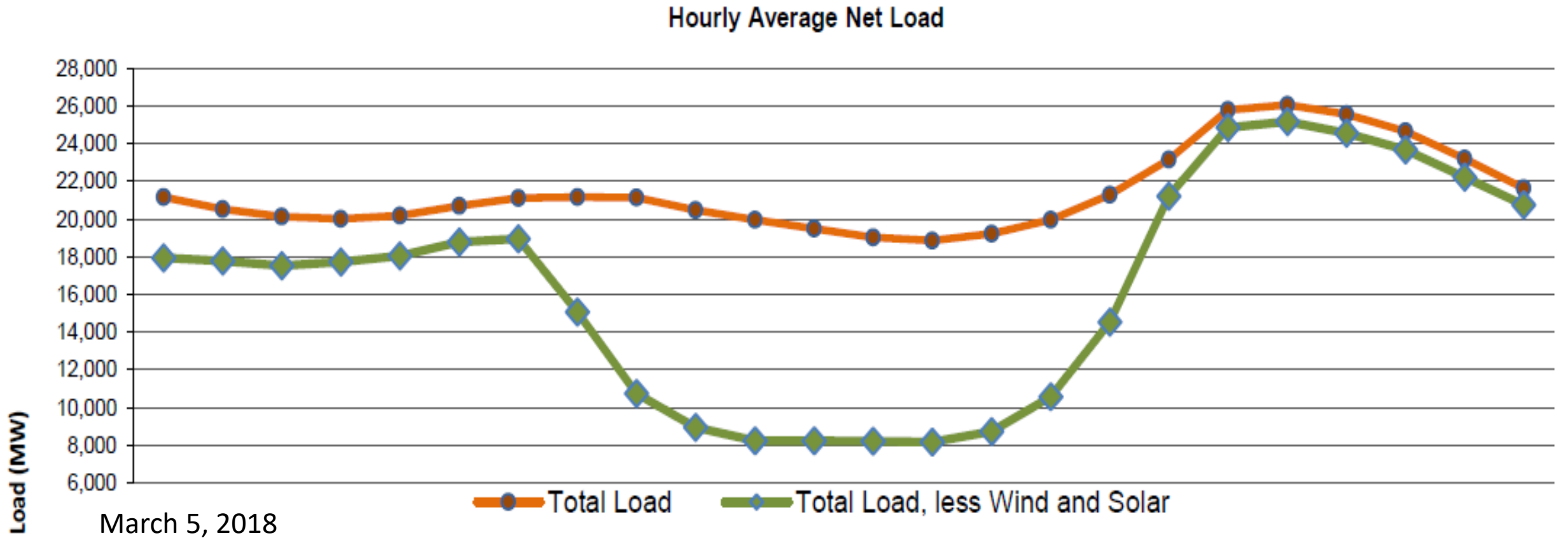
# 1. Too much of a good thing is not a good thing....



*Flexible Resources to Help Renewables*

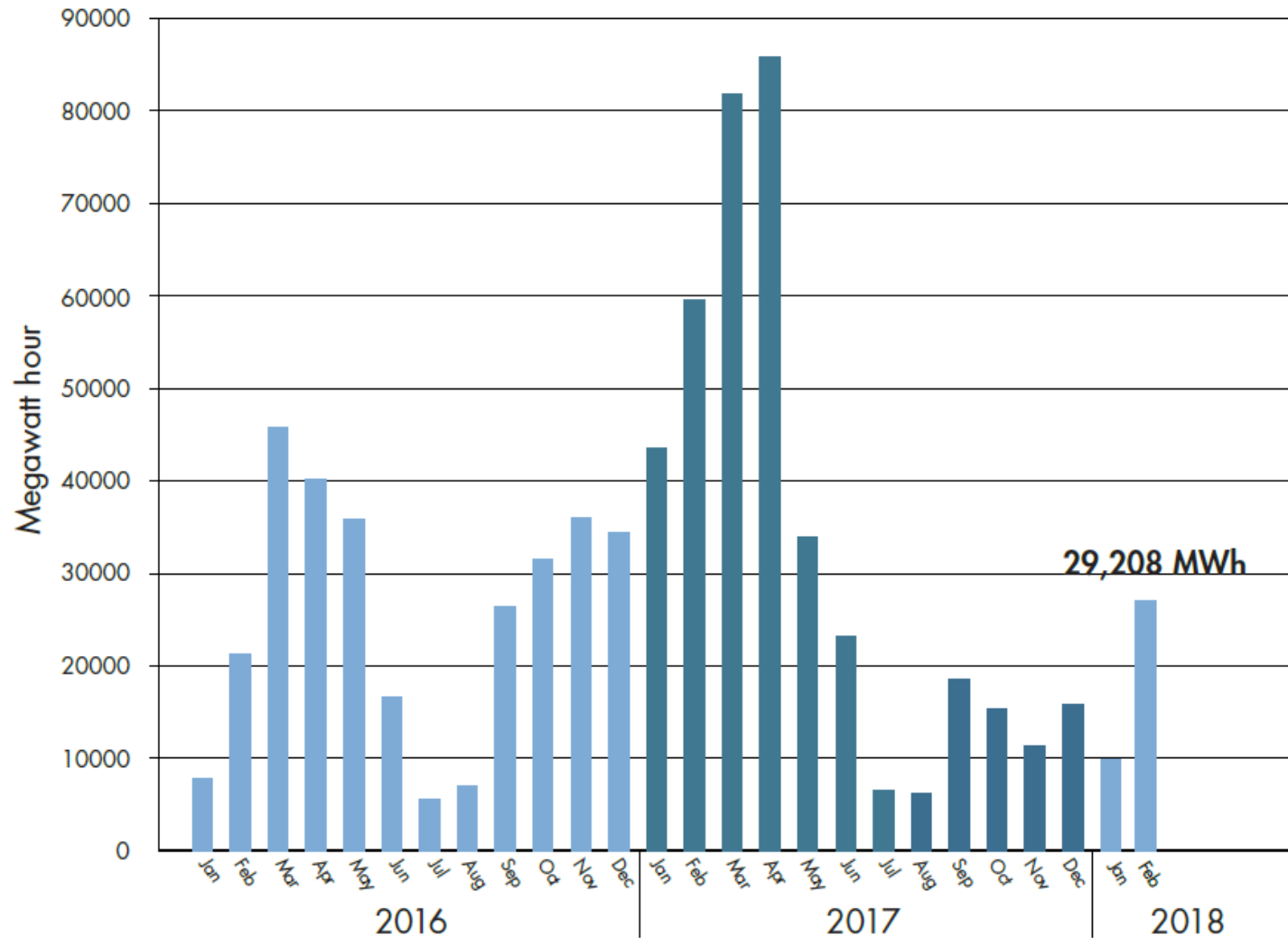
<http://www.caiso.com/market/Pages/ReportsBulletins/RenewablesReporting.aspx>

## 2. It happens faster than you thought it would



### 3. All of a sudden, everybody's getting very unhappy

#### Renewable Curtailment



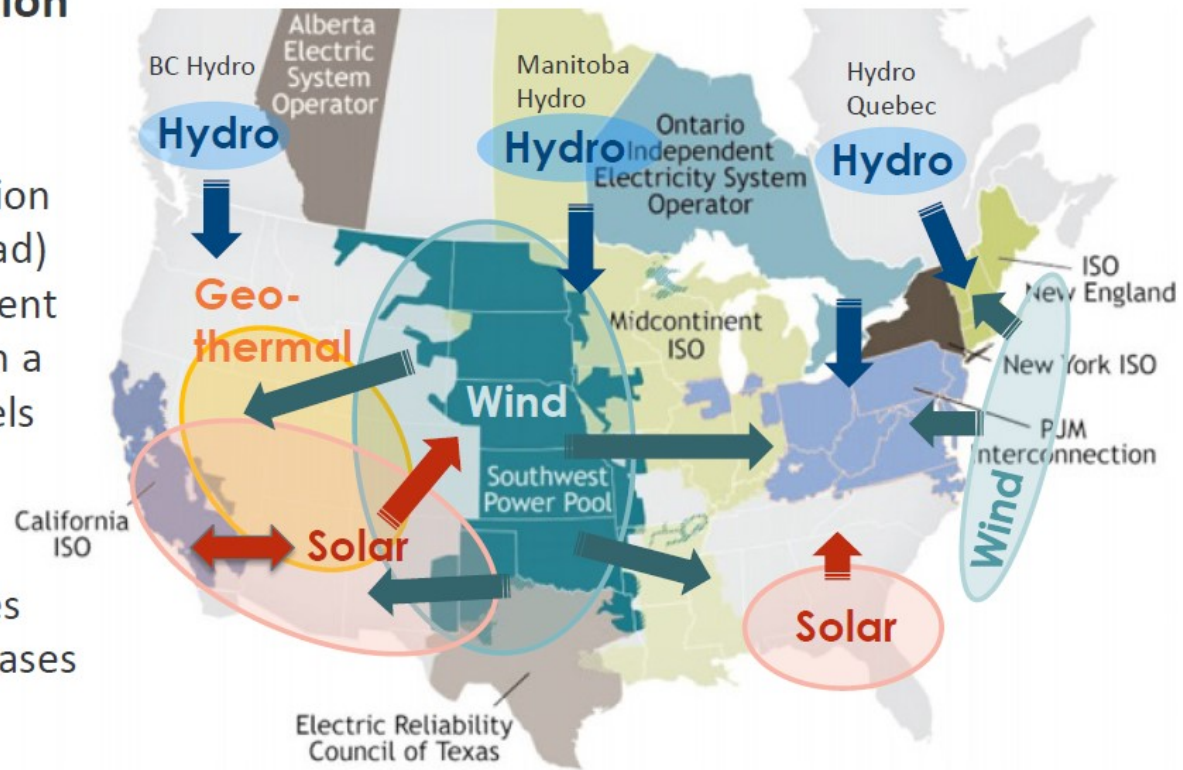
<http://www.caiso.com/Pages/Daily%20curtailment%20report>

4. If you're serious about cutting carbon with renewables, you have to think beyond state borders

## Diversifying Low-Cost Renewable Generation

Thus, focusing on resource diversification can offer significant benefits:









- Regional diversification of resources (and load) reduces the investment and balancing cost in a future with high levels of intermittent resources
- Diversity of resources (and load) also increases the value of transmission that interconnects them



## 5. One check mark is not very good ... we need to do them all

### Solutions

There are several promising concepts and technologies being explored to minimize oversupply and curtailment including:

 <p><b>Storage</b> – Increase the effective participation by energy storage resources.</p>	 <p><b>Western EIM expansion</b> – expand the western Energy Imbalance Market.</p>
 <p><b>Demand response</b> – enhance DR initiatives to enable adjustments in consumer demand, both up and down, when warranted by grid conditions.</p>	 <p><b>Regional coordination</b> – offers more diversified set of clean energy resources through a cost effective and reliable regional market.</p>
 <p><b>Time-of-use rates</b> – Implement time-of-use rates that match consumption with efficient use of clean energy supplies.</p>	 <p><b>Electric vehicles</b> – Incorporate electric vehicle charging systems that are responsive to changing grid conditions.</p>
 <p><b>Minimum generation</b> – explore policies to reduce minimum operating levels for existing generators, thus making room for more renewable production.</p>	 <p><b>Flexible resources</b> – Invest in modern, fast-responding resources that can follow sudden increases and decreases in demand.</p>



1. Think globally / act locally
  - Generation and transmission / Flexible, smart and efficient electric load
2. Decarbonize heating and transportation with flexible electric technologies
  - Reduce carbon faster
  - Avoid stranding more infrastructure costs for gas
  - Integrate more renewables better
  - Cheaper storage than batteries
  - Enhance indoor and outdoor air quality, health and safety
  - Start now!
3. Implement real-time pricing for electricity along with smart load growth
  - Unlock smart energy and smart consumers
4. Coordinate with PJM and other states on all of the above and on Energy Master Plan