Xtreme Power

CPUC Thought Leader's Panel
"The Economic Viability of Energy Storage"

Amanda Stevenson

San Francisco, CA - September 20, 2011

Agenda: Why, What, When & How

- **Why** are we here?
  - Assembly Bill (AB) 2514 directs the CPUC to determine if appropriate, and adopt, targets for each Load Serving Entity (LSE) under the Commission's jurisdiction to procure viable & cost effective energy storage systems by **October 13, 2013**
    - **December 31, 2015-** Deadline for the portion of a % of the target that would need to be achieved by LSE's
    - **December 31, 2020-** Deadline for the portion of a % of the target that would need to be achieved by LSE's

- **What** questions are we trying to answer on this panel today?
  - How can the CPUC determine the optimal cost-effective methodology for storage?
  - What are the direct and indirect costs & benefits of storage?
  - What are the advantages and disadvantages of distributed vs. centralized storage?
  - Which applications are most likely to have the most positive net benefits?
  - Which technologies are closest to commercial viability?

- **How** can the CPUC implement the recommendations & ideas given today?

Meeting CA's Energy Policy Challenges. Taking a Holistic Approach.

- California's Renewable Portfolio Standard (RPS)
  - 20% RPS by 2010 (likely achieved by 2012); 33% by 2020
  - Increases need for load-following capability and regulation-up/down to support integration of wind and solar
- Once-through cooling regulations (~2012-2022)
  - Proposed rules for repowering or retirement of 22 GW of thermal plants with once-through cooling
  - Will adversely affect ramping and energy regulation capability of generation fleet
- Greenhouse gas (GHG) policy
  - AB 32 compliance begins in 2012; target: 1990 emissions by 2020
  - Will increase costs of relying on carbon-emitting thermal plants used for energy regulation
- Governor's Clean Energy Plan calls for 12,00MW of on-site, distributed renewable generation with an assumed split of between behind the meter capacity (5,000 MW) & wholesale capacity sold to utilities (7,000 MW)

Framework: What is the Cost of NOT integrating Energy Storage in California?

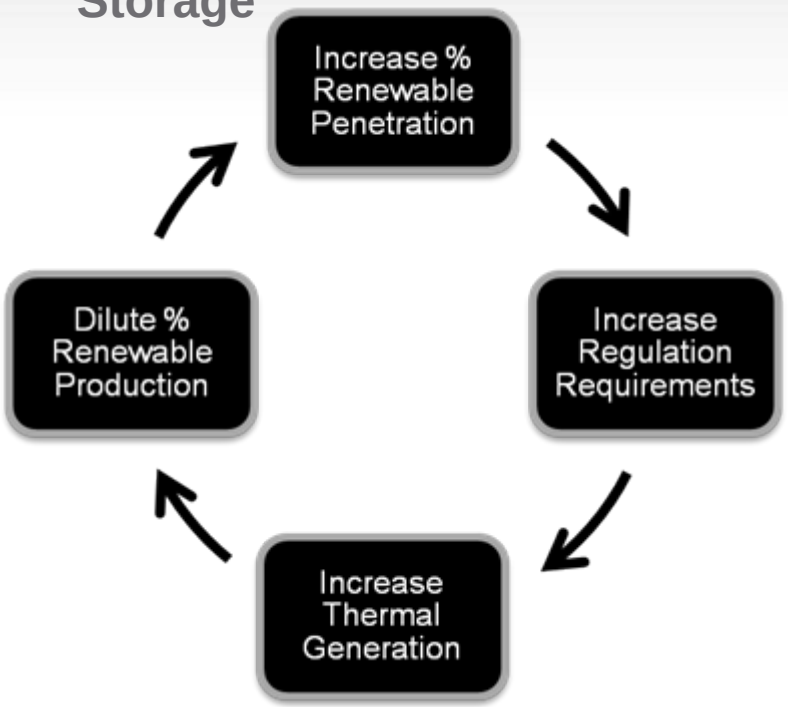
- Reduce cost to Ratepayers
- Deployment of more renewables & keeping the grid reliable in meeting the policy goal of 33%
  - What is the cost of procuring more capacity for regulation?
  - What is the cost of curtailing/spilling the clean energy produced from solar & wind?
    - Does this help to reduce pollution to meet AB32 (GHG) policy goal?
- Optimization of existing T&D fleet: “get more from what you already have”
  - What are the true costs (time & money) for more T&D build-out
    - What are the savings with using storage & deferring T&D build-out
    - Costs of EV penetration- it’s coming sooner rather than later

Recommendations

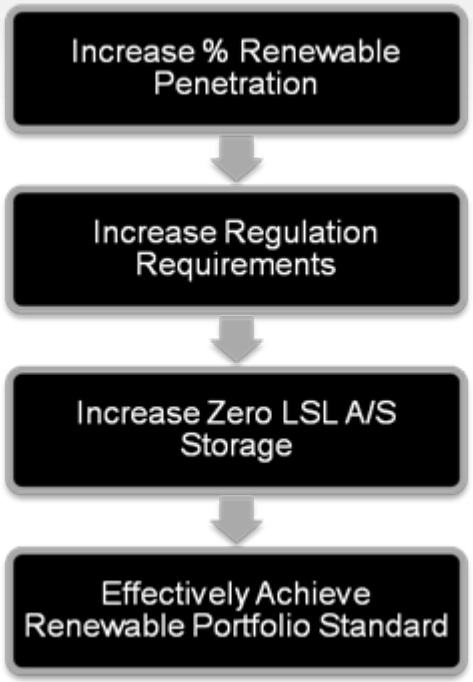
1. Don’t re-invent the wheel;
2. Think creatively about using storage in lieu of status quo;
3. Go after big ticket items first.

Can we meet 33% RPS more efficiently *without* storage & still meet CA's energy policy goals?

Meet RPS without Storage



Meet RPS with Storage



- To reach its 33% RPS, CAISO must increase regulation by 165% from 2009 levels[1]
- Insufficient down ramping capabilities will result in curtailment of wind in off peak hours[2]. Is *spilling* renewable generation counter productive to meeting policy goals?

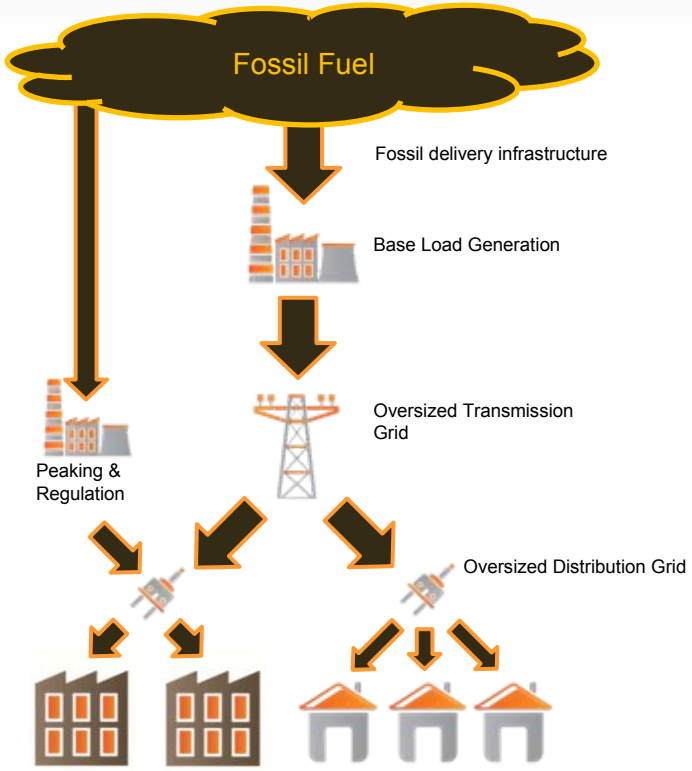
Xtreme Power

1.Energy Storage – a Cheaper, Faster, & Cleaner Alternative to Conventional Frequency Regulation, Strategen Strategies for Clean Energy, February 2011
2. ISO Study of Operational Requirements and Market Impacts at 33% RPS, California ISO, August 2010

Let's think about achieving overall system efficiency & optimizing current assets:

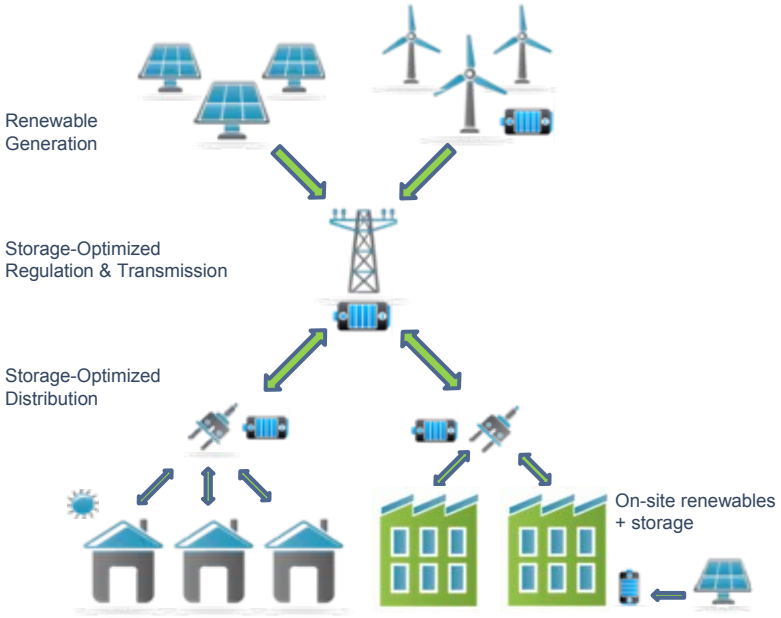
Current Grid Infrastructure

- Built for load and generation peaks that occur only a few times per year
- Massive fossil storage required



Future Grid Infrastructure

- Strategic buffers level generation and load, reducing Mura (unevenness) and Muri (overburden)4
- Result: more efficient & reliable electrical system



4. The approach is similar to Heijunka in the Toyota Production System, which levels production schedules in order to reduce overall waste