Department of Energy
Quadrennial Energy Review
Storage – Is It Finally Coming of Age?

Snohomish PUD

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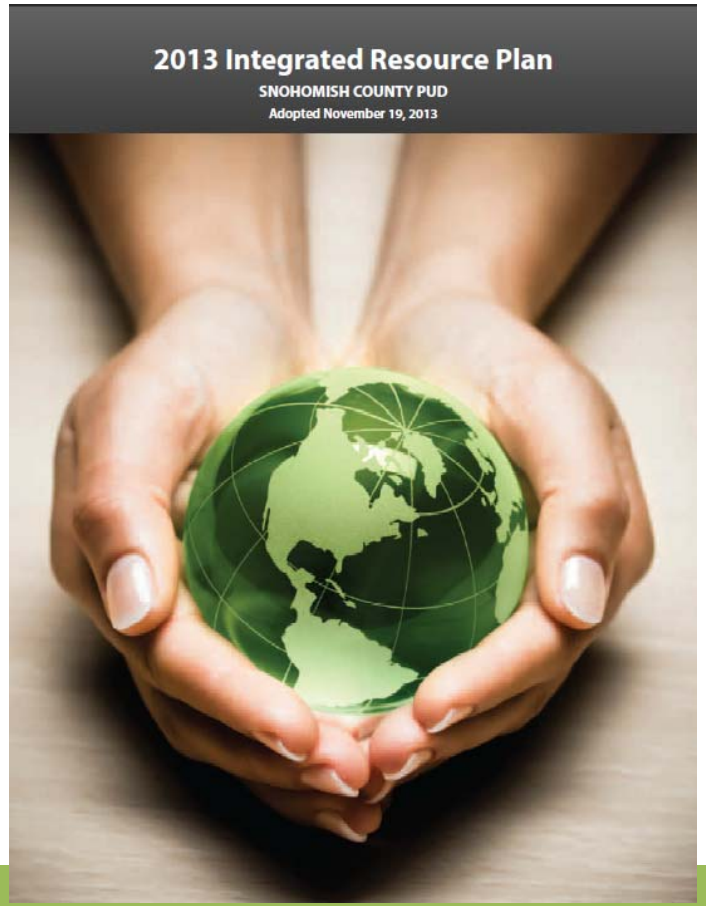
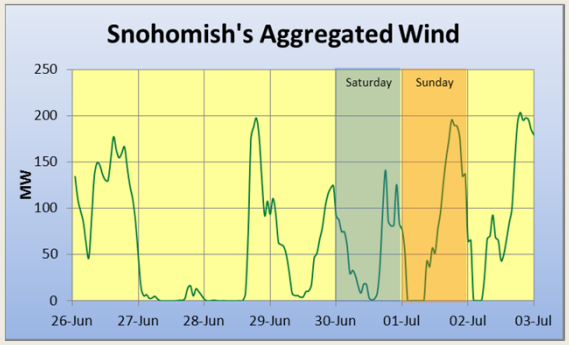
Building a Renewables Portfolio

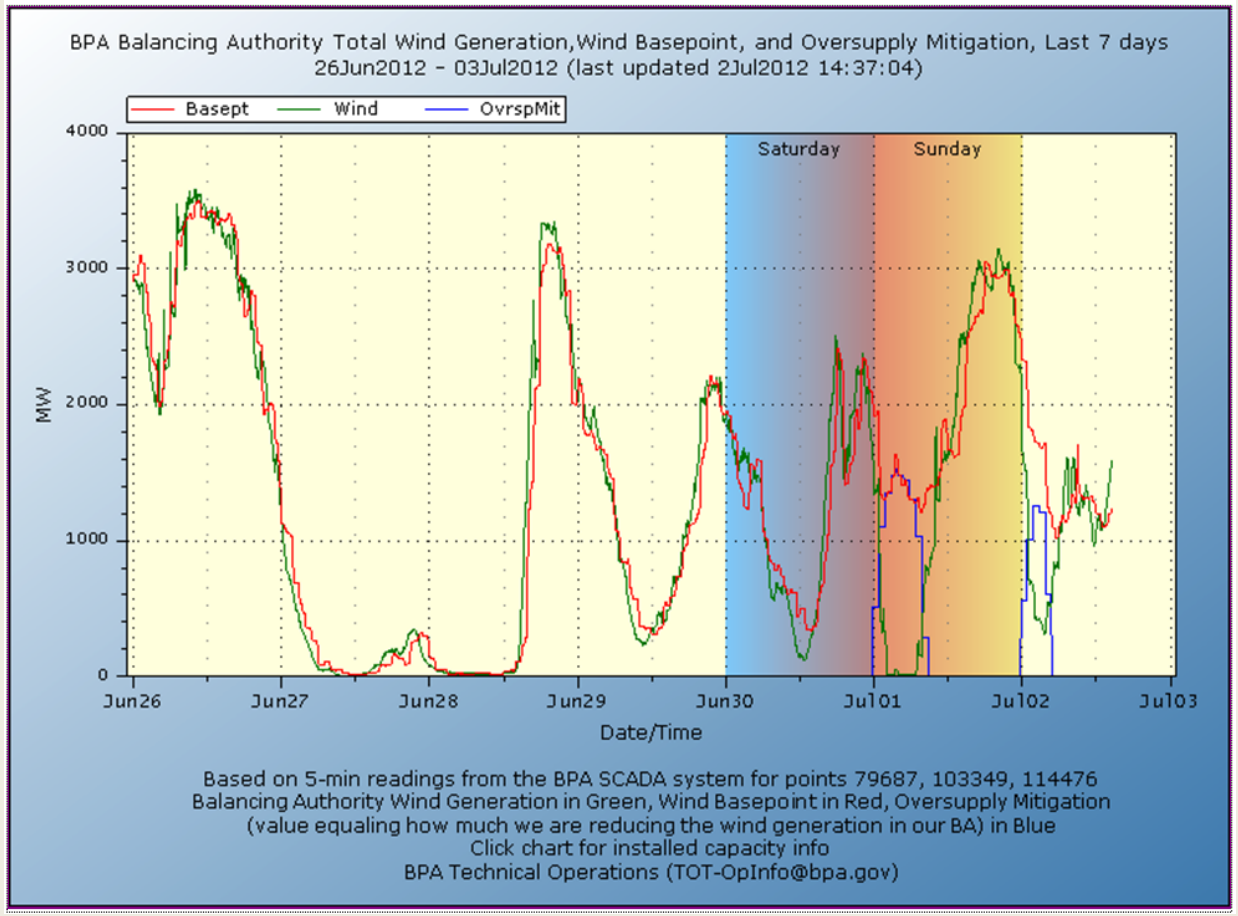
Power Supply {*we've got our sources*}

- Multiple Initiatives (*leaving no stone unturned*)
  - Conventional Resources
    - Bias for ownership
    - Wind
    - Geothermal
    - Low Impact Hydro
  - Customer Distributed
    - Solar
    - Small wind
    - Small renewables program
  - Research & Development
    - Tidal energy
    - Energy storage
  - Tying it all together
    - Smart Grid



Wind Variability





Existing Challenges for Energy Storage

- Current grid energy storage offerings
  - Expensive ($100k for 25 kw-hr system) →
  - Lack modularity
  - Lack interoperability
  - Lack scalability
  - Lack standardization
  - Monolithic; vendors operate beyond core expertise

For $30k you can get 24kw-hr of Li-ion storage with a Nissan Leaf wrapped around it...

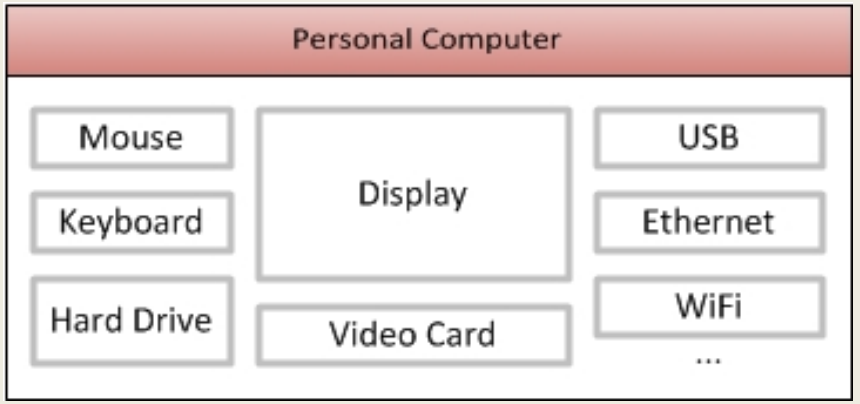
- Large gap between battery manufacturers and utilities

Vision

ESS ↔ {battery, PCS, …}

- Utilities want:
  - Standard components
  - Install, operate, maintain, upgrade, expand, …
  - Functional, cost-effective supply chain
- Standards must cover:
  - Physical
  - Electrical
  - Communications
  - Think USB, Ethernet, etc.

Analogy: PC Industry



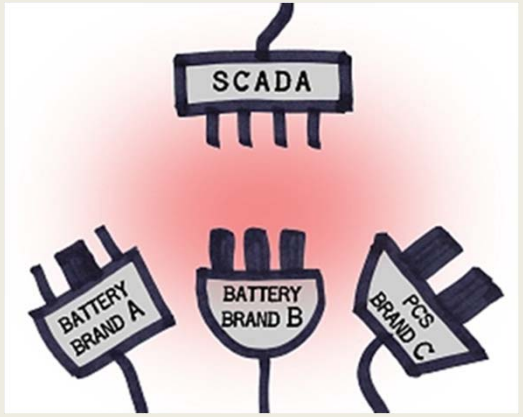
Opportunity

- Implications:
  - Utility market for significant-scale battery based storage is very small and slow growing
  - Projects to-date are either highly optimized one-off niche projects, or small learning/demonstration projects
  - Decreasing battery prices alone are unlikely to stimulate utility energy storage market growth significantly
  - Battery manufactures and other market players see the same landscape and agree there needs to be more done to effectively facilitate change

- Opportunity: focus on architecture and standardization
  - Develop and deploy "Modular Energy Storage Architecture" (MESA)

MESA Overview

- Current utility-grade energy storage systems (ESS) are project-specific, one-off solutions, built using proprietary components that are not modular or interoperable.



- *Modular Energy Storage Architecture (MESA) is an open, non-proprietary set of specifications and standards. Through standardization, MESA accelerates interoperability, scalability, safety, quality, availability, and affordability in energy storage components and systems.*

MESA Goals

- **Standardize components and interfaces**
  - Scalable, modular ESS from standard batteries, PCS, s/w
- **Give utilities real, long-term flexibility**
  - Avoid rigid, proprietary solutions
  - Enable true, large-scale **ES infrastructure**: scalable, manageable
- **Give suppliers more reach**
  - Core competencies, lower cost → grow customer base and revenue
- **Transform the energy storage market**
  - Standard components, more customers, lower risk for all

MESA Standards Alliance (www:mesastandards.org)

- Open Standards for Energy Storage
- Partnership with SunSpec
- Supporters

Mitsubishi International Corporation

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ALSTOM

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

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SUNSPEC ALLIANCE

Parker