Clean and Affordable Thoughts…

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What do we want?

"Customers want [energy with] reliability, affordability and environmental stewardship."

-- Debra Smith, Seattle City Light

Resource adequacy

Two definitions:

- "the ability of the electric system to supply the aggregate electric power & energy requirements of electric customers at all times, taking into account scheduled and reasonably unscheduled outages of system components"*
- "having enough resources – generation, efficiency measures, and demand-side resources – to serve loads across a wide range of conditions with a sufficient degree of reliability."**

"At the core of this, it's a supply & demand problem."^

* NERC LTRA 2018

** Northwest Power Pool, "Exploring a Resource Adequacy Program for the Pacific Northwest," 10/19

^ Steve Wright, Chelan PUD, 10/19

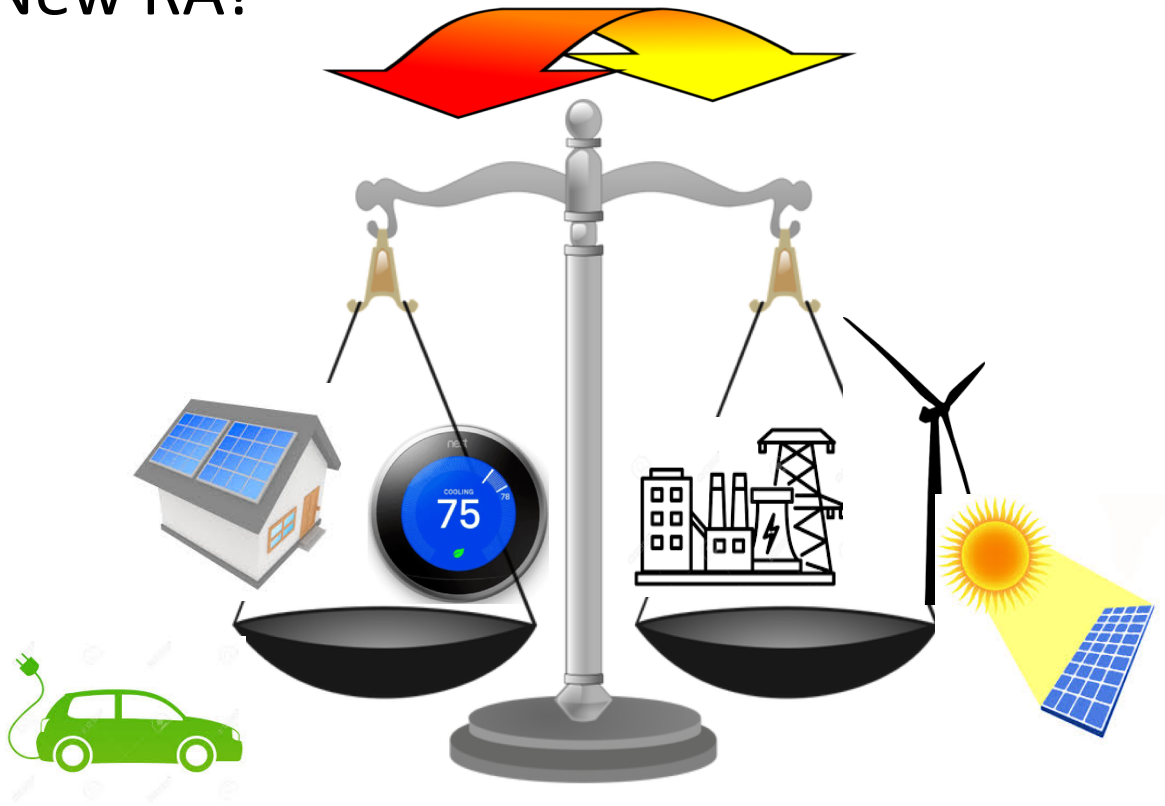
What does resource adequacy mean today?

When supply is intermittent and demand is manageable?

How to calculate adequacy, LOLP, EUE or planning reserve margin with controllable or elastic demand and DG?

Old RA

New RA?



Time to rethink capacity

Capacity can't just be bulk MW any more.

Capacity for a system with intermittent, fast-moving, manageable resources should offer value along several dimensions:

- Available at precise time of need (not just summer or winter peak)
- Fast and flexible
- Able to perform multiple reliability and market functions
- Locational diversity plus deliverability
- Predictability (deterministic or statistical? Implementation speed)

Do not reward resources that don't deliver when and what's needed!

What are the possibilities for large generators on the bulk power system?

Big guys rule…

Kumbaya

Eat or be eaten

Lots of reasons for utilities not to build big plants

- Changing technology & economics of new generation options – high cost or stranded assets
- State clean and decarbonization mandates
- Utility financing, risk allocation and insurability challenges
- Rising environmental risks
- Flat and changing loads*
- Markets not kind to big gen…

* Depending on electrification…

Affordability and resource adequacy

- Supply-demand balance matters – but it's not cheap
- The goal of RA is to be able to serve customer loads – but most customer outages (until PG&E PSPS…) are due to T&D failures, not supply failures.
- With increasingly hazardous weather and human threats to the energy system, what's the right balance of investment in resource adequacy relative to T&D (deliverability, resilience), customer protection (community & customer hardening), and other measures (e.g., flexibility, recovery)?

- What's the best way to use customers' $ to meet <u>their</u> energy needs, not just yours?

Why to do more distributed and demand-side resources

- Well-controlled (esp. automated) demand, storage and inverter-based resources can provide fast, flexible, predictable essential reliability services with time and locational precision*
- Leverage other people's money
- Much EE and DR can be built quickly and ratebased
- Better for community resilience and customer protection, particularly against extreme weather and grid failures
- Better for economic development and social equity

* Subject to effective cyber-security….

Always do efficiency first!

Do EE before DR, electrification and renewables

Why EE first:

- Usually the least expensive resource option with the highest benefits and co-benefits (health, GHG reductions, jobs, customer bill savings, economic productivity)
- Has the potential to cut both energy use and U.S. GHG emissions in half by 2050*
- Can be designed to cut peak loads at lower cost than other measures,** making it easier to manage the grid for reliability
- Can be tailored for time-specific relief in energy, demand and $^
- Much EE “always on” -- fewer vulnerabilities and failure modes

* Nadel & Ungar, “Halfway There: Energy Efficiency can cut energy use and Greenhouse Gas Emissions in Half by 2050,” ACEEE, 9/19.
** Frick, Hoffman et al., “Peak Demand Impacts from Electricity Efficiency Programs,” LBNL, 11/19.
^ Frick & Schwartz, “ Time-Sensitive Value of Efficiency,” LBNL, 11/19.

Energy efficiency priorities

- Cut demand to lower pressure on the grid
- Design EE to reduce GHG emissions, not just to cut kWh or therms
- Massive building EE retrofit effort to protect people against harsher environment and economic and grid failures
- Design and integrate EE with DR for permanent peak reductions and dispatchable demand flexibility
- Use codes and standards with utility programs for max EE

Thank you!

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