Resource Adequacy in the Future Grid

NCEP Annual Meeting: Coordinated Electricity Planning

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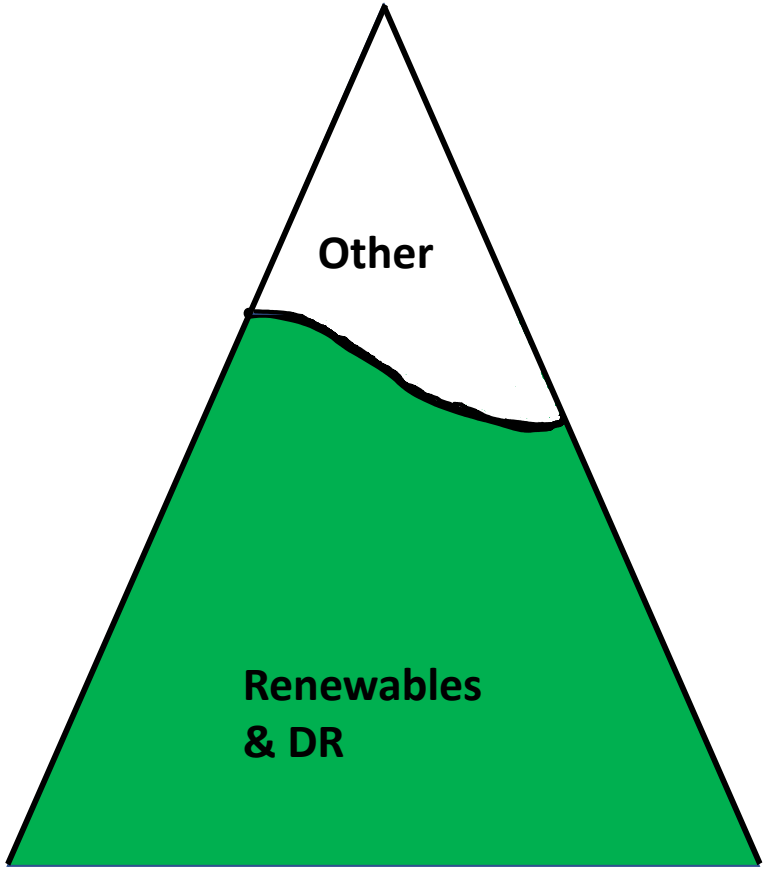
GridLAB

Outline

- Resource adequacy basics (RA)
- Energy-first planning
- Energy Systems Integration Group (ESIG) Principles for RA
- Towards a more wholistic planning process



Resource Adequacy

Resource Adequacy (RA) is a counting problem

- **Have we built enough stuff to supply demand at some future date(s)?**
  - RTO, utility IRP, region
- **"How adequate" can be turned upside down into "How often do we have a problem?"**
- **How many problems?**
- **How long did they last?**
- **How large was the energy deficit?**
- **How large was the capacity deficit?**

Also see https://pubs.naruc.org/pub/752088A2-1866-DAAC-99FB-6EB5FEA73042

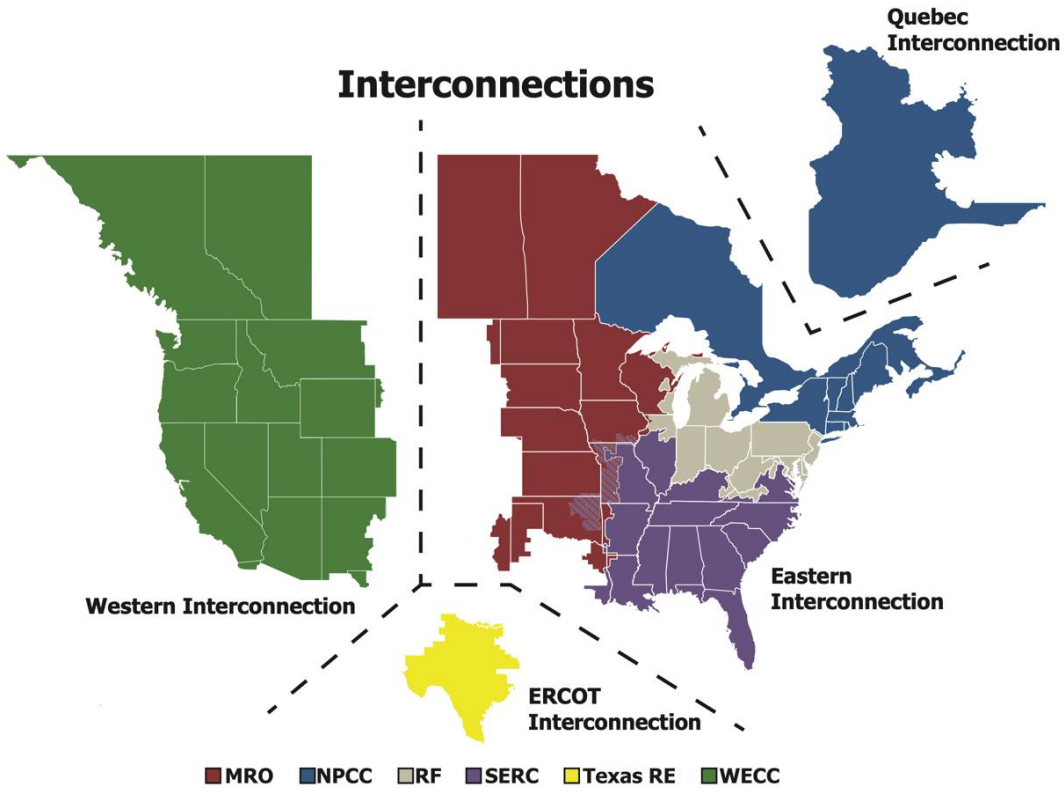
…and what is “acceptable” RA target?

- **How many loss-of-load events per period?**
- **How long of a LOL event is too long?**
- **How much demand/energy is “ok” to not supply?**
- ***These are policy questions***

- **Trade-off between reliability and cost. *Reliability is not free***

Loss of load is usually a mis-nomer

- US grid is made up of 3 interconnected systems
- "LOL" is often "emergency import"



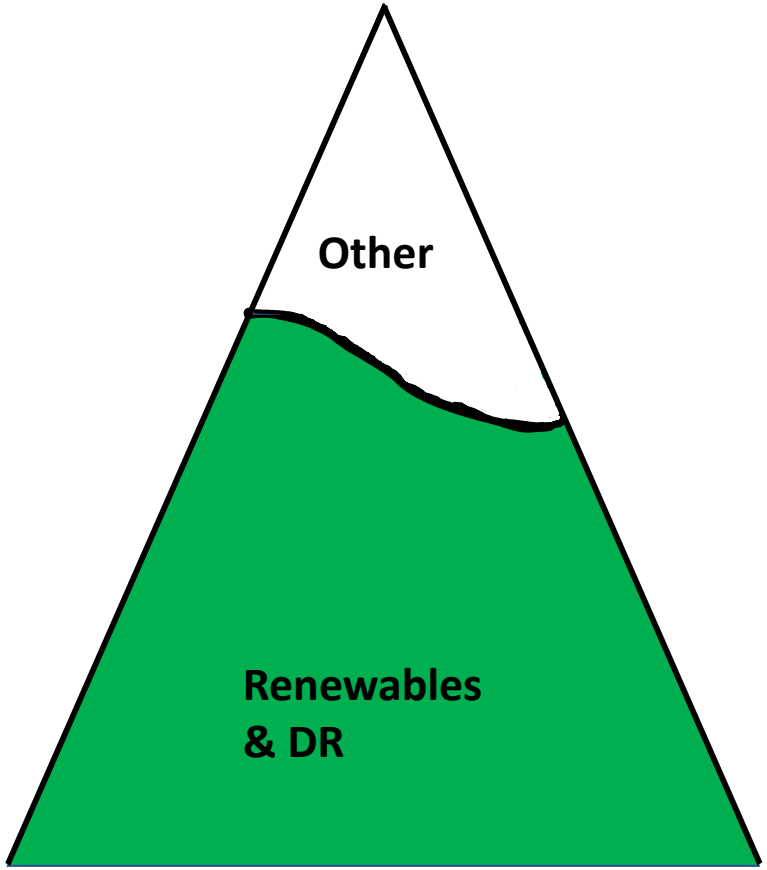
Renewables are complicating risk assessment

- **Traditional, starting in 1950s**
  - Most LOL risk during/near system peak
  - Focus on daily LOLP; ignore hourly data
- **With renewables**
  - Shifting risk periods
  - More interest in hourly view
  - More interest in energy metrics
- **Historically applied to bulk system only**
- **With DR, storage – more complexity**
- **Fortunately, methods and computational tools exist that can help**

See ESIG: Redefining Resource Adequacy: https://www.esig.energy/resource-adequacy-for-modern-power-systems/

My View

- **Comprehensive "Energy first" planning**
- **Start with renewable objectives**
- **Fill in with "other" (storage, DR, other resources)**



New Approach to RA is needed: ESIG

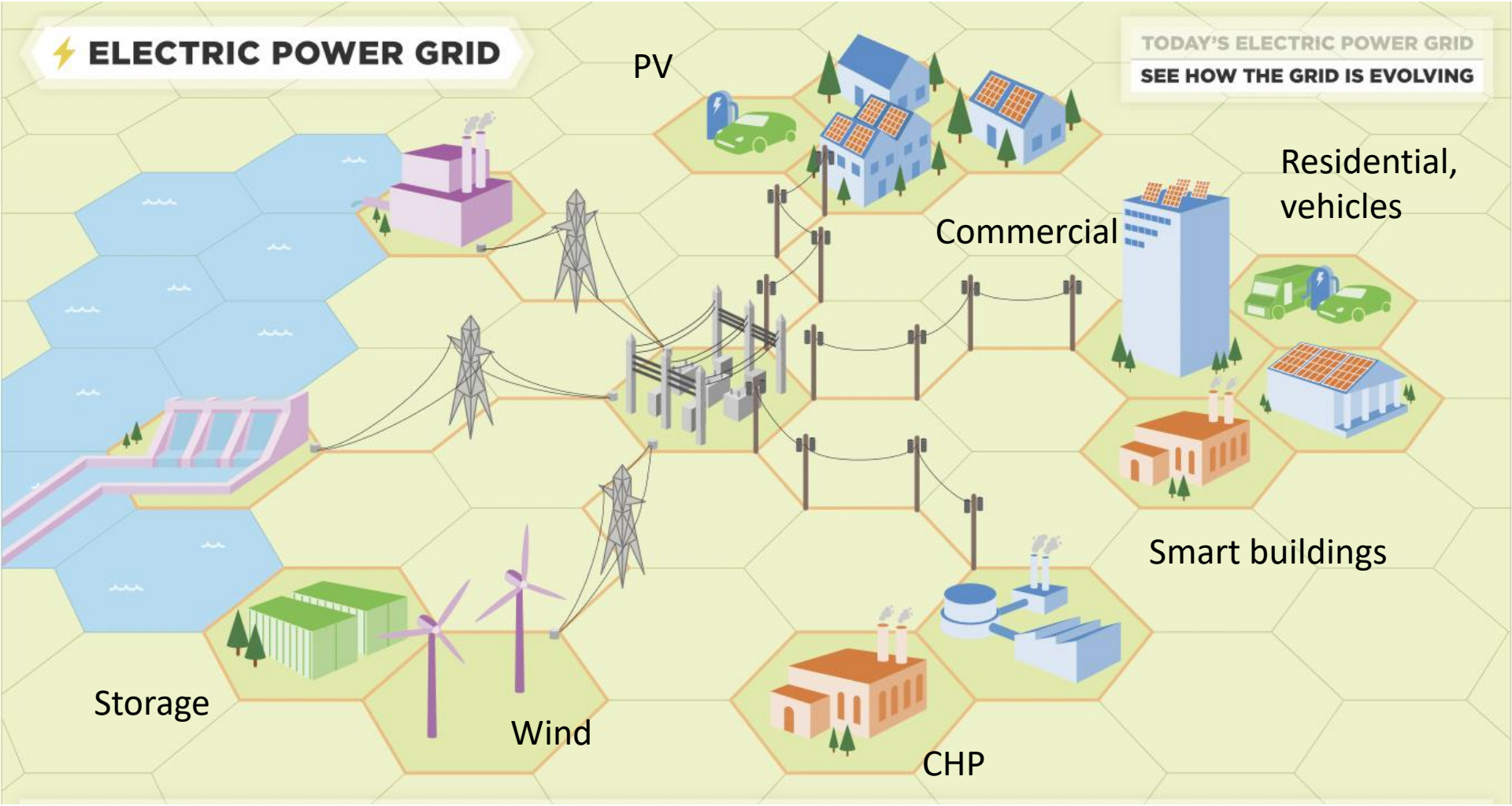
- **Quantifying size, frequency, duration, and timing of capacity shortfalls is critical to finding the right resource solutions.**
- **Chronological operations must be modeled across many weather years.**
- **There is no such thing as perfect capacity.**
- **Load participation fundamentally changes the resource adequacy construct.**
- **Neighboring grids and transmission should be modeled as capacity resources.**
- **Reliability criteria should be transparent and economic.**

See ESIG: Redefining Resource Adequacy: https://www.esig.energy/resource-adequacy-for-modern-power-systems/

Customer is key

- **Building on ESIG principles, we need to change reliability criteria**
- **Focus on customer outages**
  - Number of outages
  - Size (number of customers), duration
- **For every MW/MWh generated by customer, one less MW/MWh is required from the bulk system → we need to incorporate what happens on the distributed system too**

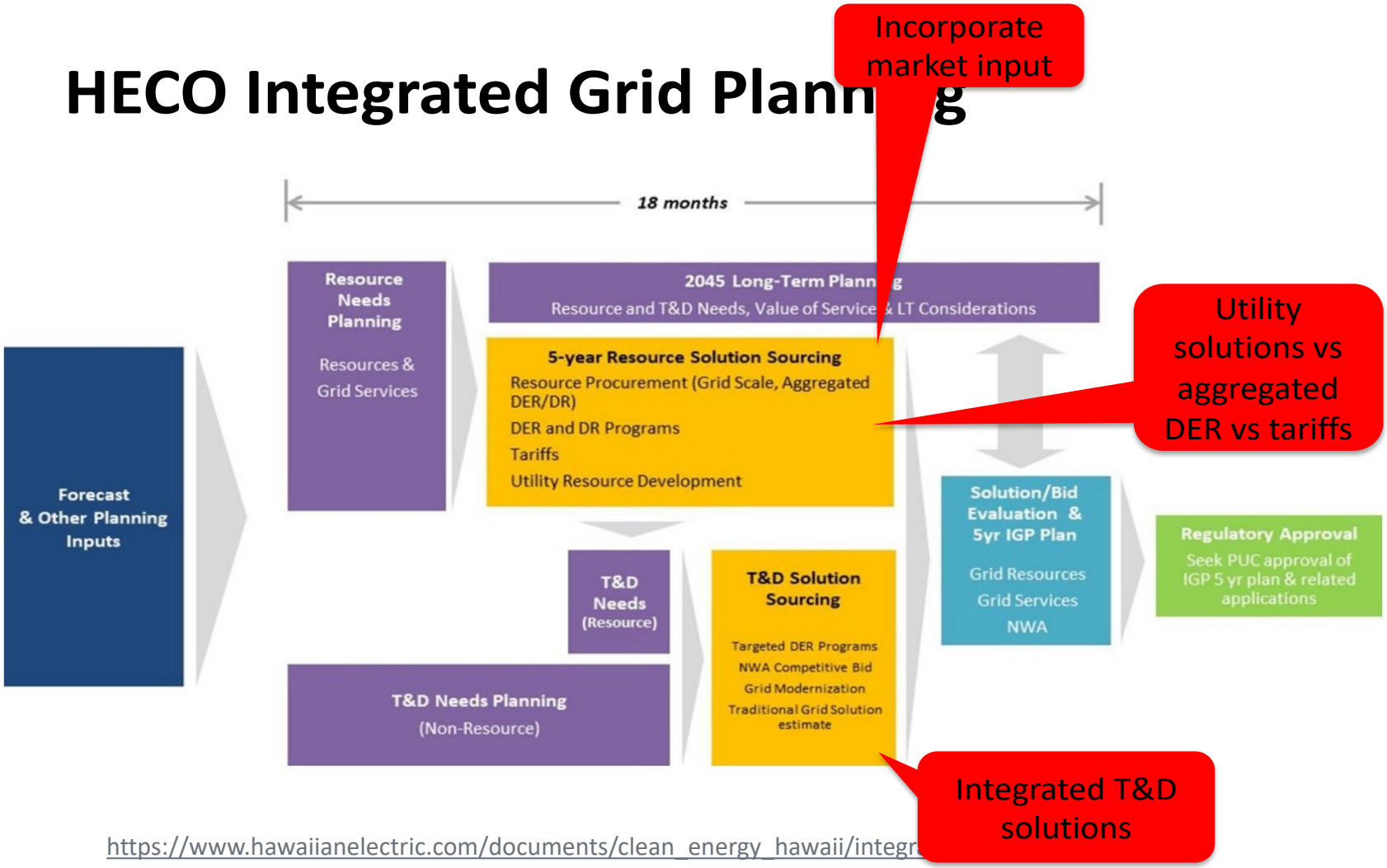
Energy-First requires comprehensive RA



U.S. EPA https://www.epa.gov/energy/about-us-electricity-system-and-its-impact-environment

Integrate G, T, D planning (HI example)

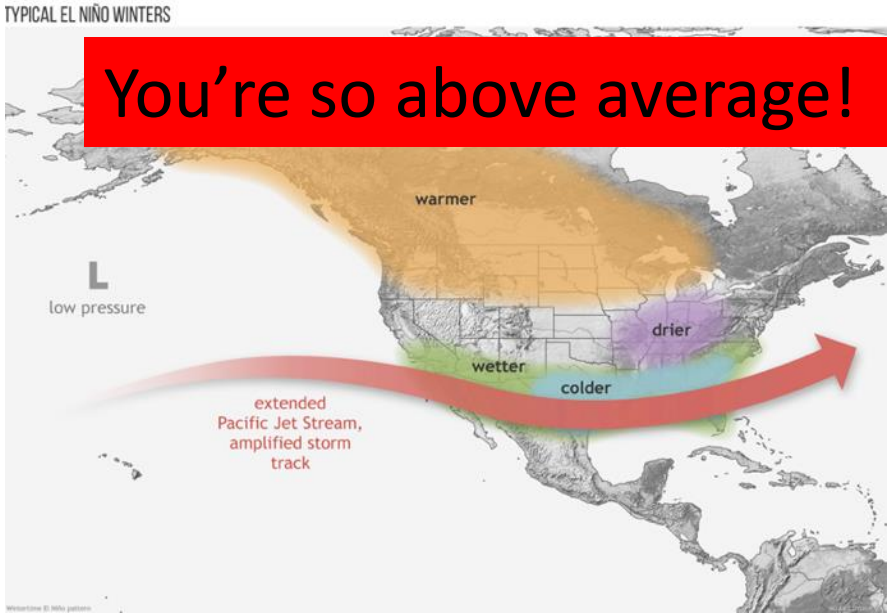
HECO Integrated Grid Planning

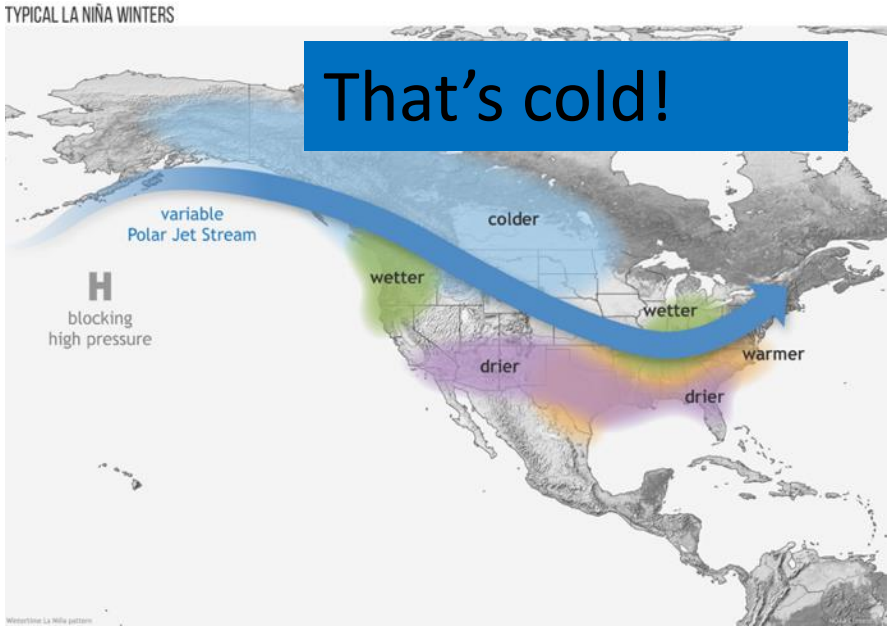


https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integr
0301_IGP_final_report.pdf

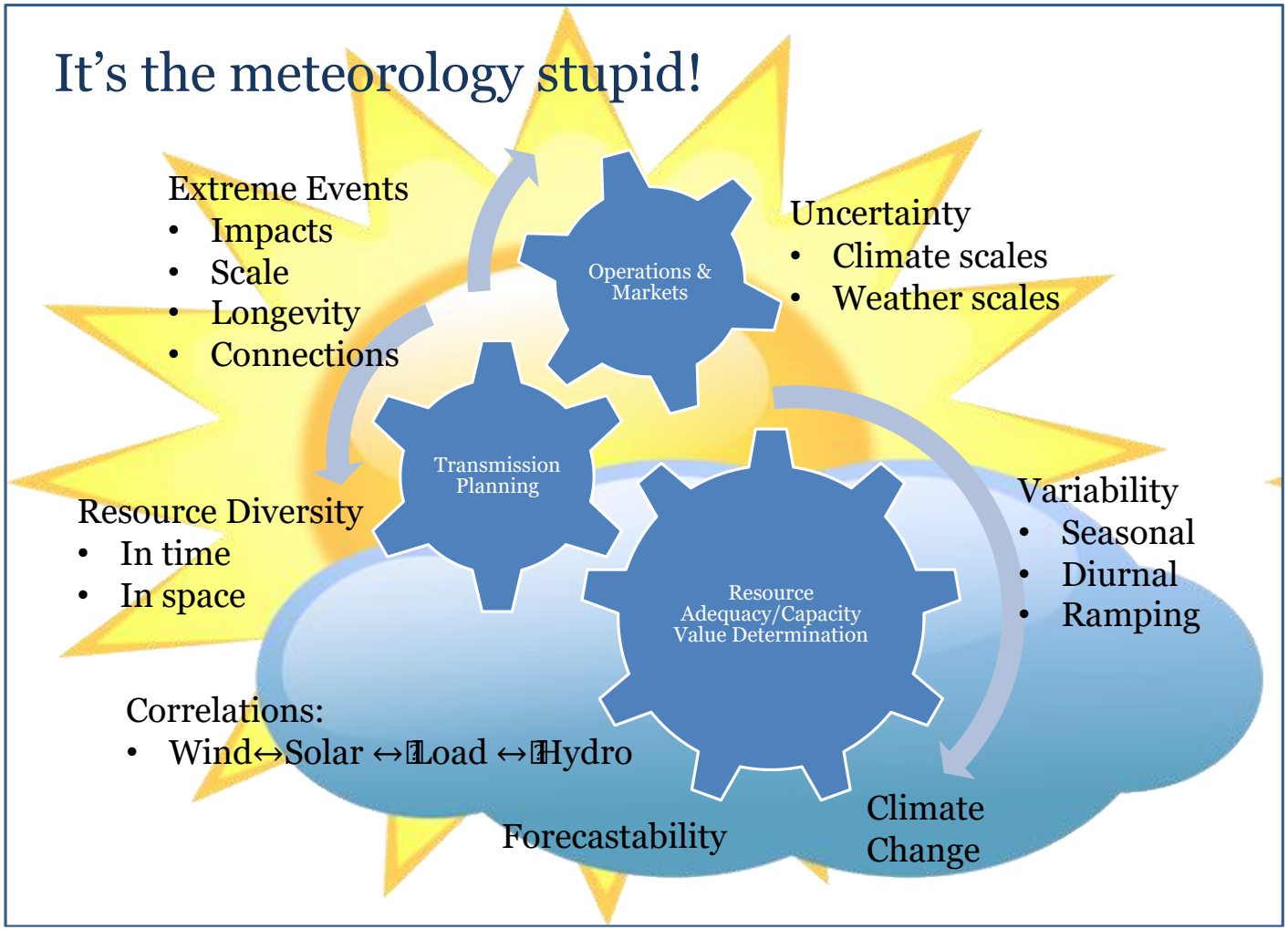
Long-term weather; need more robust planning

- As a species, humans often don't have the capability to incorporate uncertainty and volatility into planning
- Planning is usually done based on "average" or "representative" weather





Weather, weather, weather



More robust planning is needed

- **RA targets and planning must evolve**
- **A more wholistic, energy-first planning is needed**
- **Policy-makers and customers need to work together to develop new reliability targets – what is an acceptable tradeoff with cost?**
- **Long-term weather impacts must be factored into standard planning processes – don't plan to an average weather year**

Questions?