Planning Under Uncertainty: A Regional Perspective

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October 29, 2024

Northwest **Power** and
Conservation Council

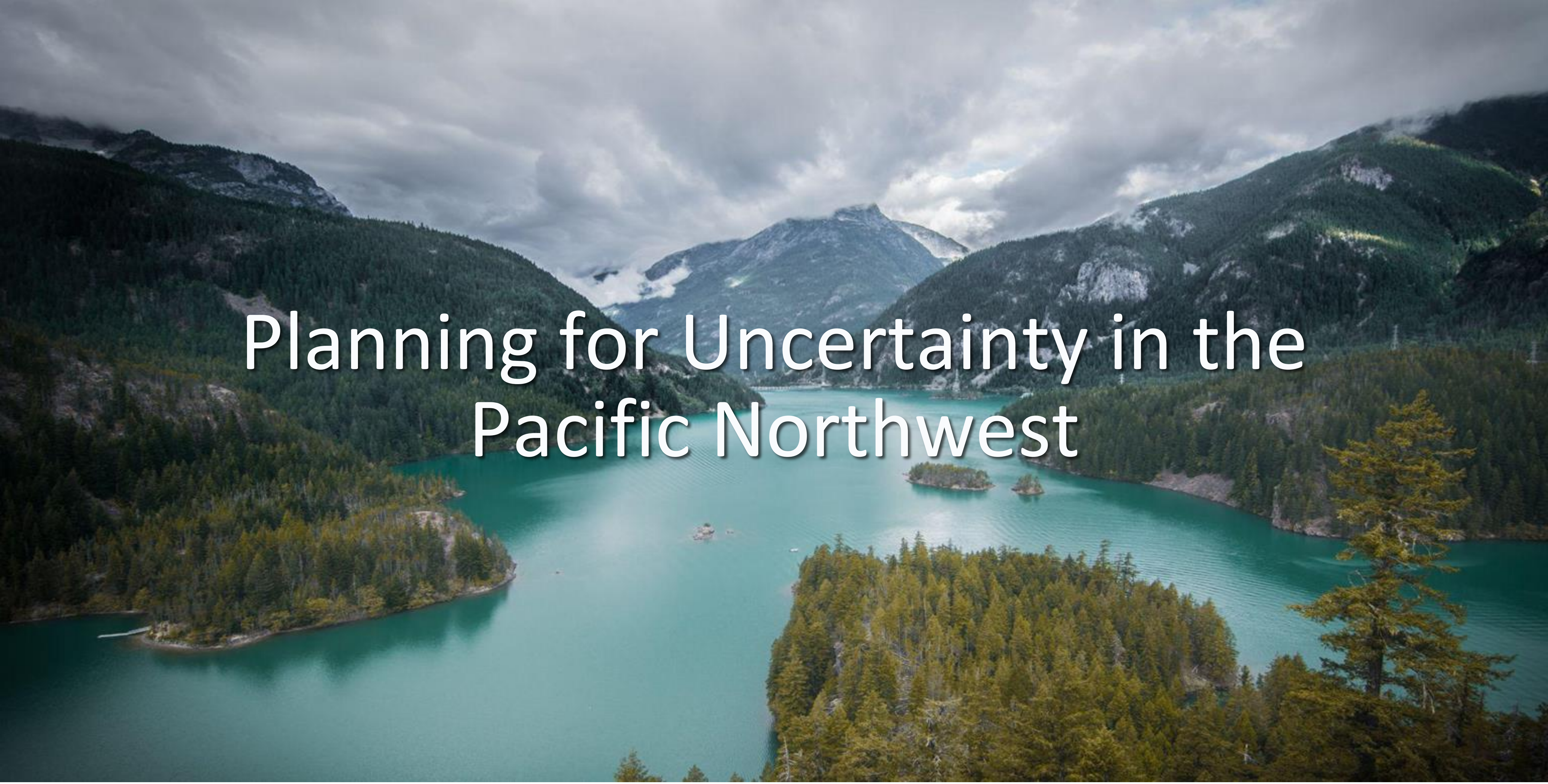
1980 NW Power Act

The Act authorized Idaho, Montana, Oregon, and Washington to create the Northwest Power and Conservation Council.

The Council's power plans/fish and wildlife programs impose legal responsibilities on BPA and other federal agencies.

Council's responsibilities under the Act

- Develop a **conservation and generation power plan** to add low-cost electrical energy resources and assure the Pacific Northwest has an adequate, efficient, economical and reliable power supply
- Develop a **program to protect, mitigate and enhance fish and wildlife** affected by hydroelectric facilities in the Columbia River Basin
- Inform and involve the **public**



Planning for Uncertainty in the Pacific Northwest

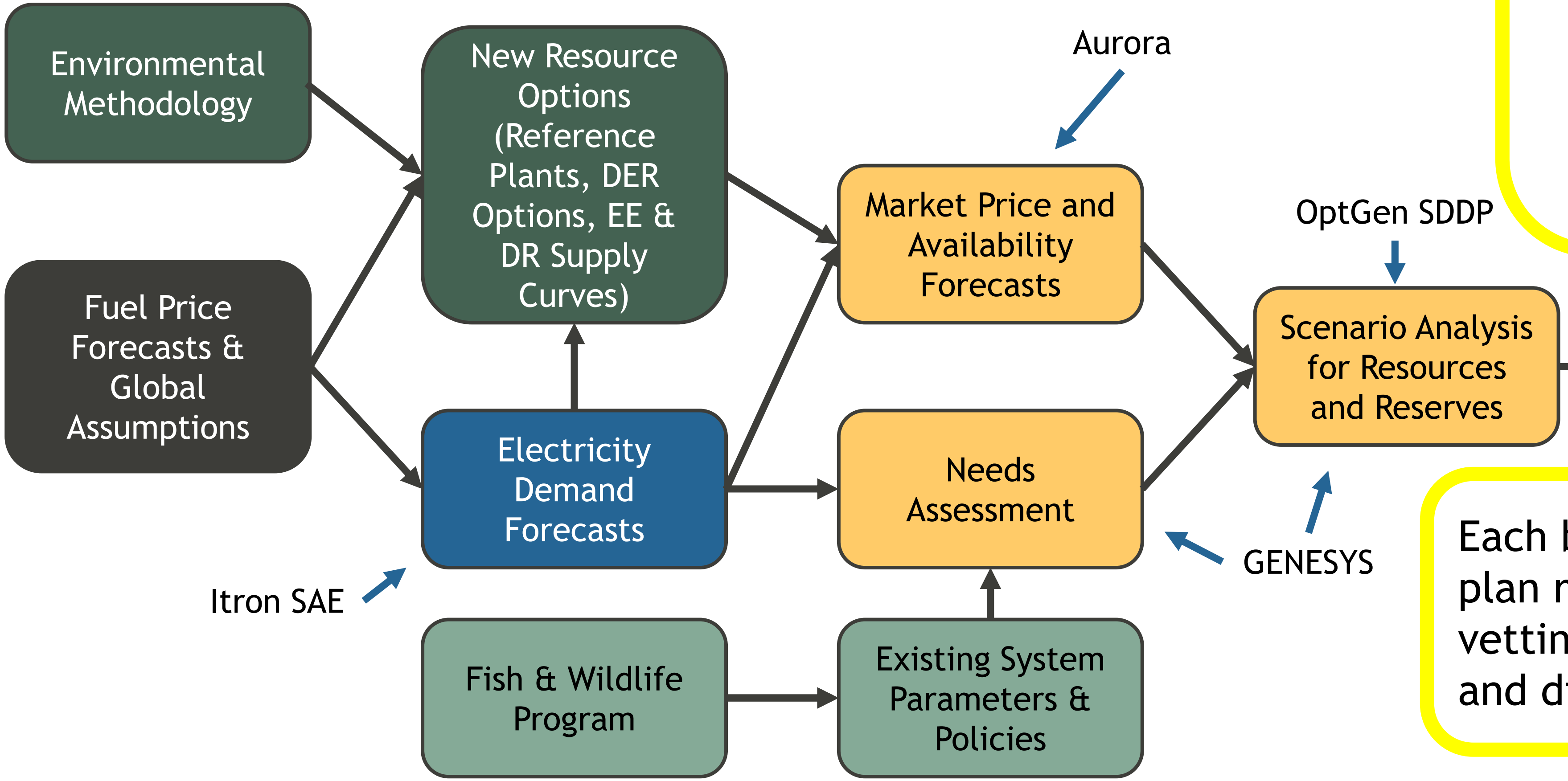
The need for power planning

- Council created in response to a significant misjudgment in energy needs; resulted in a cost burden the region still bears today

- Revisit the power plan every 5 years

- The pace of transition to a new energy mix brings up a question:
  Will energy be available when we need it?

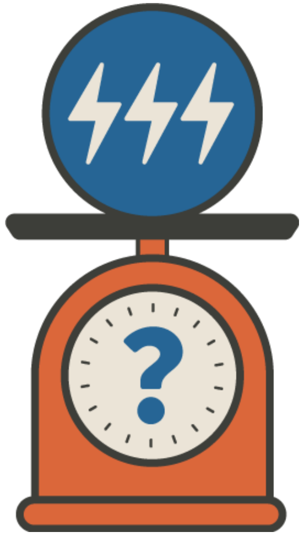
Roadmap to building a Regional Power Plan



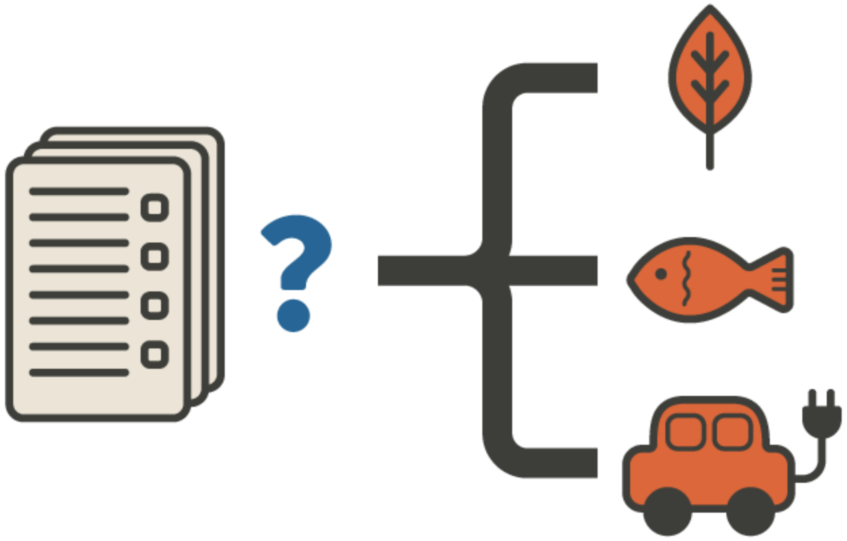
Council Meetings
Advisory Committees
Fuels
Generating Resources
Demand Response
Conservation Resources
Demand Forecast
System Analysis
Resource Adequacy
Climate and Weather

Each building block of a power plan requires significant vetting, project management and discussion in public

Planning for uncertainty



Load uncertainty
How much energy will we need at any given time?



Policy uncertainty
Where are policies going, how to meet them and how might that impact the energy needs or choices?

Supply uncertainty
Will the energy supply be there when we need it?

How Have We Balanced Cost and Risk in Our Process?

No power system is designed to deliver power 100% of the time, as the cost to ratepayers of achieving that outweigh the risks.

Separate the problem into parts

- Strategically simulate regional operational risk in throughout planning period (Adequacy Risk)
- Calculate energy, capacity and reserves that are tuned to meeting regional adequacy standard and capabilities of resources to meet those obligations (Metrics)
- Run capital expansion modeling different policy scenarios over many different futures (Investment Costs and Risks)
- Check investment strategy for adequacy

Modeling Different Risks in Operational Modeling (Adequacy)

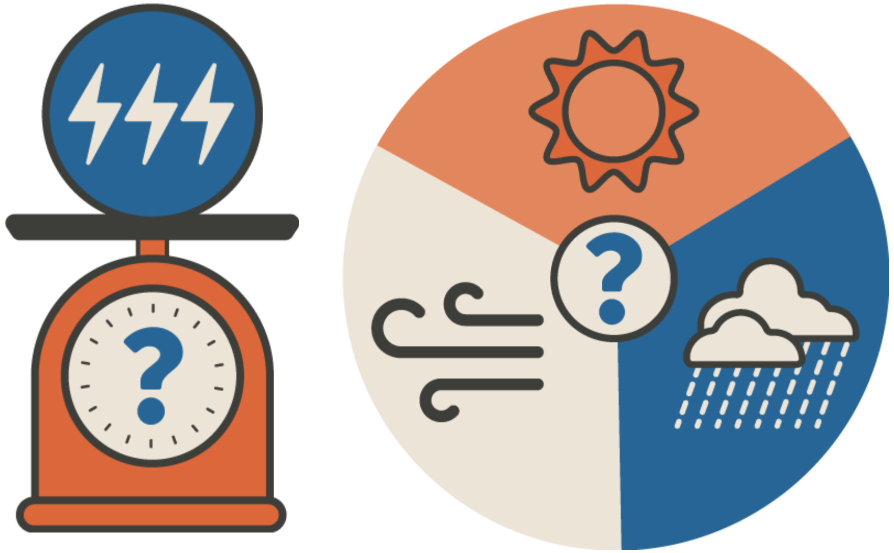
- We use *futures* to represent sources of risk to which the regional power system is subjected in the operational timeframe.
  - By using this technique over a sufficient number of simulations we can test a lot of risk, not exhaustively, but hopefully representatively.
- An adequacy future consists of a draw of a random vector that can represent sources of uncertainty including the following:
  1. Temperature sensitive loads
  2. **Hydro Conditions**
  3. Solar and wind generation availability
  4. Thermal generation Availability
- Variations in policies, system constraints and market fundamentals risks are accounted for via scenarios coordinated to be meaningful with the investment scenarios
- The production cost simulation reflects chronological, co-optimized decision making with detailed fuel accounting and forecast error for renewables and load modeled via multiple model stages.

Modeling Different Futures in the Capital Expansion Modeling (Economics/Adequacy)

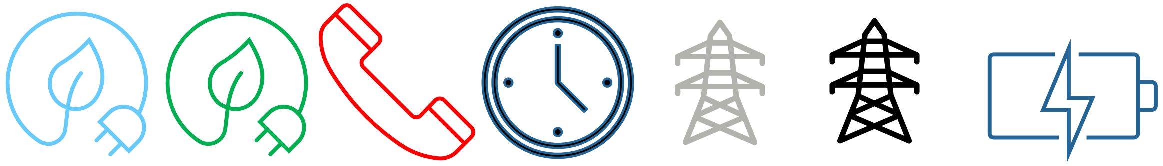
- We use *futures* to represent sources of risk to which the regional power system is subjected, and that we may use to test regional resource strategies over a particular policy scenario of interest.
  - By using this technique over a sufficient number of simulations we can test a lot of risk, not exhaustively, but fairly comprehensively.
- A capital expansion model future consists of a draw of a random vector that can represents the sources of uncertainty including the following:
  1. **Weather Normalized Loads**
  2. Natural Gas Prices
  3. Electricity Prices/Market Availability
  4. **Hydro Conditions**
- The capital expansion is optimized minimize cost or risk (TailVAR##).

The Trick: Creating Metrics Associating the Economics and Adequacy

- Reserve Margins
  - Change in system obligations



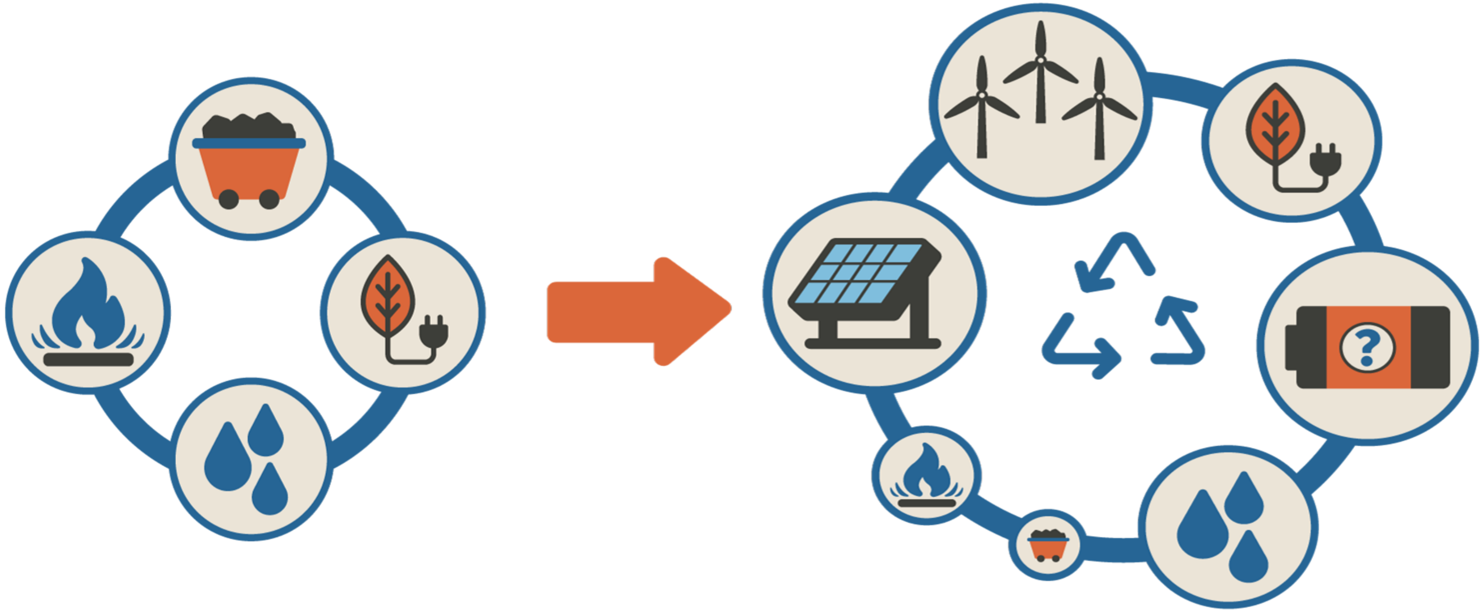
- Capacity contributions within the context of a portfolio
  - Change in portfolio contribution to those system obligations



Need for New Metrics, New Methodologies, New Models???

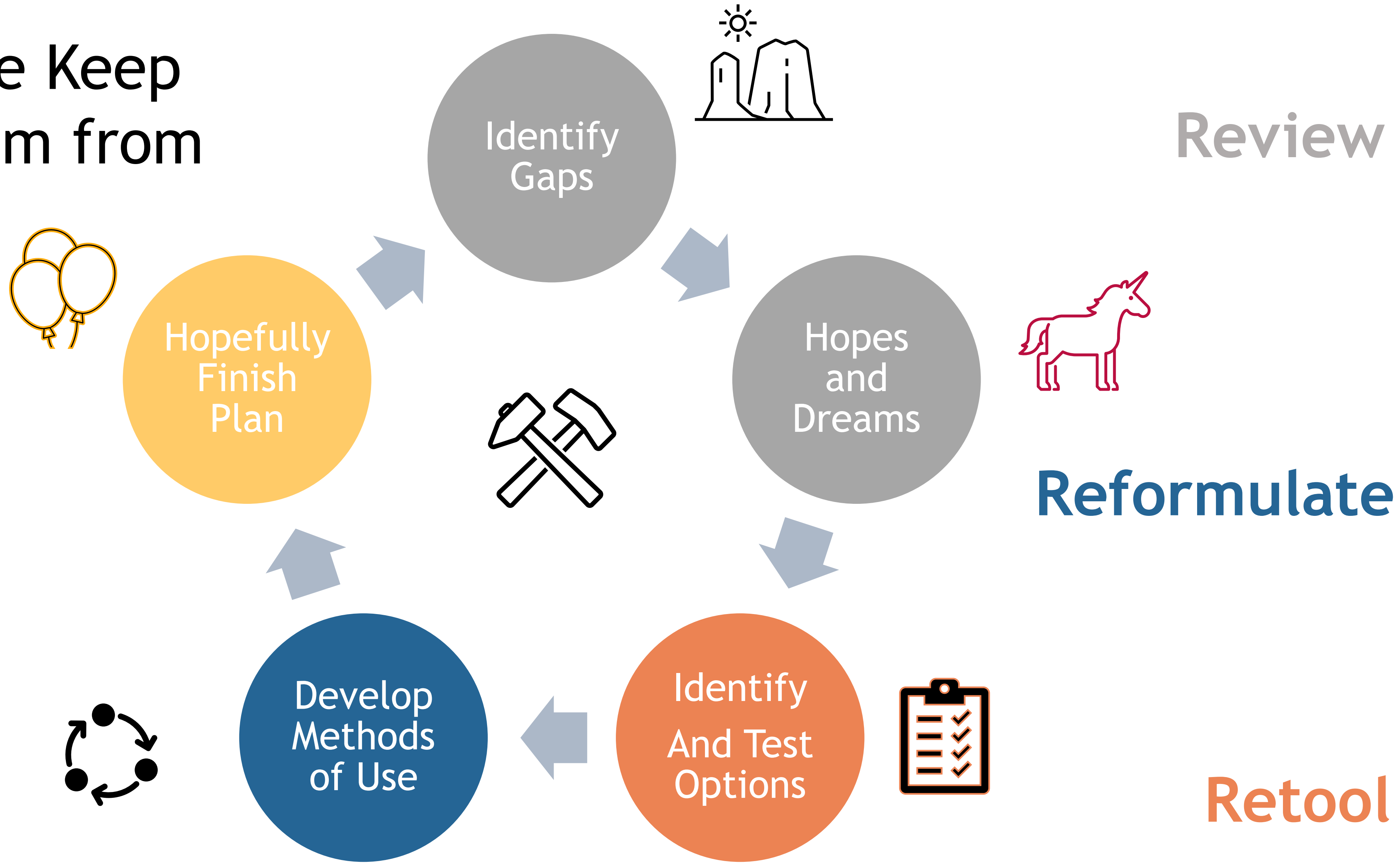
12

Power system of the past is changing



The uncertainties are growing too

How Do We Keep the Problem from Growing?



14

Planning Challenge During Energy Transition: *Maintaining Adequacy While Meeting Policies*

Fuel Diversity

- Is the fuel on-call and always available?
- If not, is the fuel available at a different time?

Locational Value

- Does the resource make good use of existing infrastructure/transmission requirements to serve load?
- Does the resource defer or replace additional infrastructure/requirements?

Either

Both

Meet Policies

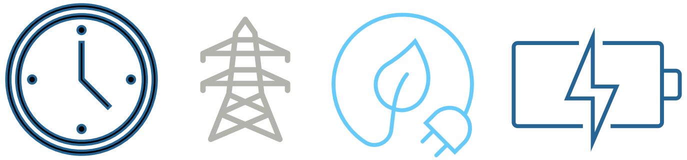
- Is the resource non-emitting or qualify as renewable energy?
- Does it shift or reduce curtailment of qualifying energy?

<u>Caveat:</u> For this discussion all of these attributes are generalized. Any particular resource may or may not have these attributes.

Leveraging The Existing Generation Wisely

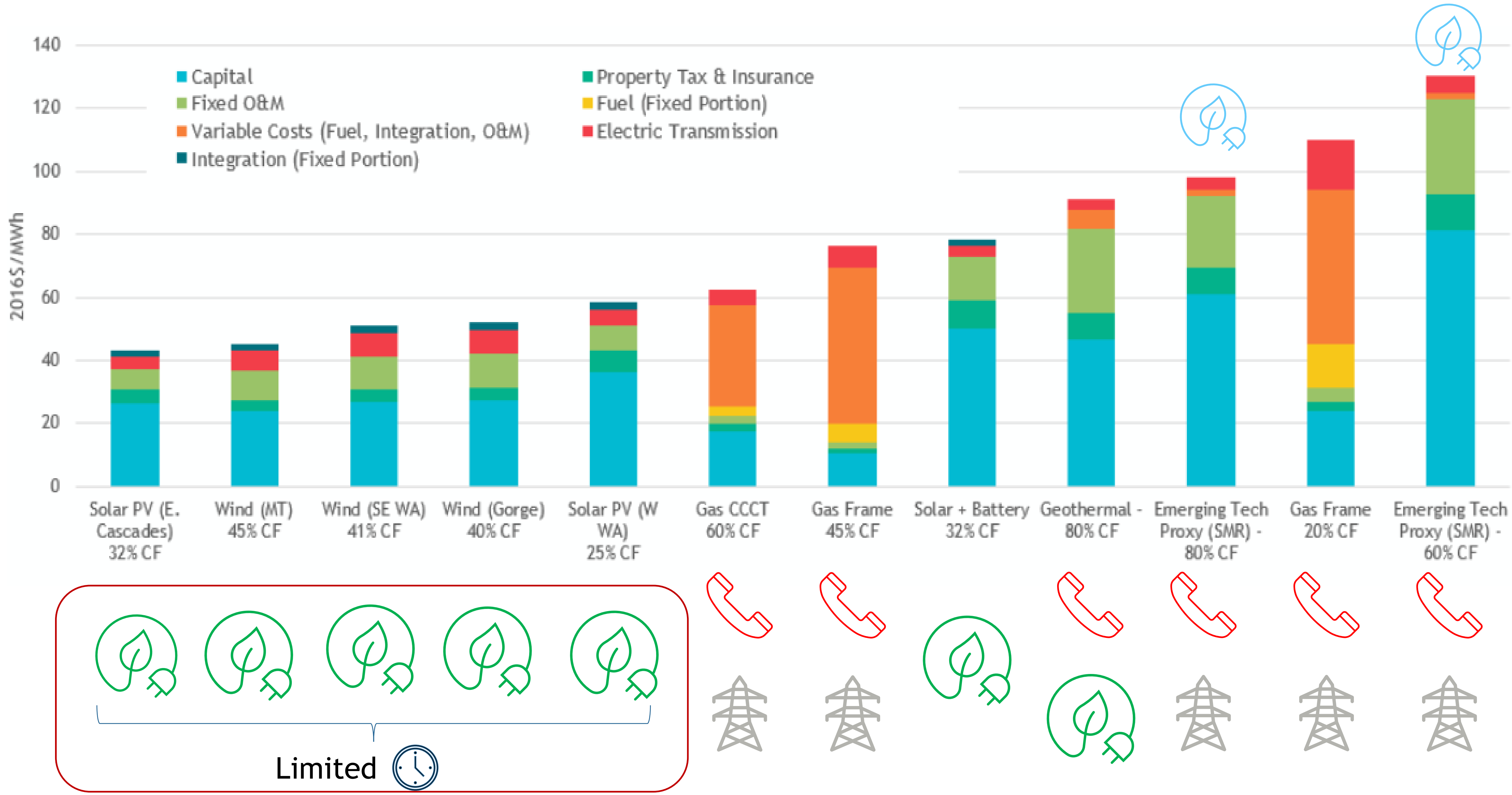
Existing Hydropower Resources

- Shifting use of the existing hydro system will likely defer the need in the region for emerging resources
- Can be used for meeting policies and/or for integrating other resources that meet policy
- Very difficult to build new hydropower resources



Existing Thermal Resources

- Shifting use of the existing thermal system will likely defer the need in the region for emerging resources
- Can be used to integrate other resources that meet policy
- Very difficult to build new coal and gas resources


140
120
100
80
60
40
20
0
2016$/MWh
Capital
Fixed O&M
Variable Costs (Fuel, Integration, O&M)
Integration (Fixed Portion)
Property Tax & Insurance
Fuel (Fixed Portion)
Electric Transmission
Solar PV (E. Cascades) 32% CF
Wind (MT) 45% CF
Wind (SE WA) 41% CF
Wind (Gorge) 40% CF
Solar PV (W WA) 25% CF
Gas CCCT 60% CF
Gas Frame 45% CF
Solar + Battery 32% CF
Geothermal - 80% CF
Emerging Tech Proxy (SMR) - 80% CF
Gas Frame 20% CF
Emerging Tech Proxy (SMR) - 60% CF
Limited

What Should Be Considered for Planning?

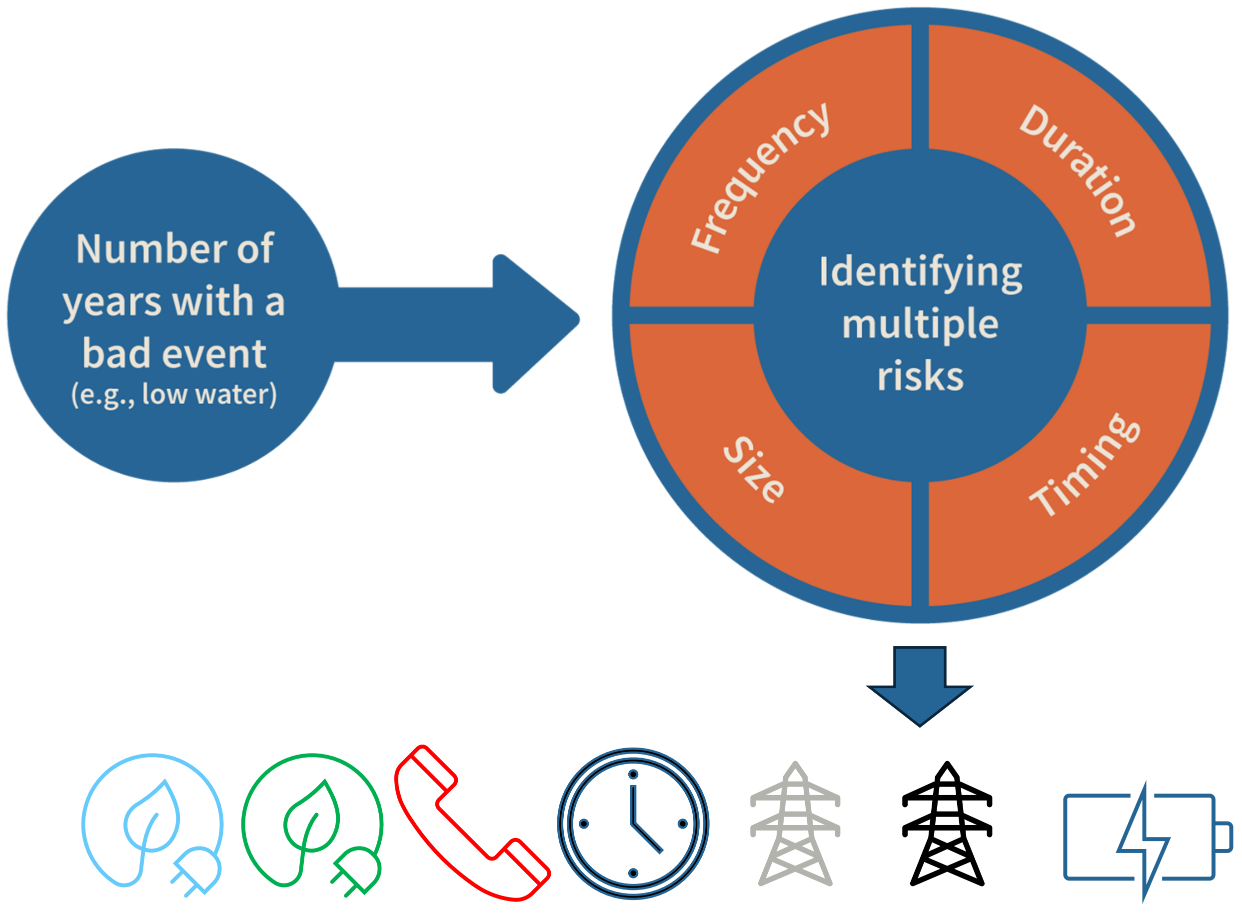
The stand-alone cost may be high or uncertain, but the portfolio benefit of adding resources has the potential to be high.

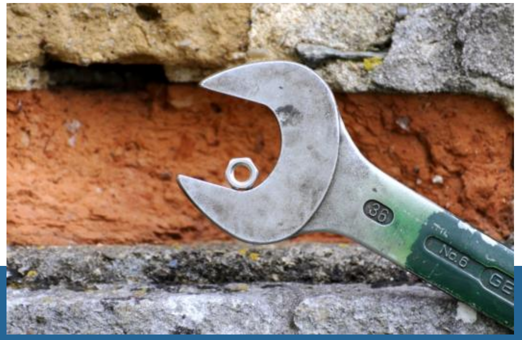
1. Only considering the current commercial resource types may result in a less efficient, higher cost and riskier power system.
2. The cost and availability may become more certain over the next few years.

Resource Type	Cost	Availability	Attributes
"Clean" Peakers	Uncertain	Uncertain	
Small Modular Reactors	High/Uncertain	Uncertain	
Offshore Wind	High	Timing Uncertain	
Utility Scale Storage (long duration)	Uncertain	Now	
Distributed Storage	High	Now	
Emerging Tech EE	Uncertain	Uncertain	
Emerging Tech DR	Uncertain	Uncertain	
Transmission Upgrade/Add	High/Uncertain	Uncertain	
Coal to Gas Conversion	Medium	Limited	

Matching Resources to Needs More Effectively

- Per current utility plans, investments in cost-effective solutions that adhere to policies and maintain an adequate system will likely rely on some of these riskier and newer resources within the next plan's time horizon
- Continue work on refining regional adequacy metrics to reflect needs more clearly
- Continue to modify analytical tools and metrics used for planning and frequently coordinate with stakeholders to adjust to new operational realities





Questions?

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