Tacoma Power 2022 IRP Workshop 4

Updated Findings

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The Plan

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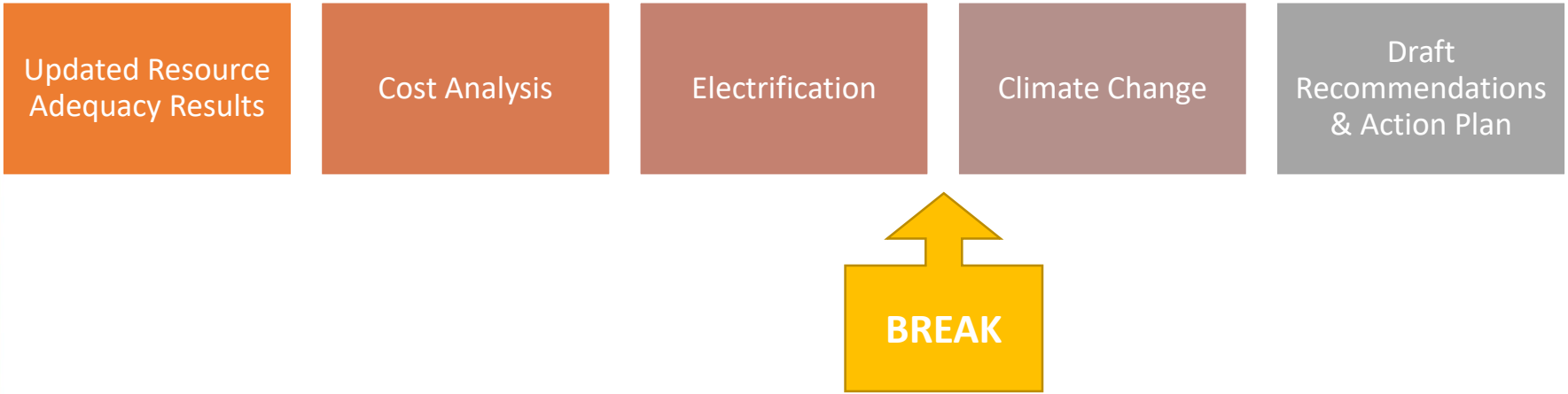

Updated Resource Adequacy Results

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Summary RA Results

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Renew BPA @ current levels

- Slice/Block
- Block with Shaping Capacity (BWSC)
- Slice/Block + 10MW DR
- Slice/Block + 10MW 6-hour Battery Storage
- Slice/Block + 100 MW Wind
- BWSC + available DR
- BWSC + 10MW 6-hour Battery Storage
- BWSC + 100 MW Wind

Renew BPA @ reduced level

- Reduced Slice/Block + 100 MW Wind
- Reduced BWSC + 100 MW Wind
- Reduced Slice/Block + 100 MW MT Wind
- Reduced BWSC + 100 MW MT Wind
- Reduced Slice/Block + 100 MW Solar
- Reduced BWSC + 100 MW Solar

Don't renew BPA

- 2,300 MW Wind + 100MW Solar + DR + 300MW Pumped Storage
- 2,300 MW Wind + 100 MW Solar + DR + 300MW SMR

KEY

Red = Inadequate

Yellow = Minor adequacy concerns under certain conditions

Green = Always meets adequacy standard

Note: All portfolios also include Tacoma Power-owned hydro resources and cost-effective conservation

What adequacy risks do we face?

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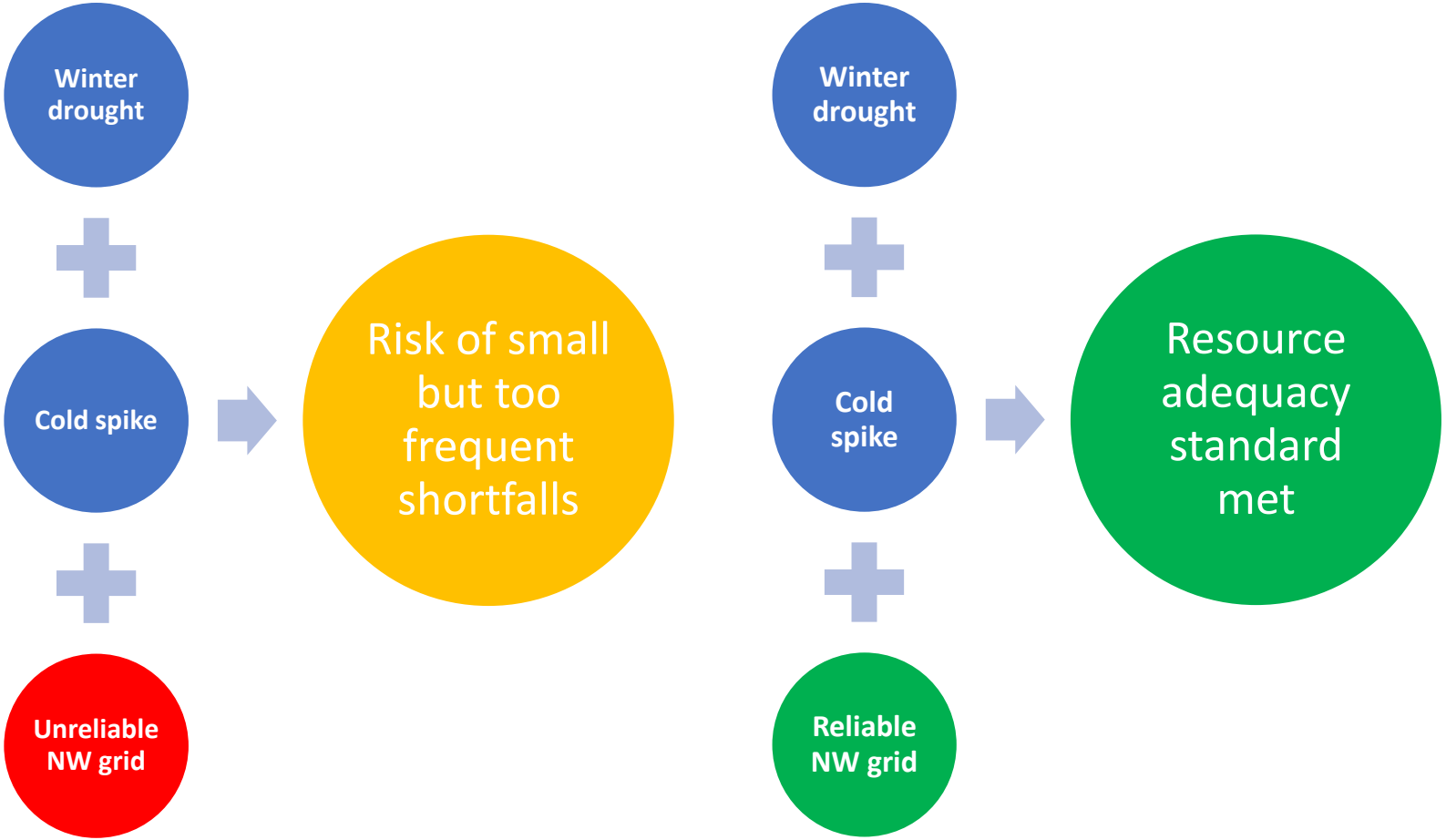

Summary RA Results – Reliable NW Grid

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Renew BPA @ current levels

- Slice/Block
- Block with Shaping Capacity (BWSC)
- Slice/Block + 10MW DR
- Slice/Block + 10MW 6-hour Battery Storage
- Slice/Block + 100 MW Wind
- BWSC + available DR
- BWSC + 10MW 6-hour Battery Storage
- BWSC + 100 MW Wind

Renew BPA @ reduced level

- Reduced Slice/Block + 100 MW Wind
- Reduced BWSC + 100 MW Wind
- Reduced Slice/Block + 100 MW MT Wind
- Reduced BWSC + 100 MW MT Wind
- Reduced Slice/Block + 100 MW Solar
- Reduced BWSC + 100 MW Solar

Don't renew BPA

- 2,300 MW Wind + 100MW Solar + DR + Pumped Storage
- 2,300 MW Wind + 100 MW Solar + DR + SMR

KEY

Red = Inadequate

Yellow = Minor adequacy concerns under certain conditions

Green = Always meets adequacy standard

Note: All portfolios also include Tacoma Power-owned hydro resources and cost-effective conservation

Resources that could help when the grid is unreliable

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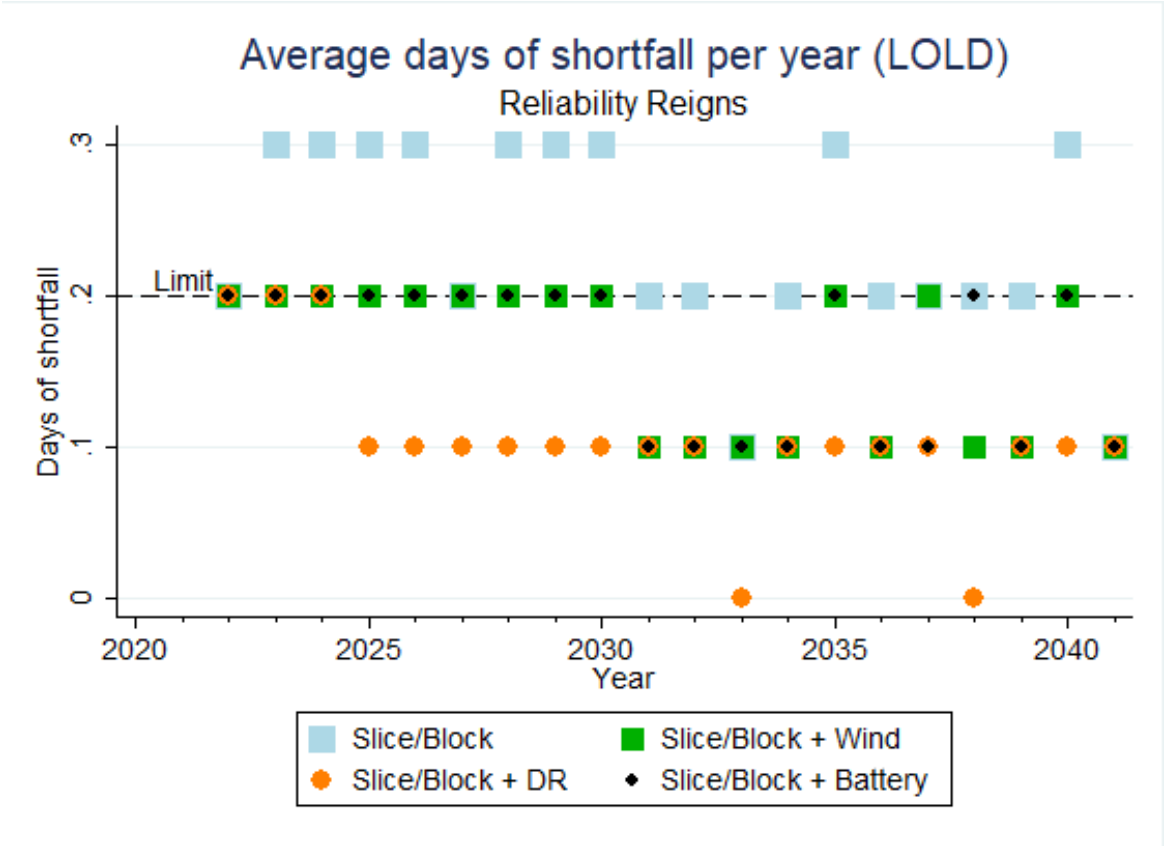

Adding either 100MW wind, 10MW demand response or 10MW battery storage would achieve resource adequacy even under unreliable grid conditions.

Findings are similar for BPA's Block with Shaping Capacity product

Cost Analysis

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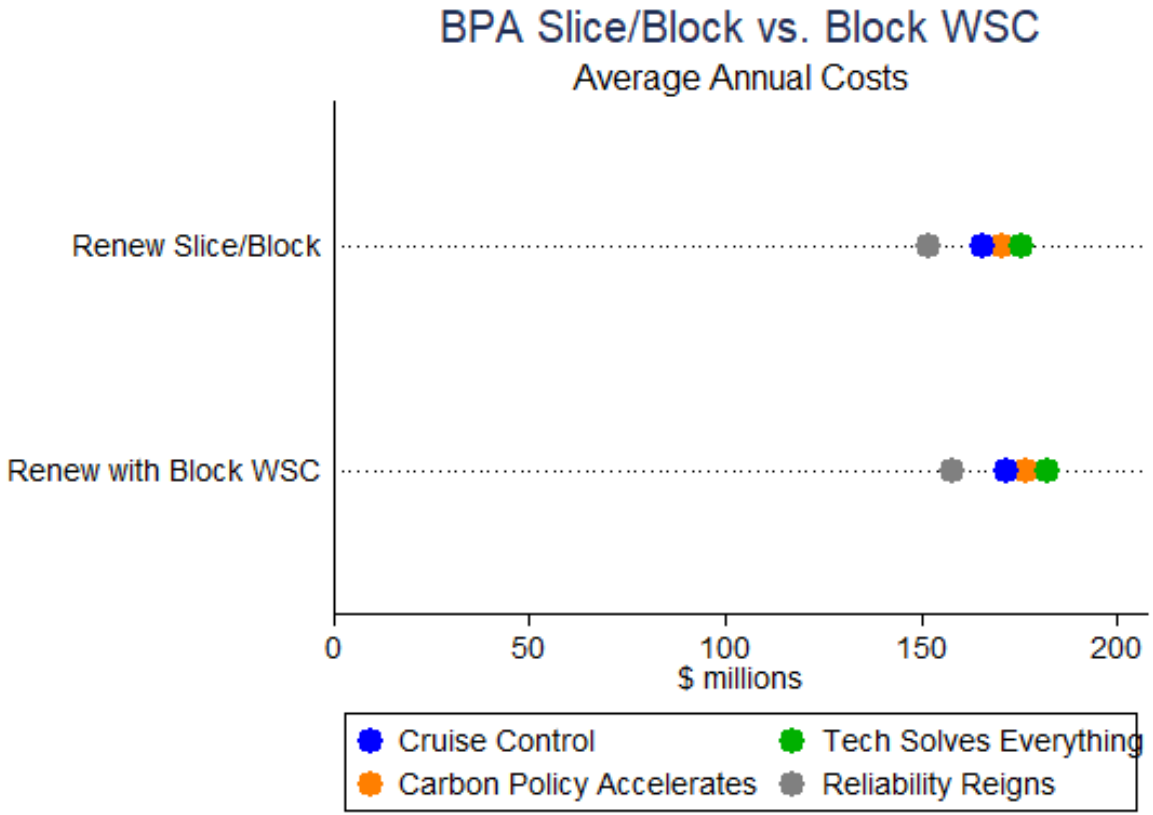
Slice/Block vs. Block with Shaping Capacity



Switching from Slice/Block to Block with Shaping Capacity in 2028 would not substantially improve resource adequacy and would increase annual costs by ~$8 million annually.

Caveat: Assumes future BPA products resemble current products.

Annualized cost of potential enhancements

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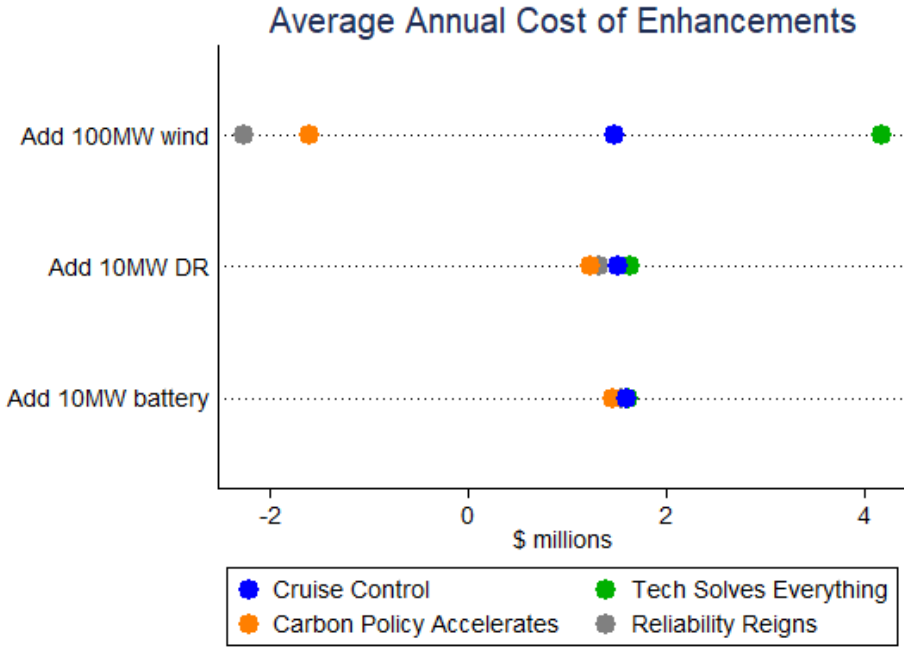
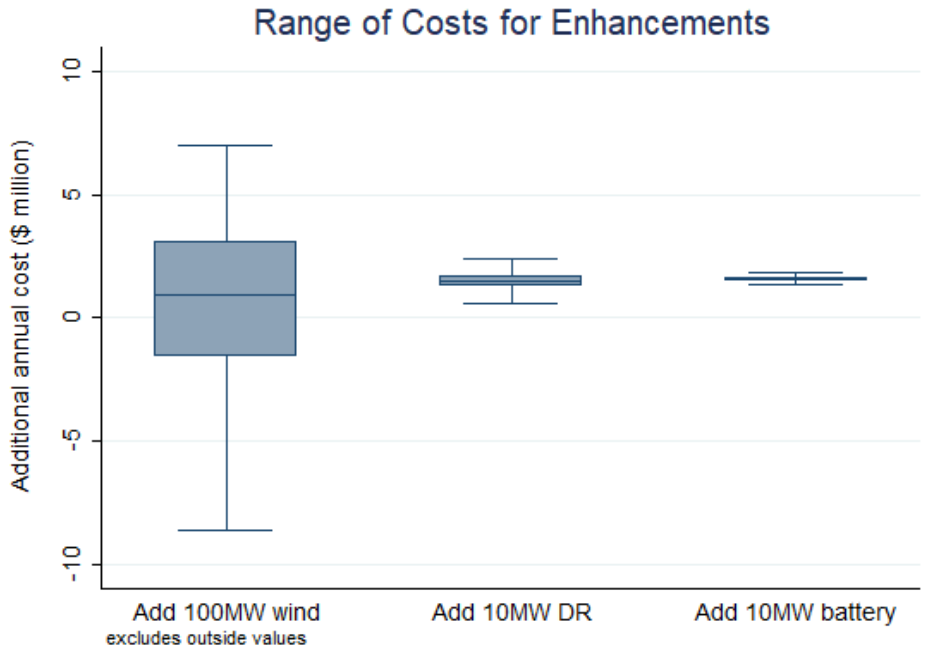
Expected costs are similar across all three options under base case (Cruise Control) scenario but vary substantially depending on wholesale power market prices.





Note: Annual costs are net of revenues from wholesale power market sales.

How should we reduce potential adequacy risks?

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Strategy	Expected Annual Cost	Advantages	Disadvantages
Add 10MW demand response Preferred resource	$1.6 million	▪ $ spent in our community ▪ Lowest environmental impact ▪ Preserves optionality	▪ May not be able to get 10MW
Add 10MW of battery storage	$1.5 million	▪ Expected cost less volatile than wind	▪ Long-term commitment ▪ Price & supply chain issues ▪ Potential environmental impacts
Add 100MW of wind	-$2 million to $4 million	▪ Adds renewable generation to the grid	▪ Long-term commitment to a large resource ▪ Net cost is volatile and depends on wholesale power prices ▪ Price & supply chain issues
Short-term contract	TBD	▪ Immediate & flexible terms to meet our specific needs	▪ Availability over the long-term ▪ Price may change over time
Western Resource Adequacy Program (WRAP)	TBD	▪ May alleviate need for any additional resources	

Electrification Impacts

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Reminder: Simplified electrification cases

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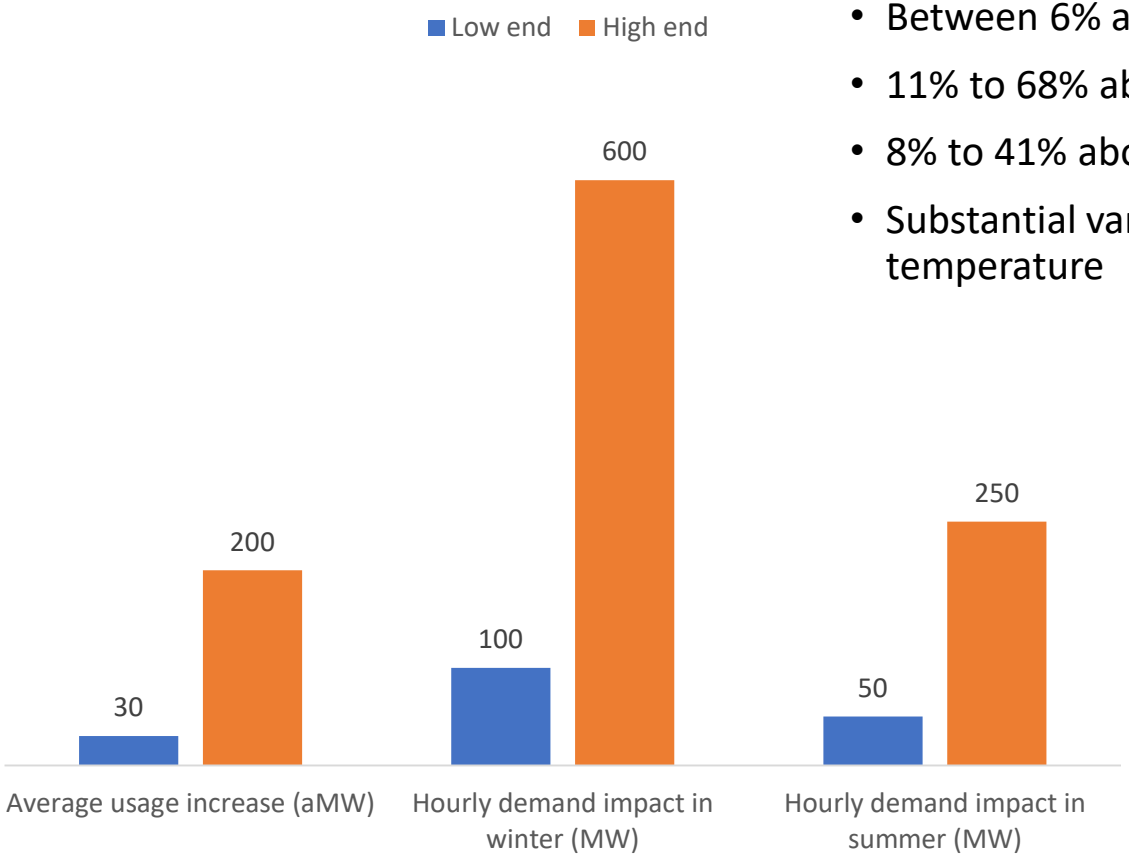
High Demand, High Saturation	Low Demand, High Saturation
High Demand, Low Saturation	Low Demand, Low Saturation

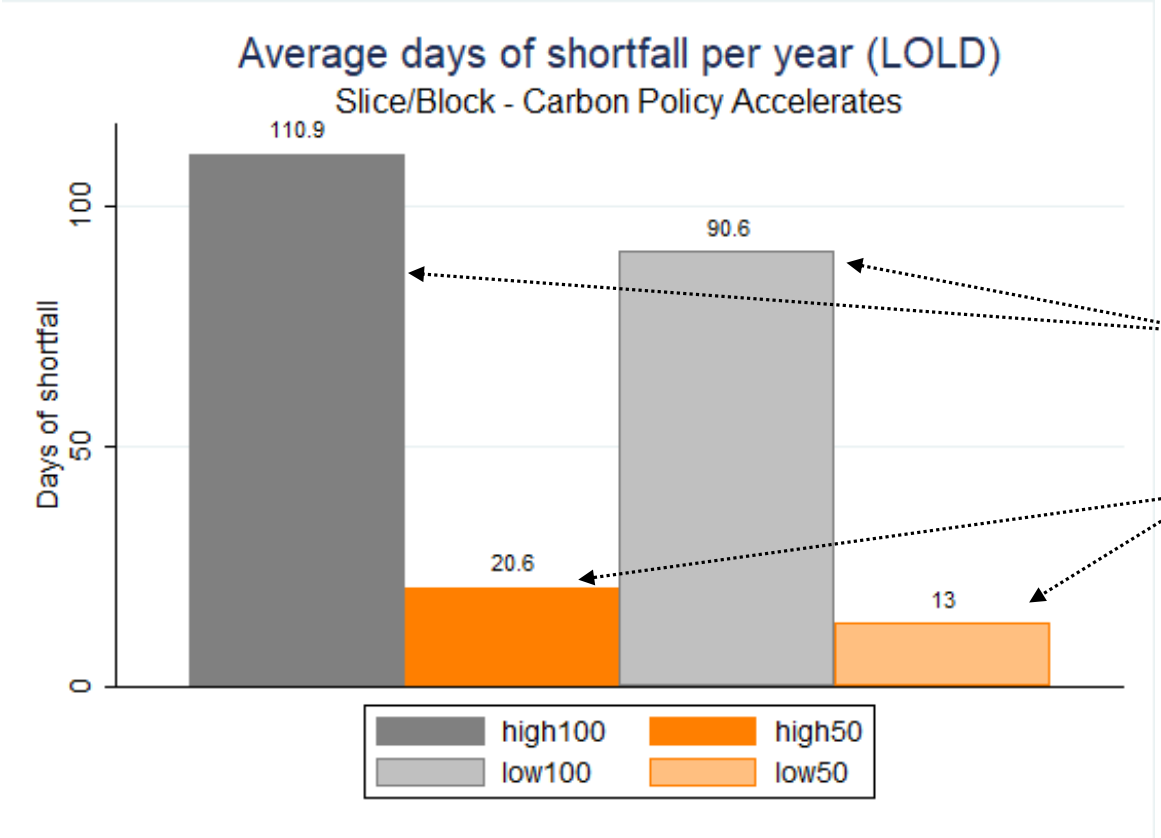
- **Includes**
  - Light & medium-duty vehicles
  - Residential & commercial buildings
- **Excludes**
  - Heavy duty vehicles
  - Industrial buildings
  - Port electrification
- **Analysis for single year (2041)**

How big might the impact be?



- Between 6% and 36% above average load
- 11% to 68% above normal winter peak
- 8% to 41% above normal summer peak
- Substantial variability depending on temperature

Reminder: Resource adequacy with current portfolio



We would fail our adequacy standard even under our lowest demand case.

Electrifying with energy efficient technologies helps but doesn't eliminate resource adequacy challenges

Note: Standard for frequency adequacy metric (LOLD) is no more than 0.2 days per year (2 days in 10 years)

What would it take to maintain resource adequacy?

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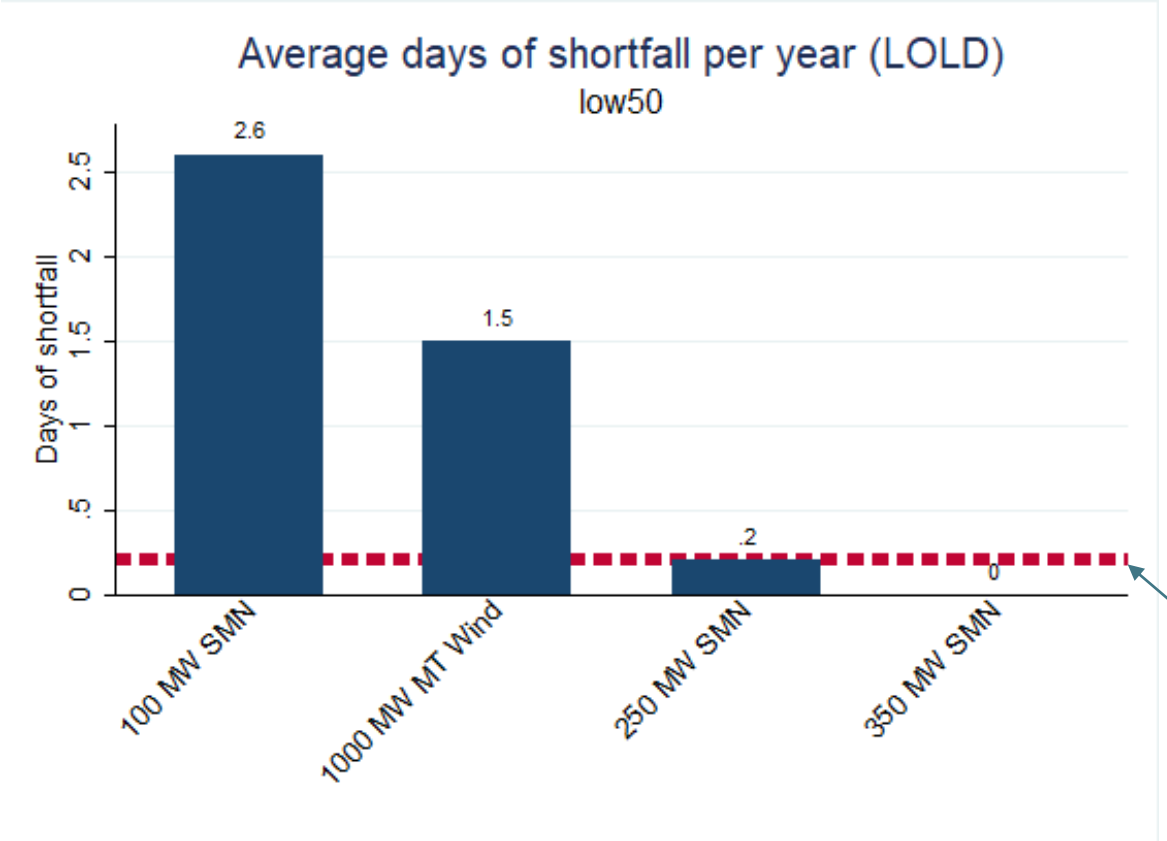
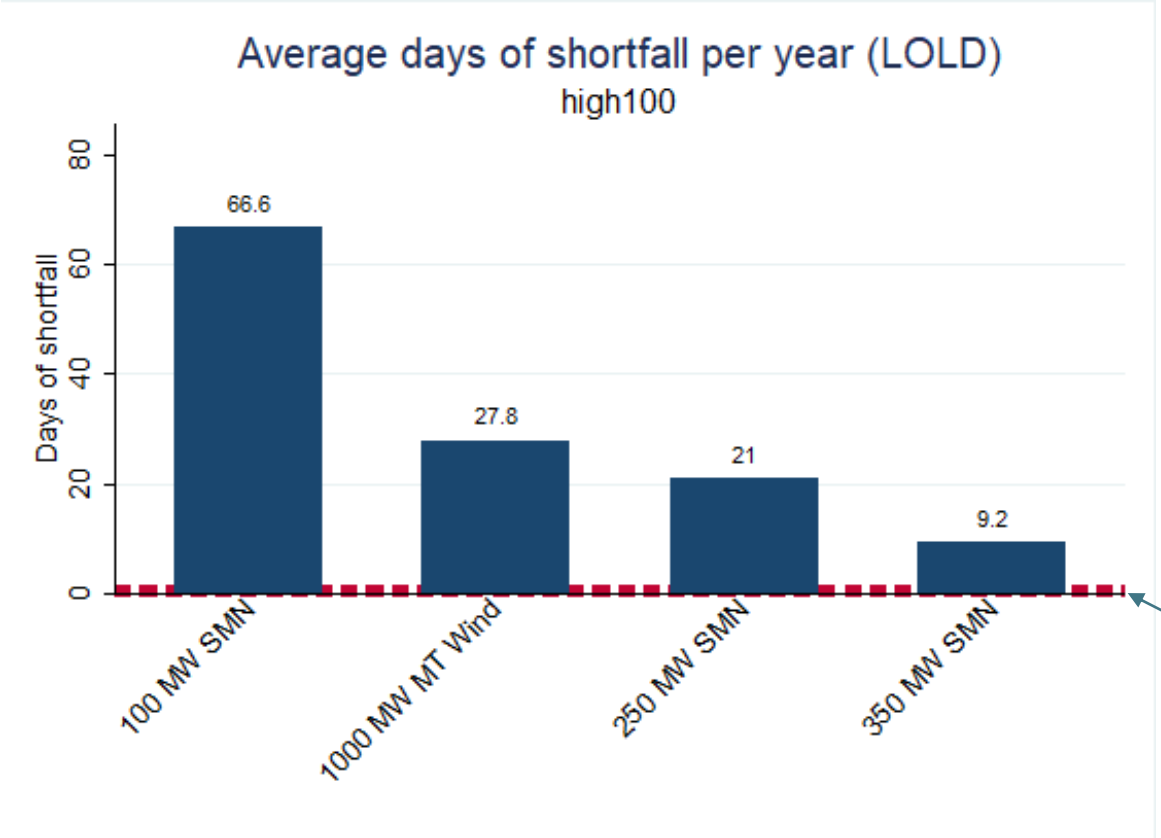


Lowest impact case requires large addition of consistently available resources

Highest impact case



Even these large additions would not be enough to maintain adequacy in our highest-impact case

A combination of strategies will likely be needed

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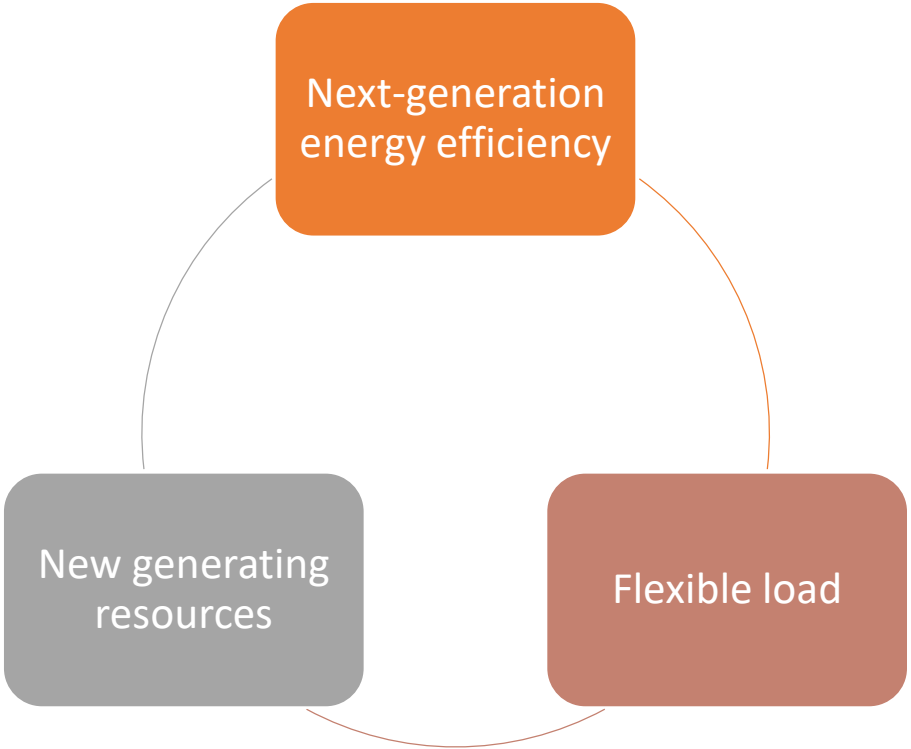

We want to hear your feedback!

Survey Monkey

8 questions

3 minutes to complete

https://www.surveymonkey.com/r/TF8GZRY

Climate Change Impacts

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Climate Change Sensitivity Overview

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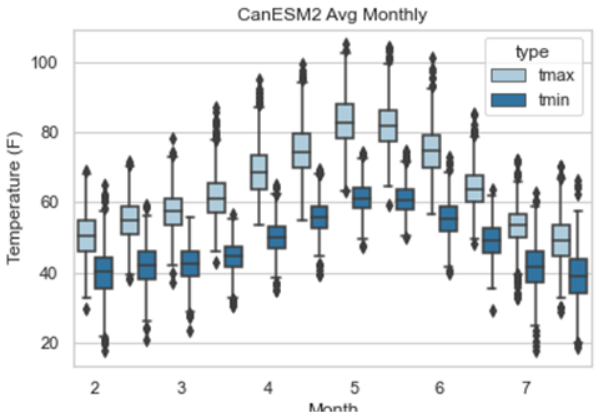
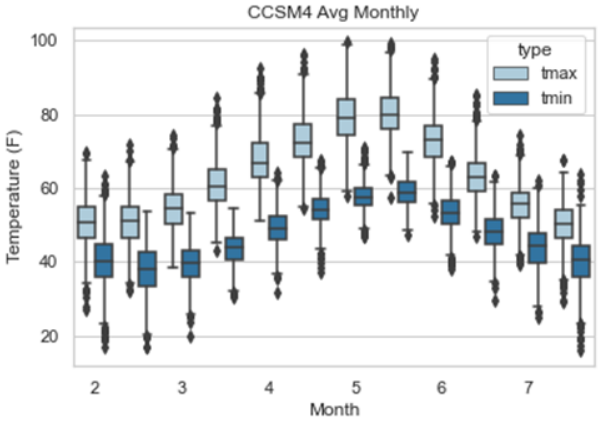
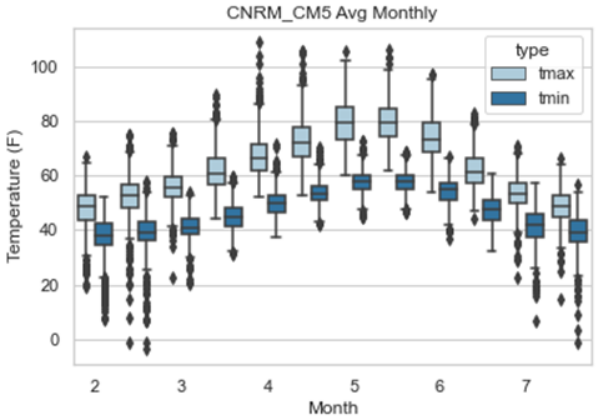
- Inputs into SAM
  - 30 climate change *weather years*
    - temperature (loads)
    - inflows (Tacoma projects generation, BPA products)
- Global Climate Models
  - CanESM2
  - CCSM4
  - CNRM-CM5

Temperatures

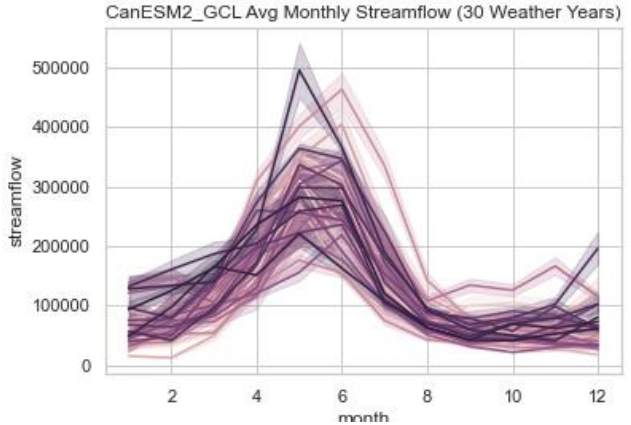


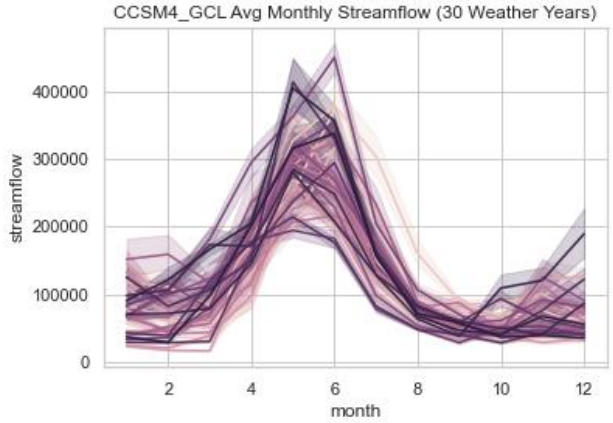


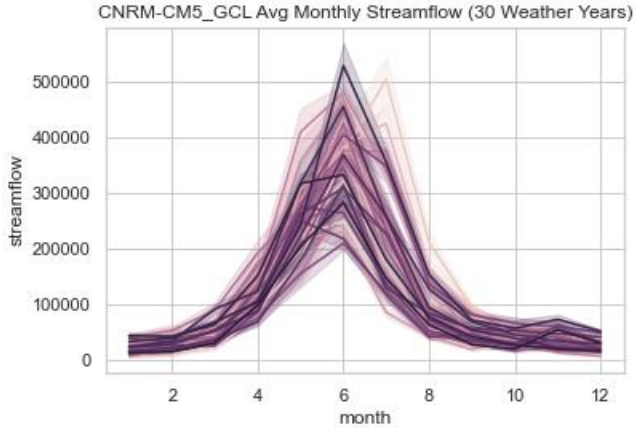


CNRM-CM5 model has the most extreme temperature distribution

Inflows into Grand Coulee







Resource adequacy impacts

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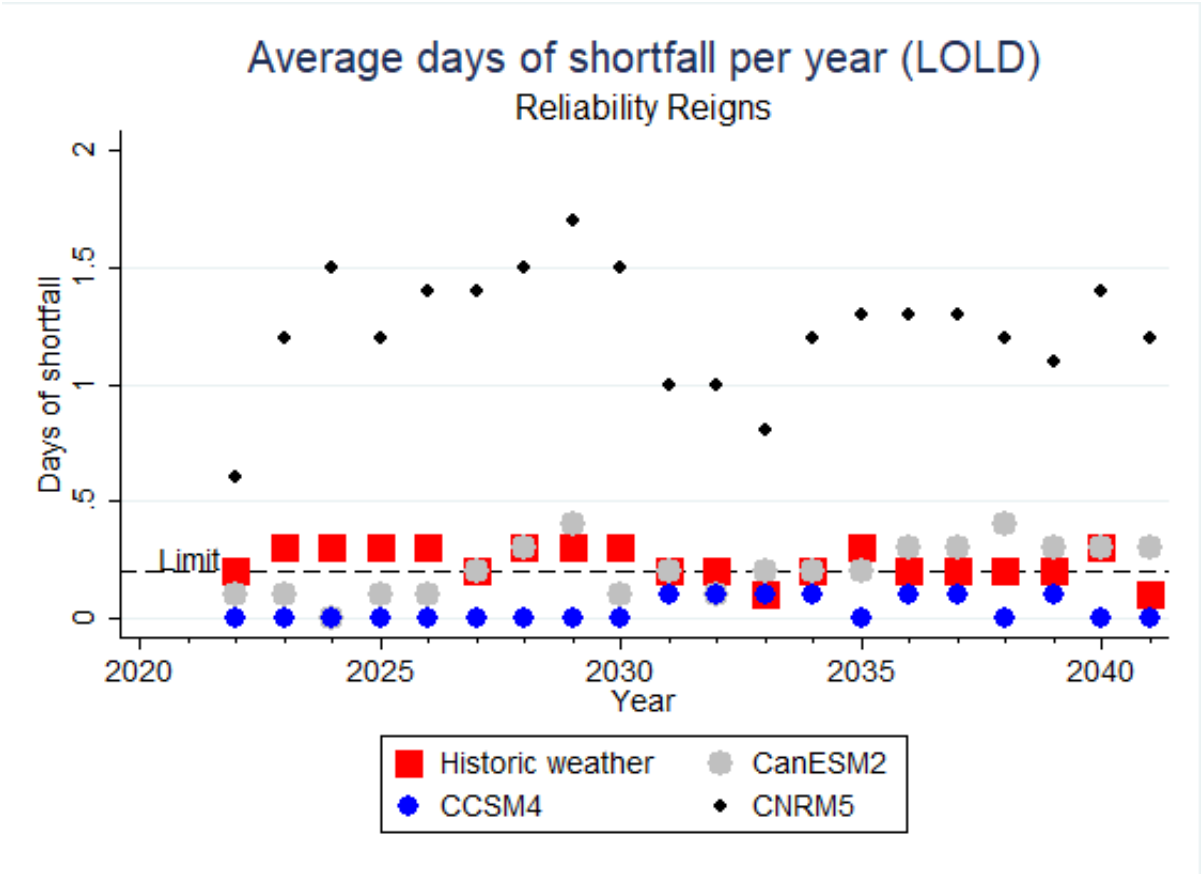

Impacts vary substantially based on specific climate projection.

Need to update number of projections we include and how we select them in order to get appropriate range of impacts.

Draft Recommendations & Action Items

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Summary of key findings & recommendations

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- Preferred resource strategy:
  - Renew Slice/Block product in 2028 if it remains similar to today's product
  - Continue to acquire all cost-effective conservation identified in CPA
  - Continue to develop capability to acquire DR
  - Continue involvement in Western Resource Adequacy Program efforts

- Electrification:
  - Our preferred portfolio is likely not capable of handling large-scale electrification
  - Uncertainty as to how much and when it will show up
  - Continue to work to understand how we can prepare and how quickly we might need to prepare

Action plan

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	2-year action plan	4-year action plan	10-year action plan
Conservation	▪ Acquire all cost-effective conservation identified in CPA	▪ Acquire all cost-effective conservation identified in CPA	▪ Acquire all cost-effective conservation identified in CPA
BPA	▪ Continue active participation in BPA post-2028 contract discussions	▪ Final BPA decision	▪ Renew or replace BPA contract
Other Resources	▪ Pursue additional opportunities for DR ▪ Explore short-term contracts to shore up potential resource adequacy risks	▪ Update DR potential assessment	▪ Acquire 10MW to 12MW of DR
Other	▪ Final decision on joining WRAP ▪ Electrification Futures study ▪ Enhance climate change modeling		

Next Steps & Wrap Up

Rachel Clark

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Workshop schedule

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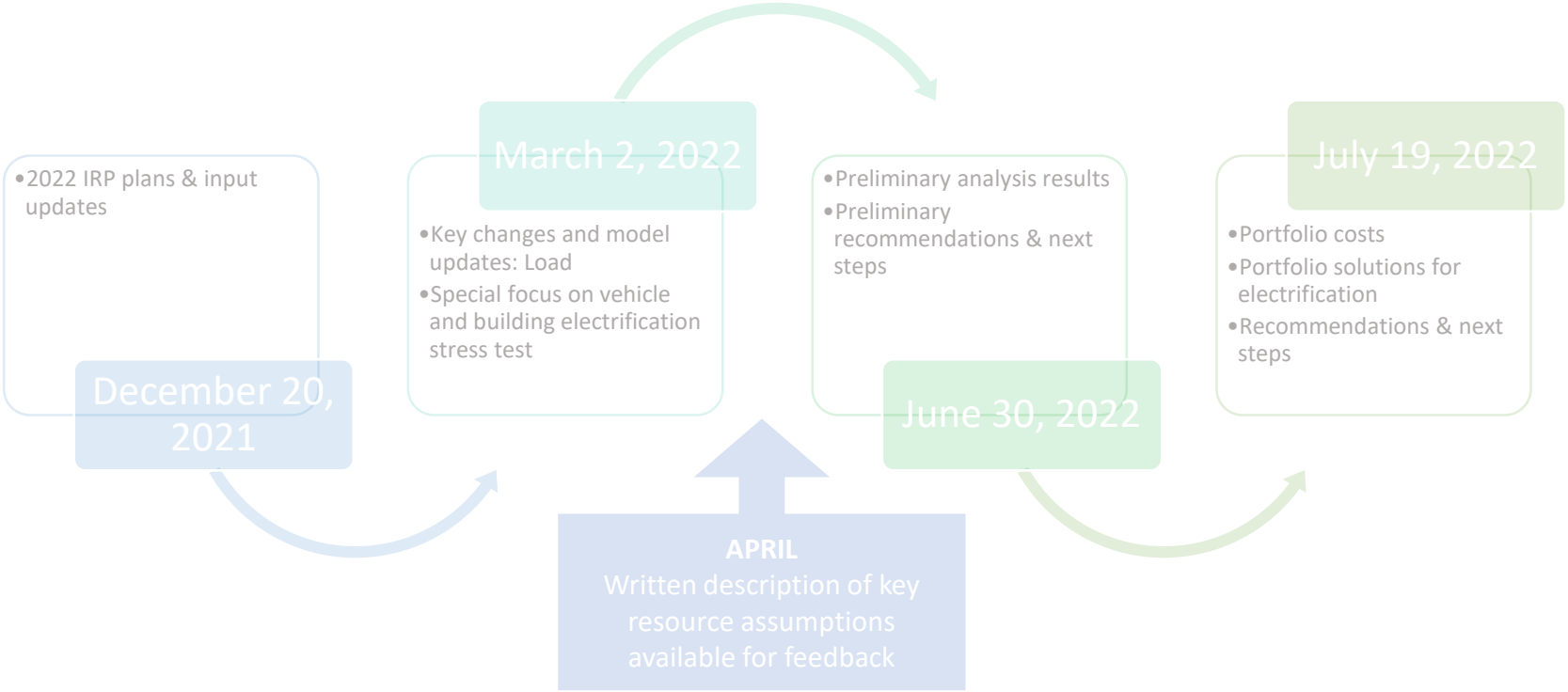
More to come for 2024 IRP!



IRP Next Steps

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July 27

Review results with Public Utility Board (PUB)

August 1

Draft IRP complete & available for comment

August 24

PUB Meeting: Request approval of 2022 IRP update

September 1

IRP Update due to Department of Commerce

We want to hear your feedback!

Survey Monkey

8 questions

3 minutes to complete

https://www.surveymonkey.com/r/TF8GZRY

Additional Slides

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Deeper Dive into Specific Periods of Risk

Deeper Dive into Specific Periods of Risk

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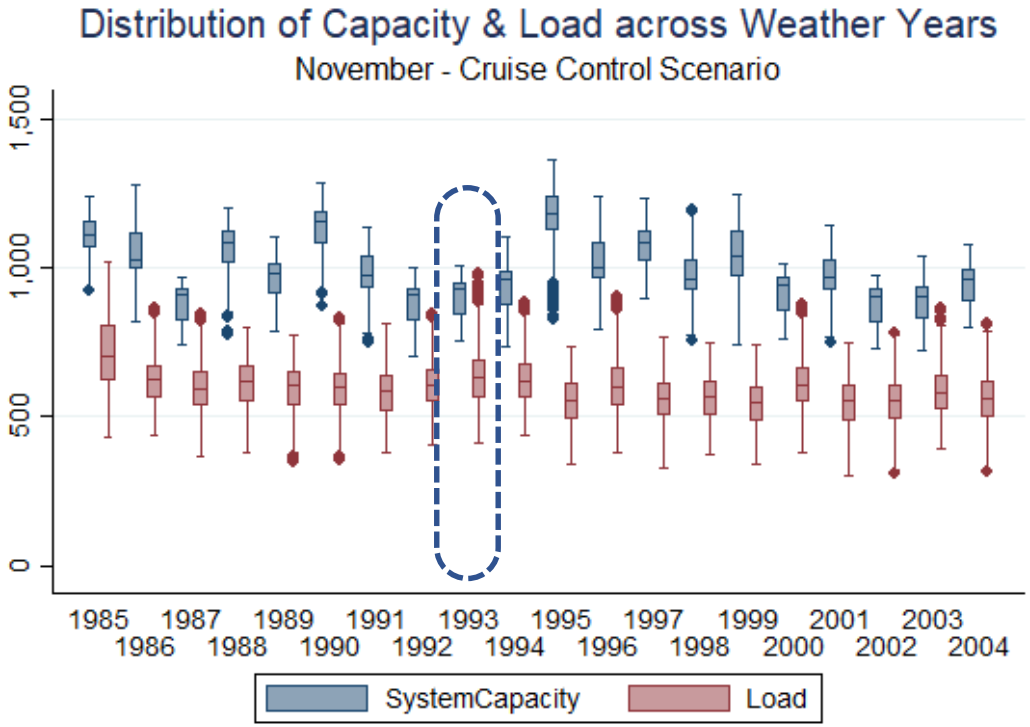
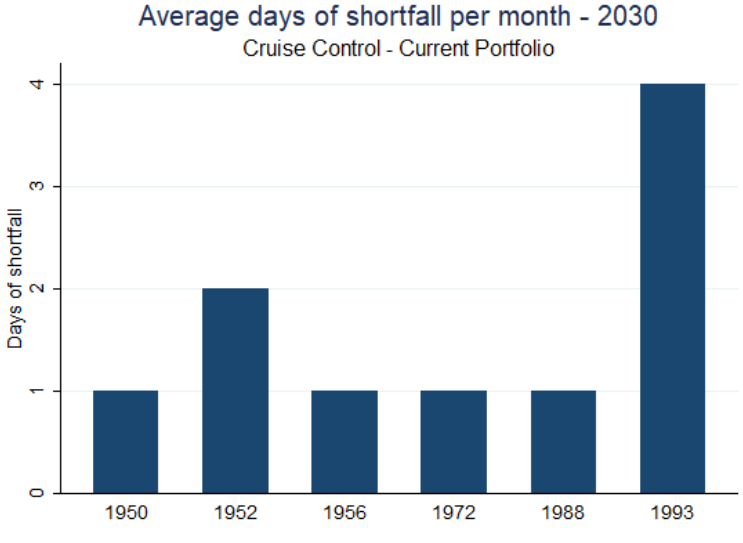
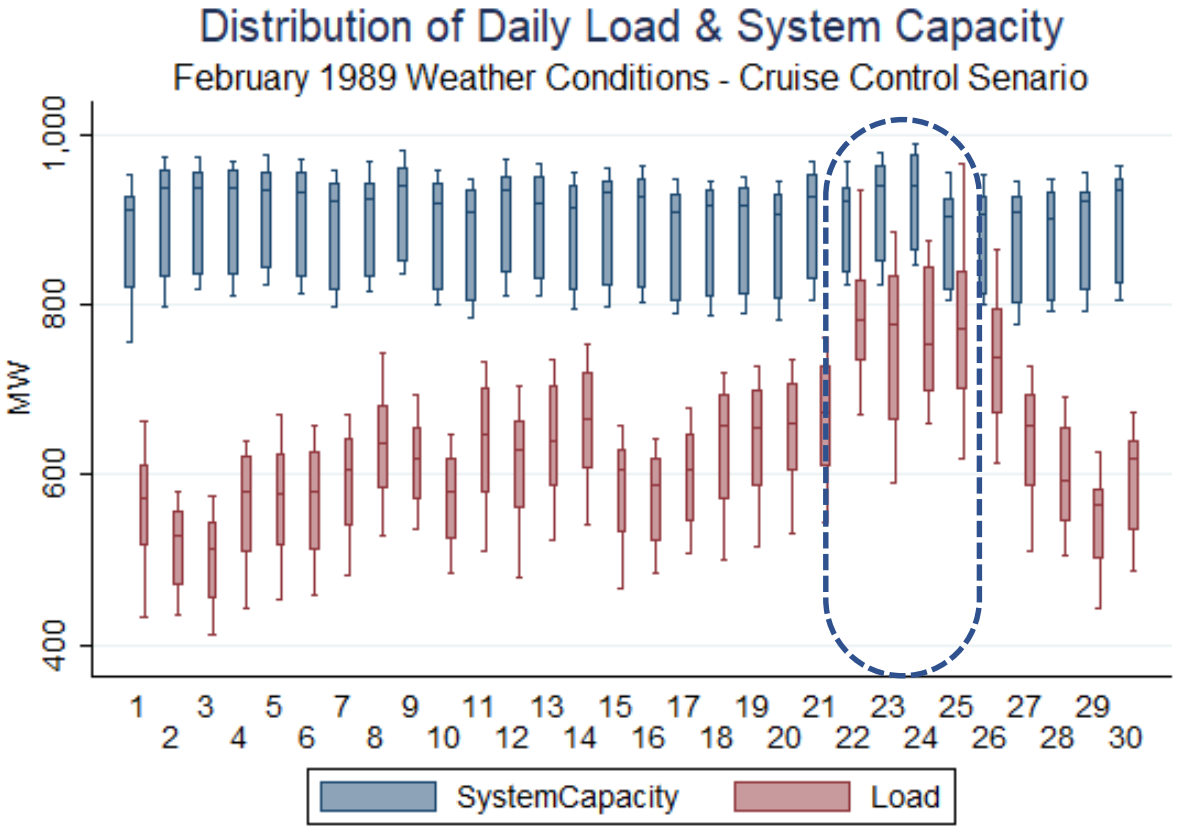


1993 has most days of shortfall but 1952 has larger shortfalls (concentrated in Nov)



November 1993 Example – High Load Days



- Even though our capacity is lower in November 1993 than other years, we have plenty of capacity to spare most of the time
- Risk is when the low water is combined with load spikes

November 22, 1993 – Hourly Look

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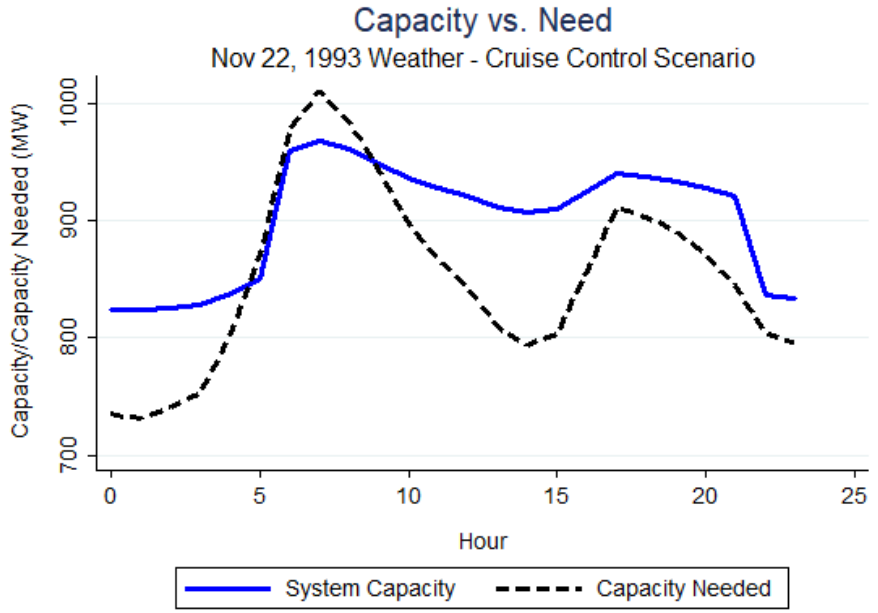

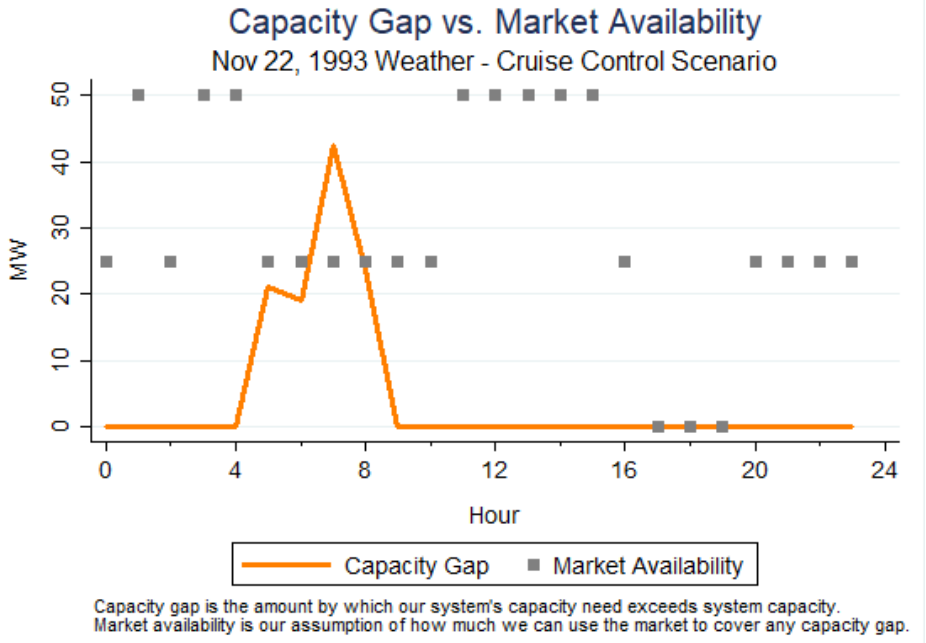

Capacity gap is the amount by which our system's capacity need exceeds system capacity.
Market availability is our assumption of how much we can use the market to cover any capacity gap.

BPA Renewal and BPA Diversification

What would happen if we didn't renew BPA?

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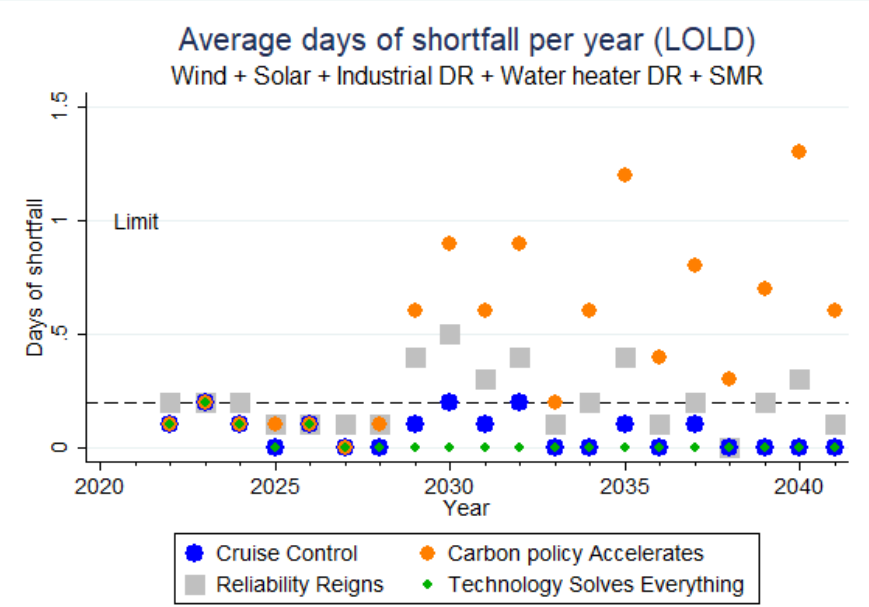
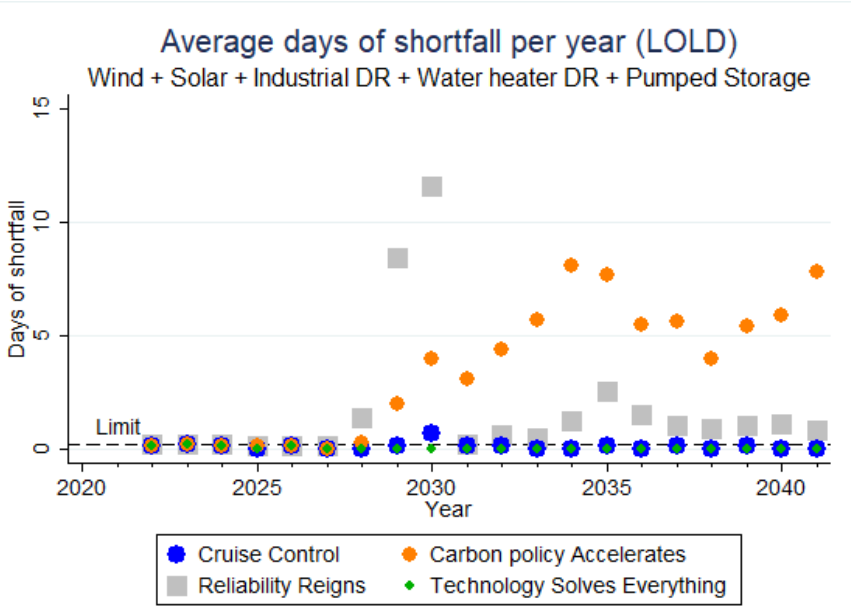
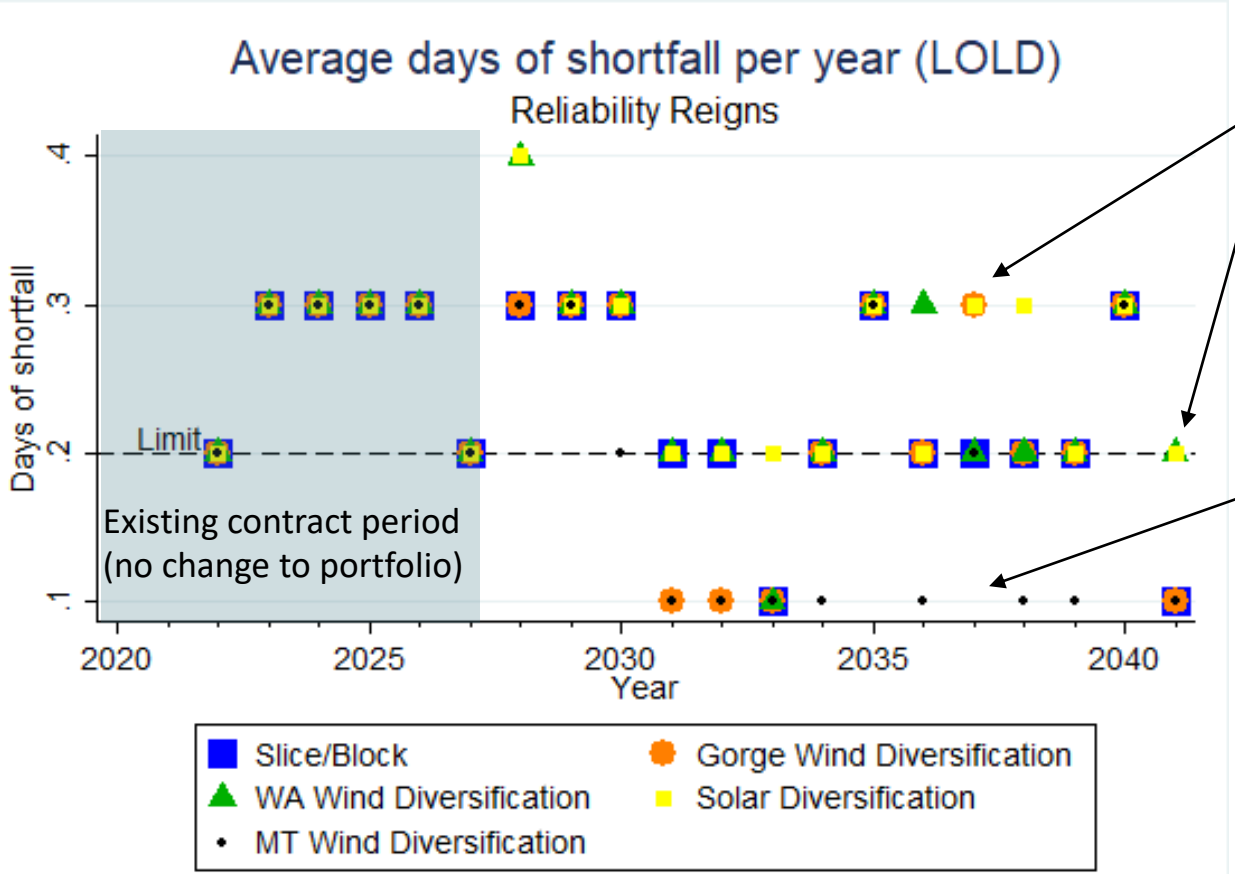
Even with unrealistic quantities of wind and solar and 300 MW of additional capacity, we would still not have enough resources in high load growth scenarios.





Diversification



Diversification with solar & WA wind tends to worsen adequacy.

Diversification with MT wind tends to improve adequacy but not enough to always meet our standard

Diversification with WA wind does not change our adequacy position.