WELCOME!

We look forward to working with you.
Scenarios

How are we adjusting inputs?
What do prices look like?
Reminder: 4 Scenarios

- **Cruise Control (Base Case)**
- **Carbon Policy Accelerates**
- **Technology Solves Everything**
- **Reliability Reigns**

Axes:
- **HIGH VOLATILITY**
- **LOW ELECTRIC PRICES**
- **HIGH ELECTRIC PRICES**
- **LOW VOLATILITY**
Top Down vs Bottom Up Scenarios

1. Start
2. Identify Factors
3. Determine Impact
4. Compose Scenarios
5. Project Trends
# Scenario Input Summary

<table>
<thead>
<tr>
<th>Factors:</th>
<th>Scenario 1: Carbon Policy Accelerates</th>
<th>Scenario 2: Technology Solves</th>
<th>Scenario 3: Cruise Control (Base Case)</th>
<th>Scenario 4: Reliability Reigns</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demand</strong></td>
<td>2.13%</td>
<td>0.00%</td>
<td>0.85%</td>
<td>1.28%</td>
</tr>
<tr>
<td>Peak Growth Rate</td>
<td>1.74%</td>
<td>-0.79%</td>
<td>0.79%</td>
<td>1.11%</td>
</tr>
<tr>
<td>Energy Growth Rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Storage Resources</strong></td>
<td>5 GW</td>
<td>28 GW</td>
<td>2 GW</td>
<td>2 GW</td>
</tr>
<tr>
<td>2hr (by 2045)</td>
<td>0 GW</td>
<td>28 GW</td>
<td>0 GW</td>
<td>0 GW</td>
</tr>
<tr>
<td>16hr (by 2045)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Carbon Policy</strong></td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>yes</td>
</tr>
<tr>
<td>SCC (in price) pre 2030</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>no</td>
</tr>
<tr>
<td>SCC (in price) post 2030</td>
<td>50%</td>
<td>base</td>
<td>base</td>
<td>Base 2030</td>
</tr>
<tr>
<td>Min RPS by 2045</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Natural Gas Prices</strong></td>
<td>400% higher</td>
<td>50% lower</td>
<td>base</td>
<td>300% higher</td>
</tr>
<tr>
<td>Growth Rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Capital Costs</strong></td>
<td>base</td>
<td>-30%</td>
<td>base</td>
<td>base</td>
</tr>
<tr>
<td>wind</td>
<td>base</td>
<td>-30%</td>
<td>base</td>
<td>base</td>
</tr>
<tr>
<td>solar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RA Standard</strong></td>
<td>15%</td>
<td>15%</td>
<td>15%</td>
<td>5% then 15%</td>
</tr>
<tr>
<td>PRM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Coal Retirements</strong></td>
<td>2025</td>
<td>base</td>
<td>base</td>
<td>none post 2030</td>
</tr>
<tr>
<td>NW Coal</td>
<td>2030</td>
<td>base</td>
<td>base</td>
<td>none post 2030</td>
</tr>
<tr>
<td>WECC Coal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Scenario Inputs: Demand

Annual WECC Peak (MW)

Annual WECC Energy (aMW)

SCENARIOS
Scenario Inputs: Natural Gas

Natural Gas Price Scenarios

$/MMbtu (2012$)

- Scenario 1_Policy
- Scenario 2_Technology
- Base_BAU
- Scenario 4_Reliability
WECC Buildout by 2045

- Gas buildout driven by peak demand increase
- Renewable buildout driven by policy (and technology)
Avg. Price and Volatility Comparison

Average Mid-C Price and Volatility 2020-2040

Scenario 1: Policy
Scenario 2: Technology
Scenario 3: Base Case
Scenario 4: Reliability

$/MWh (2019$)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Price</th>
<th>STDev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1: Policy</td>
<td>41</td>
<td>45</td>
</tr>
<tr>
<td>Scenario 2: Technology</td>
<td>10</td>
<td>19</td>
</tr>
<tr>
<td>Scenario 3: Base Case</td>
<td>32</td>
<td>67</td>
</tr>
<tr>
<td>Scenario 4: Reliability</td>
<td>36</td>
<td>35</td>
</tr>
</tbody>
</table>

Price vs. STDev

TACOMA POWER
TACOMA PUBLIC UTILITIES
Annual Mid-C Price and Volatility

Scenario 3: Base Case

Scenario 2: Technology

Scenario 1: Policy

Scenario 4: Reliability

SCENARIOS
Average WECC Emissions Comparison

WECC Emission Rate vs Total Emissions 2020-2040

- Scenario 2 high emission rate due to decreasing energy (increasing distributed energy resources)
Annual Emissions Comparison

**Scenario 3: Base Case**

- **High Volatility**
  - Emissions Rate (lbs CO2/MWh)
  - Total Emissions (tons)

- **Low Volatility**
  - Emissions Rate (lbs CO2/MWh)
  - Total Emissions (tons)

**Scenario 1: Policy**

- **High Electric Prices**
  - Emissions Rate (lbs CO2/MWh)
  - Total Emissions (tons)

- **Low Electric Prices**
  - Emissions Rate (lbs CO2/MWh)
  - Total Emissions (tons)

**Scenario 2: Technology**

- **High Volatility**
  - Emissions Rate (lbs CO2/MWh)
  - Total Emissions (tons)

- **Low Volatility**
  - Emissions Rate (lbs CO2/MWh)
  - Total Emissions (tons)

**Scenario 4: Reliability**

- **High Electric Prices**
  - Emissions Rate (lbs CO2/MWh)
  - Total Emissions (tons)

- **Low Electric Prices**
  - Emissions Rate (lbs CO2/MWh)
  - Total Emissions (tons)
Are we adequately addressing key changes we might see in the future with our scenarios?

- YES
- NO

Poll Results

<table>
<thead>
<tr>
<th>Answer</th>
<th>Count</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>12</td>
<td>8%</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td>92%</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>100%</td>
</tr>
</tbody>
</table>
Resource Need

Do we pass our resource adequacy test with our current portfolio?
Do we have enough resources?

Load vs. 25th Percentile Generation

Load across different weather years

Generation after CBH contracts expire

Generation after BPA contract expires
What do our metrics say?

We still have enough if we don’t renew our CBH contracts.

We **don’t have enough** if we don’t renew our BPA contract in 2028.

<table>
<thead>
<tr>
<th></th>
<th>LOLH (hours per year we’re short)</th>
<th>NEUE (annual shortage as % of load)</th>
<th>LOLE (days per year we’re short)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold to stay below</td>
<td>2.4</td>
<td>0.001%</td>
<td>0.2</td>
</tr>
<tr>
<td>Value before CBH ends</td>
<td>1.9</td>
<td>0.001%</td>
<td>0.2</td>
</tr>
<tr>
<td>(2020-2025)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value after CBH ends</td>
<td>1.7</td>
<td>0.001%</td>
<td>0.2</td>
</tr>
<tr>
<td>but before BPA ends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2026-2027)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value after BPA contract</td>
<td>5,916</td>
<td>19.4%</td>
<td>299</td>
</tr>
<tr>
<td>ends (after 2028)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
When do you think our need is biggest?

- Summer
- Fall
- Winter
- Spring

Poll Results

<table>
<thead>
<tr>
<th>Answer</th>
<th>Count</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>4</td>
<td>23%</td>
</tr>
<tr>
<td>Fall</td>
<td>1</td>
<td>6%</td>
</tr>
<tr>
<td>Winter</td>
<td>12</td>
<td>71%</td>
</tr>
<tr>
<td>Spring</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>100%</td>
</tr>
</tbody>
</table>
When is our need?

Without BPA, we have a need in every season, but need is highest October through January.

High winter loads drive large winter capacity shortfalls.

Waning summer water supply + rise in loads drive large capacity shortfalls in October.
Draft Portfolio Options

What could we do to fill the gap?
## Resources to be considered

<table>
<thead>
<tr>
<th>Category</th>
<th>Options</th>
</tr>
</thead>
</table>
| CBH Contract                    | • Renew  
• Don’t renew                                                         |
| BPA Contract                    | • Renew with same product (Slice/Block)  
• Renew with different product (Block with Shaping)  
• Don’t renew                        |
| Non-Hydro Renewables            | • Solar  
• Eastern WA wind  
• Gorge wind                                           |
| Adding to Existing Hydro Projects| • Add generator to Cowlitz project  
• Add pumped storage to Cowlitz project                        |
| Other Backup for Renewables     | • Small modular nuclear  
• Simple cycle natural gas                                      |
Do we have the right list of resources?

- **YES**
- **NO**, there are important resources **missing** from the list
- **NO**, there are some resources on the list that we should not consider

**Poll Results**

<table>
<thead>
<tr>
<th>Answer</th>
<th>Count</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>9</td>
<td>17%</td>
</tr>
<tr>
<td>No. There are resources missing</td>
<td>2</td>
<td>8%</td>
</tr>
<tr>
<td>NO, there are resources we should not consider</td>
<td>1</td>
<td>75%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
**Renew BPA Slice/Block**

- Tacoma Power Hydro + BPA Slice + renew CBH *(continue current portfolio)*
- Tacoma Power Hydro + BPA Slice
- Tacoma Power Hydro + BPA Slice + 2023 Solar
- Tacoma Power Hydro + BPA Slice + 2028 Solar
- Tacoma Power Hydro + BPA Slice + WA Wind
- Tacoma Power Hydro + BPA Slice + Gorge Wind
- Tacoma Power Hydro + BPA Slice + Pumped Storage at Cowlitz
- Tacoma Power Hydro + BPA Slice + 3rd Generator at Cowlitz

**Renew BPA with Shapeable Block**

- Tacoma Power Hydro + BPA Block
- Tacoma Power Hydro + BPA Block + 2023 Solar
- Tacoma Power Hydro + BPA Block + 2028 Solar
- Tacoma Power Hydro + BPA Block + WA Wind
- Tacoma Power Hydro + BPA Block + Gorge Wind
- Tacoma Power Hydro + BPA Block + Pumped storage at Cowlitz
- Tacoma Power Hydro + BPA Block + 3rd Generator at Cowlitz

**No BPA Renewal**

- Tacoma Power Hydro + WA Wind + Gorge Wind + 2028 Solar
- Tacoma Power Hydro + WA Wind + Gorge Wind + 2028 Solar + Pumped storage at Cowlitz
- Tacoma Power Hydro + WA Wind + Gorge Wind + 2028 Solar + 3rd Generator at Cowlitz
- Tacoma Power Hydro + WA Wind + Gorge Wind + 2028 Solar + Limited Natural Gas
- Tacoma Power Hydro + WA Wind + Gorge Wind + 2028 Solar + Small Modular Nuclear
Next Steps and Action Items

What are we covering next?
Workshop Plan

**Background Information**

**Workshop 1**
IRP Overview

**Workshop 2**
Present key inputs
Present and discuss metrics
Present and discuss scenarios

**Workshop 3**
Present and discuss scenario results
Review resource need
Present and discuss resource alternatives

**Workshop 4**
Present analysis results
Present and discuss preferred portfolio
Discuss action items
How can we improve next time?

**Current Situation and Future Options**

**Preferred Alternative and Action Items**

**JUNE 11**
1 Present analysis results
How do each of our portfolios perform?

2 Present and discuss preferred portfolio
Which portfolio is recommended?

3 Discuss action items
What do we need to do between now and the next IRP?

4 How can we improve next time?
What can we do to improve the public process?
Are there any other topics that we should address at our next meeting?