2022 BPA Resource Program

Preliminary Resource Solutions

June 28, 2022
Agenda

- Recapping
  - Needs Assessment
  - Long-Term Capacity Expansion
  - Market Prices
  - Market Limits

- Draft Portfolio Optimization Results (aka Resource Solutions)
2022 Resource Program Process

Needs Assessment Metrics

End Use Load Forecast

BPA Resource Forecast

Conservation Potential Assessment

Generation Resource Supply Curves

DR Supply Curves

Optimization Process

Market Price Forecast

Wholesale Market Reliance

Resource Solutions
30 years of historical streamflows results in more generation in winter and less generation in summer, compared to the 80 years of history.
Cumulative WECC Builds & Retirements

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LT 2021 PNW Prices, Avg. by Mouth and Hour
PNW Price Distributions

- Month flat avg. PNW prices, **gray is LT2019, blue is LT2021**
- More volatile over time, and price variability is more significant in tighter months (winter & summer)
- Note the difference between average of Aurora forecasts and individual iterations (futures)

2032 Mid-C Sample Iterations

- **High**, **Mid**, **Low**, **Avg**
BPA Market Limit Results, Month HLH aMW

2024-2028

2032

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30 Water Year (WY) and Market Purchase Limits (MPL)
As we reviewed in our Needs Assessment conversation, BPA is looking to incorporate the impacts of climate change on hydro generation, and hence our needs for energy/capacity.

We see the streamflow conditions from 1989 to 2018 (recent 30 years) as representative of the changing climate and a good predictor of conditions in next 10 years. Recent 30 years of streamflows aligns well with the RMJOC-II (River Management Joint Operating Committee) streamflow forecasts.

We are now carrying those 30 WY needs into portfolio optimization.
MPLs and Needs in FY 2027

2027 p10 HLH Needs vs Market Purchase Limits

- **p10 Market Purchase Limit**
  - Oct: 546
  - Nov: 0
  - Dec: 266
  - Jan: 377
  - Feb: 118
  - Mar: 0
  - Apr: 307
  - May: 0
  - Jun: 0
  - Jul: 187
  - Aug: 17
  - Sep: 850

- **2021 NA p10 Needs**
  - Oct: 600
  - Nov: 850
  - Dec: 900
  - Jan: 750
  - Feb: 1200
  - Mar: 800
  - Apr: 1850
  - May: 1900
  - Jun: 900
  - Jul: 850
  - Aug: 850
  - Sep: 850

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MPLs and EEI-Adj Needs in FY 2027
Portfolio Optimization Refresher
Refresher: Portfolio Optimization

- **Step 1**: Find Portfolio 1, the “least-COST” mix of resources that meet P10 HLH Energy needs and don’t violate Market Purchase Limit

- **Step 2**: Find Portfolio 40, the “least-RISK*” mix of resources that meet P10 HLH Energy needs and don’t violate Market Purchase Limit

- **Step 3-40**: Incrementally add budget to Portfolio 1’s budget value and remix resources to find risk minimizing combination at given budget level

*Risk is the variance in total portfolio cost across iterations, with expected resource costs and expected market prices causing most of the variance
Preliminary Results
Preliminary Resource Solutions Summary

• EE aMWs are consistent with Council target in Power Plan

• DR shows up as a regularly deployed, low impact, low cost energy related load management product

• Renewables are selected to reduce volatility in risk reducing scenarios, highlighting the potential benefit of resource diversity from potential thin-market futures
## EE Results and Comparison to 2020

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>2-year</th>
<th>4-year</th>
<th>10-year</th>
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</thead>
<tbody>
<tr>
<td>Portfolio 1</td>
<td>96</td>
<td>223</td>
<td>723</td>
</tr>
<tr>
<td>Portfolio 2</td>
<td>103</td>
<td>242</td>
<td>785</td>
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<tr>
<td>Portfolio 3</td>
<td>105</td>
<td>245</td>
<td>787</td>
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<table>
<thead>
<tr>
<th>Portfolio</th>
<th>2-year</th>
<th>4-year</th>
<th>10-year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio 1</td>
<td>111</td>
<td>229</td>
<td>506</td>
</tr>
<tr>
<td>Portfolio 2</td>
<td>123</td>
<td>250</td>
<td>501</td>
</tr>
<tr>
<td>Portfolio 3</td>
<td>126</td>
<td>256</td>
<td>505</td>
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</table>
• The 2022 Resource Program uses updated EE supply curves from the 2021 Plan
  – BPA’s market price forecast, needs assessment, market purchase limits

• 2022 RP, Portfolio 1 EE Savings over 2021 Plan Timeline:

<table>
<thead>
<tr>
<th>2022*</th>
<th>2023*</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
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<tbody>
<tr>
<td>2022 RP Port 1</td>
<td>38</td>
<td>76</td>
<td>119</td>
<td>171</td>
<td>231</td>
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</table>

[Comparison to Council’s 2021 Power Plan]

• NWPCC 2021 Draft Plan EE target for BPA is 270-360 cumulative aMW by 2027¹


*Represents anticipated EE acquisitions for 2022 and 2023, prior to 2022 RP study horizon
Demand Response Assumptions

• Demand response can be used to meet energy needs

• DR products are split into summer and winter classes
  – “Summer” is April – September
  – “Winter” is October – March
Demand Response in 2022 RP

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Season</th>
<th>2-year</th>
<th>4-year</th>
<th>10-year</th>
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<tbody>
<tr>
<td>1</td>
<td>Summer</td>
<td>213</td>
<td>436</td>
<td>371</td>
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<tr>
<td></td>
<td>Winter</td>
<td>158</td>
<td>283</td>
<td>243</td>
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<tr>
<td>2</td>
<td>Summer</td>
<td>213</td>
<td>474</td>
<td>488</td>
</tr>
<tr>
<td></td>
<td>Winter</td>
<td>158</td>
<td>283</td>
<td>260</td>
</tr>
<tr>
<td>3</td>
<td>Summer</td>
<td>213</td>
<td>474</td>
<td>488</td>
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<tr>
<td></td>
<td>Winter</td>
<td>158</td>
<td>283</td>
<td>260</td>
</tr>
</tbody>
</table>

- Least-cost DR totals are mainly comprised of four products: DVR, and Residential, Commercial, and Industrial CPP programs.
- DVR comprises roughly half of the total for the 2-year and 4-year periods.
- Risk-reducing portfolios start to add other DR products
- Portfolio 1 acquires DVR and CPP
  - And winter residential BYOT in 2033
- Portfolios 2 and 3 acquire those and additionally Residential Summer TOU in 2024
### Generation Resources in 2022 RP

#### Generating Resources (Nameplate Capacity, MW)

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Resource</th>
<th>2-year</th>
<th>4-year</th>
<th>10-year</th>
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<tr>
<td></td>
<td>Offshore Wind OR S</td>
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<td>0</td>
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<tr>
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<td>Solar PV</td>
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<tr>
<td></td>
<td>Offshore Wind OR S</td>
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<td>106</td>
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<tr>
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<td>Solar PV</td>
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<td>500</td>
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<tr>
<td></td>
<td>Offshore Wind OR S</td>
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<td>0</td>
<td>428</td>
</tr>
</tbody>
</table>

- No non-DSM resources are acquired in the least-cost portfolio
- 500MW of Solar PV acquired in 2030 in portfolios 2 and 3
- Offshore wind in southern Oregon is acquired starting in 2033 in portfolios 2 and 3
- Any resource in portfolio 2 or onward reduces market reliance during volatile (i.e. high variance) periods
FY 2027 Resource Build

Solid black line = P10 HLH Needs that are EEI adjusted
FY 2033 Resource Build

Solid black line = P10 HLH Needs that are EEI adjusted

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Next Steps

Final Resource Program public workshop in August
- Share High Policy scenario results
- Share next steps for BPA's Potential Resource Solutions

EE Action Plan
- Provides an operational plan for BPA to achieve its energy efficiency goals.
- Bottoms up plan using Power Plan, Resource Program, customer needs, and market intelligence to create an operational roadmap.
- Will guide BPA's implementation efforts over the 2021 Power Plan period.
- Timeline
  - Spring/Summer: Internal workshops and input gathering
  - Fall: Draft Action Plan
  - Winter: Publish draft Action Plan for comment
  - Spring: Final Action Plan published