BALANCING THE CLEAN GRID: RELIABILITY AND RENEWABLE ENERGY

NARUC CENTER FOR PARTNERSHIPS & INNOVATION WEBINAR SERIES

JUNE 17, 2021
• The National Association of Regulatory Utility Commissioners (NARUC) is a non-profit organization founded in 1889.

• Our Members are the state regulatory Commissioners in all 50 states & the territories. FERC & FCC Commissioners are also members. NARUC has Associate Members in over 20 other countries.

• NARUC member agencies regulate electricity, natural gas, telecommunications, and water utilities.
WHAT IS NARUC’S CENTER FOR PARTNERSHIPS AND INNOVATION?

• Grant-funded team dedicated to providing technical assistance to members.
• CPI identifies emerging challenges and connects state commissions with expertise and strategies.
• CPI builds relationships, develops resources, and delivers trainings.
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Challenges Integrating Wind, Solar and Storage

- New products and services to address changing system needs.
- Services can be delivered by IBRs.
- Harmonized policies and standards are preferable.
- Economic incentives are needed.

IBR – Inverter Based Resource (solar PV, wind, battery storage)
Incremental Wind

ERZ3 – Diverse! Unique! HIGH

Colorado

Existing Wind

More Wind = Declining ELCC
**Firm Capacity**

### PSCo 2030 Preferred Plan

<table>
<thead>
<tr>
<th>Resource</th>
<th>TOTAL*</th>
<th>FIRM</th>
<th>Capacity Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fossil-Based Generation</td>
<td>5,257</td>
<td>5,257</td>
<td>100%</td>
</tr>
<tr>
<td>Hydroelectric</td>
<td>24</td>
<td>13</td>
<td>55%</td>
</tr>
<tr>
<td>Solar</td>
<td>4,652</td>
<td>1,264</td>
<td>27%</td>
</tr>
<tr>
<td>Wind</td>
<td>5,738</td>
<td>843</td>
<td>15%</td>
</tr>
<tr>
<td>Storage and DR</td>
<td>1,581</td>
<td>1,300</td>
<td>82%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>17,252</strong></td>
<td><strong>8,678</strong></td>
<td></td>
</tr>
</tbody>
</table>

*summer net dependable capacity

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**Graph Details:**
- **Installed Capacity** versus **Firm Capacity**
- **Fossil-Based Generation:** 5,257 GW
- **Hydroelectric:** 24 GW
- **Solar:** 4,652 GW
- **Wind:** 5,738 GW
- **Storage and DR:** 1,581 GW

- **Total Installed Capacity:** 17,252 GW
- **Total Firm Capacity:** 8,678 GW

**Legend:**
- Green: Storage and DR
- Blue: Wind
- Yellow: Solar
- Gray: Hydroelectric
- Orange: Fossil-Based Generation
GE Energy Consulting seeing need for holistic planning w/ high renewables

Regulators can facilitate the barriers to change

% Wind and solar generation ('20)

Peak demand

% gen by fuel ('20)

Max ~60%
2am 5/2

Max ramp:
45 -> 25%
5pm 12/24

Max 83%

4am 11/6

Av g 25%

New “peaks” to plan around

Renewable peaks ...w/wind or sun
Ramping peaks ...w/changes in wind and sun
Uncertainty and coincidence ...weather, outages, demand

Plan physics + operations holistically

Current practices often siloed ...who leads change?
Synch units avail to support voltage / freq?
Can inverter-based controls displace synchronous unit ancillary services reliably?

Unlock cheapest enablers first

Use diversity ...smooth risk w/siting, tech, pooling
Integrate demand to use REN over/undersupply
Mkt products/req’ts ...pay /ask for new needs

Ref: Ventyx ABB, PSCo

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Q&A

SUBMIT USING THE QUESTIONS PANE IN THE CONTROL PANEL
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• Virtual Power Plants In The 20s: Moving From Theory To Practice
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THANK YOU

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