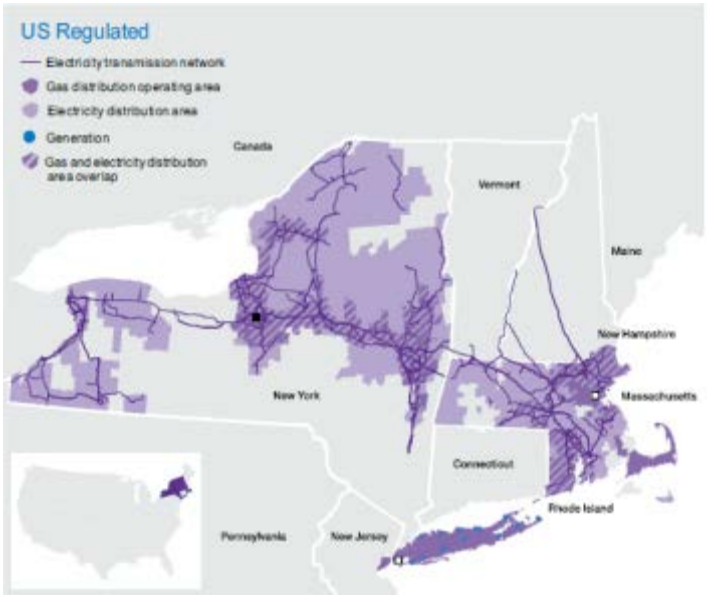
nationalgrid ventures
Rye Development

Pumped Storage Hydropower

Proven, affordable grid-scale storage

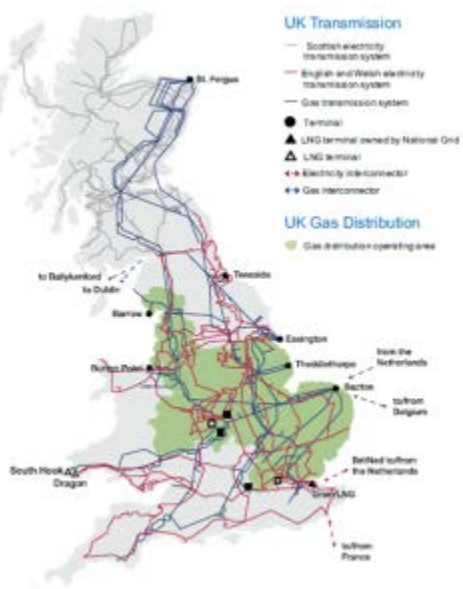
National Grid – Overview

Fortune 500 company and one of the largest investor-owned energy companies in the world with a market capitalization just under $50B with utility operations in US and UK



USA

UK

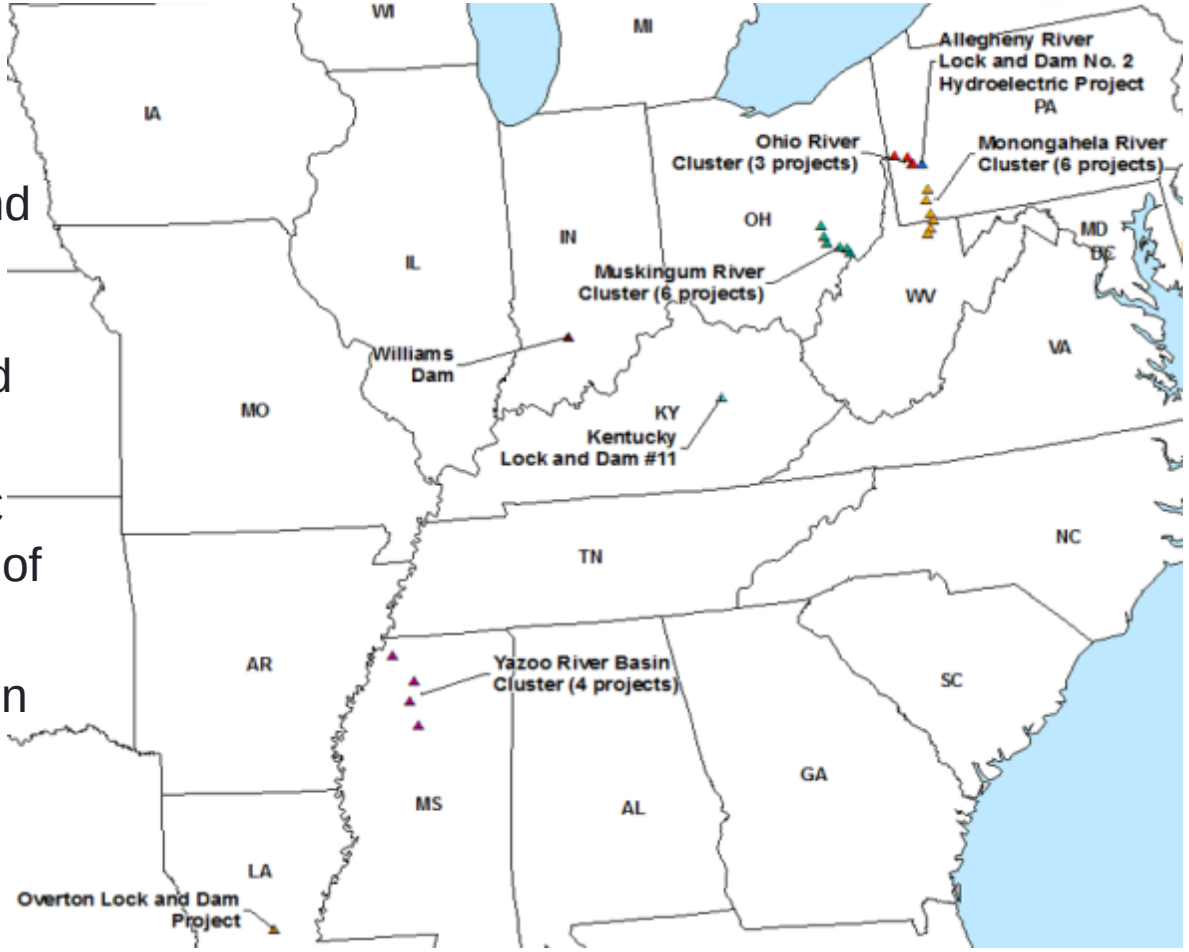


Over 3.4 million electricity customers	Electric Transmission Operator (TO) across England & Wales
Largest transmission network in the Northeast	Gas TO across all of Great Britain
2,000 MW HVDC interconnection with Canadian Hydro ~ 270 circuit miles (450 kV DC)	Four Gas distribution networks
~ 9,000 circuit miles of transmission & 520 substations	System Operator (SO), managing Gas and Electric Transmission for all of Great Britain

Rye Development – Overview

Rye Development is the leading Developer of New Hydro on existing dams in the US

- FFP New Hydro LLC ("FFP NH") is institutionally owned and funded, by US Renewables Group, Crestline Investors, and Ascent Holdings
- Rye Development, LLC ("Rye") is the manager of FFP NH
- 24 projects – $1.5-billion in development



Pumped storage is only proven, cost-effective storage technology at scale

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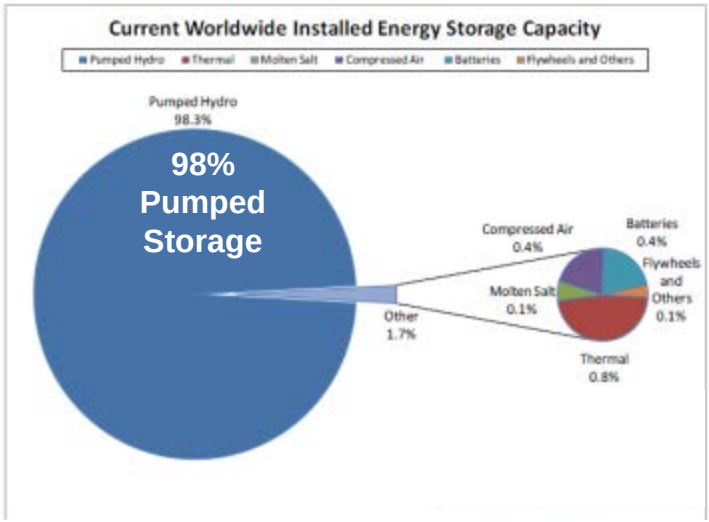
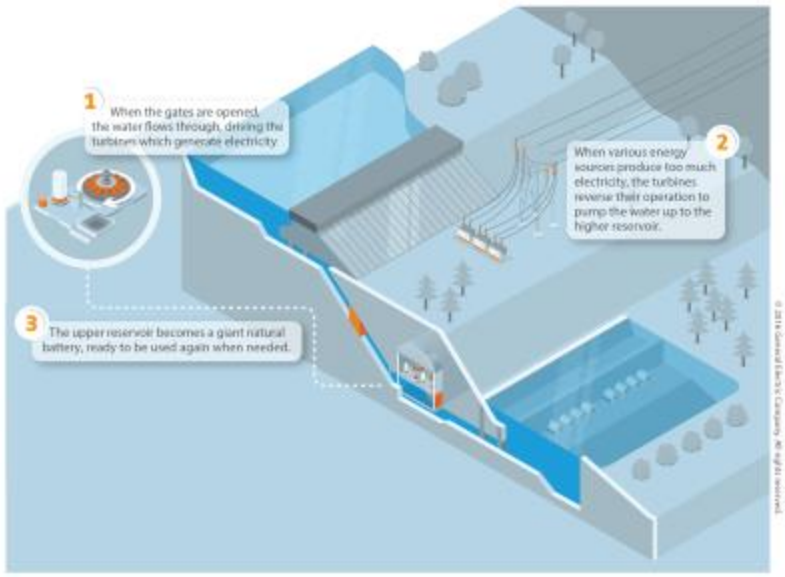
- **Pumped storage** is the only **proven**, **cost-effective** storage at **scale**
- Consists of pumping or generating by moving energy in the form of water through a powerhouse between an upper and lower reservoir
- **Pumped storage is prolific** in the **US** – there are **39 pumped storage plants** in operation with a total installed capacity of about **22,000 MW**
- **Globally**, there is nearly **131,000 MW** of pumped storage capacity currently in operation
- **Batteries** still very expensive, not at scale necessary to replace thermal plants, don't last nearly as long and come with mining/toxic waste issues

Current Worldwide Installed Energy Storage Facility Capacity

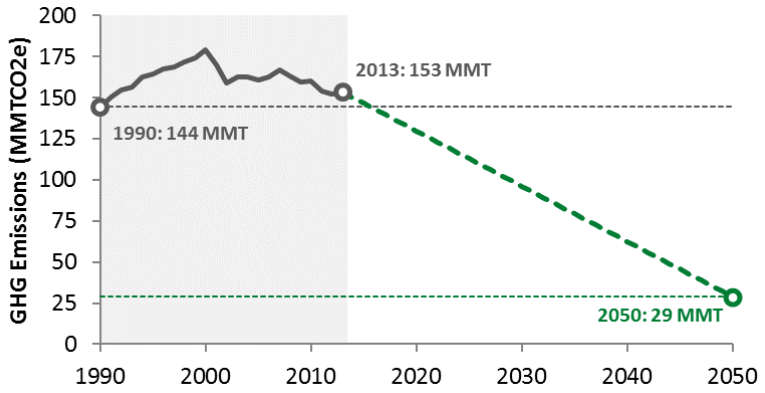




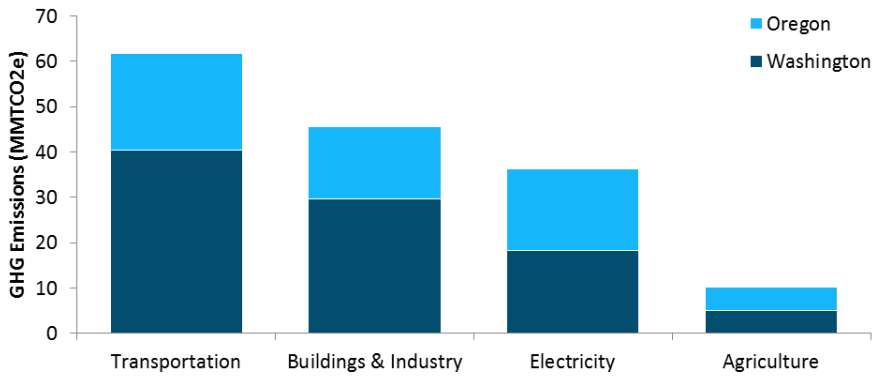
Pumped storage necessary to transition to a low-carbon grid cost-effectively and reliability

- Oregon and Washington are currently exploring potential commitments to deep decarbonization in line with international goals:
  - Washington: 80% below 1990 levels by 2050 (proposed)
  - Oregon: 75% below 1990 levels by 2050 (existing); 50% RPS enacted; 80% Clean Energy Jobs (proposed)
  - California 50% RPS enacted
- Largest sources of GHG emissions in the region guide prioritization of emission reduction strategies

Oregon and Washington Greenhouse Gas Emissions Trends



Oregon and Washington Greenhouse Gas Emissions by Sector (2013)



Very difficult if not impossible for approval to build new thermal capacity in PNW

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- WA and CA considered 100% clean energy bills this past session that would prohibit new thermal plants
- In PSE IRP, beyond 2025, thermal peaking units appear to be the most cost-effective resource to meet larger capacity resource needs:
  - 2027 – 717 MW
  - 2037 – 1912 MW (1195MW incremental to 717MW in 2027)
- However, PSE hopes technology innovations in EE, DR, **energy storage** and renewable resources will **eclipse the need for additional fossil-fuel plants of any kind in the future**
- **Bottom line, "gas is the new coal" given decarbonization goals; case in point – proposed Carty 2 gas plant by PGE in Oregon to meet 561-MW capacity deficit denied/suspended**

Electric Resource Capacity Need, Peak Deficit/(Surplus)

2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
28	29	1	(21)	(42)	36	171	253	565	551	557	623	717	759	837	908	1,015	1,128	1,624	1,695

Electric Resource Plan Forecast, Cumulative Nameplate Capacity of Resource Additions

	2023	2027	2037
Conservation (MW)	374	521	714
Demand Response (MW)	103	139	148
Solar (MW)	266	378	486
Energy Storage (MW)	50	75	75
Redirected Transmission (MW)	188	188	188
Baseload Gas (MW)	0	0	0
Peaker (MW)	0	717	1,912

Expected solar buildout in California through 2030 with 50% RPS

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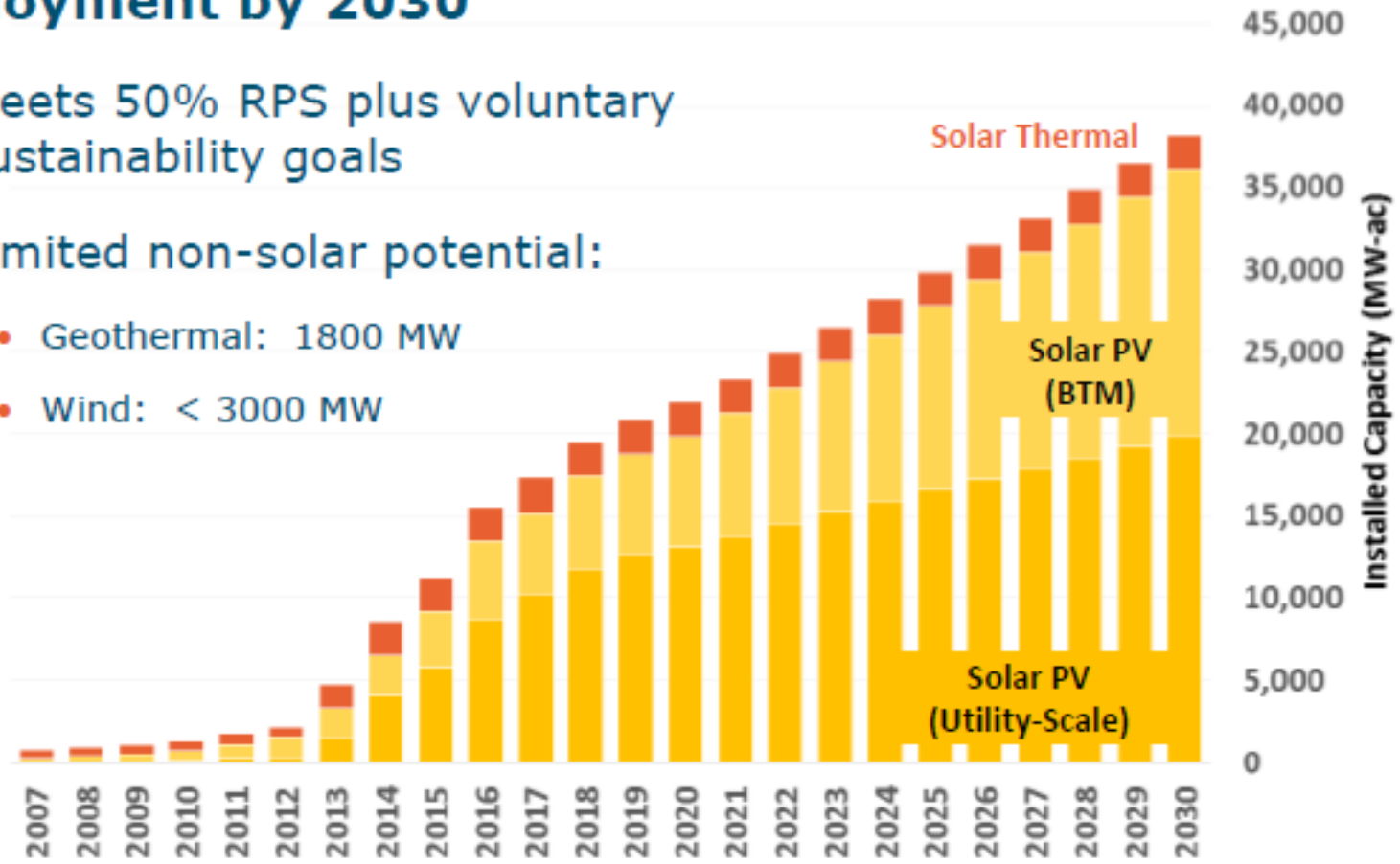
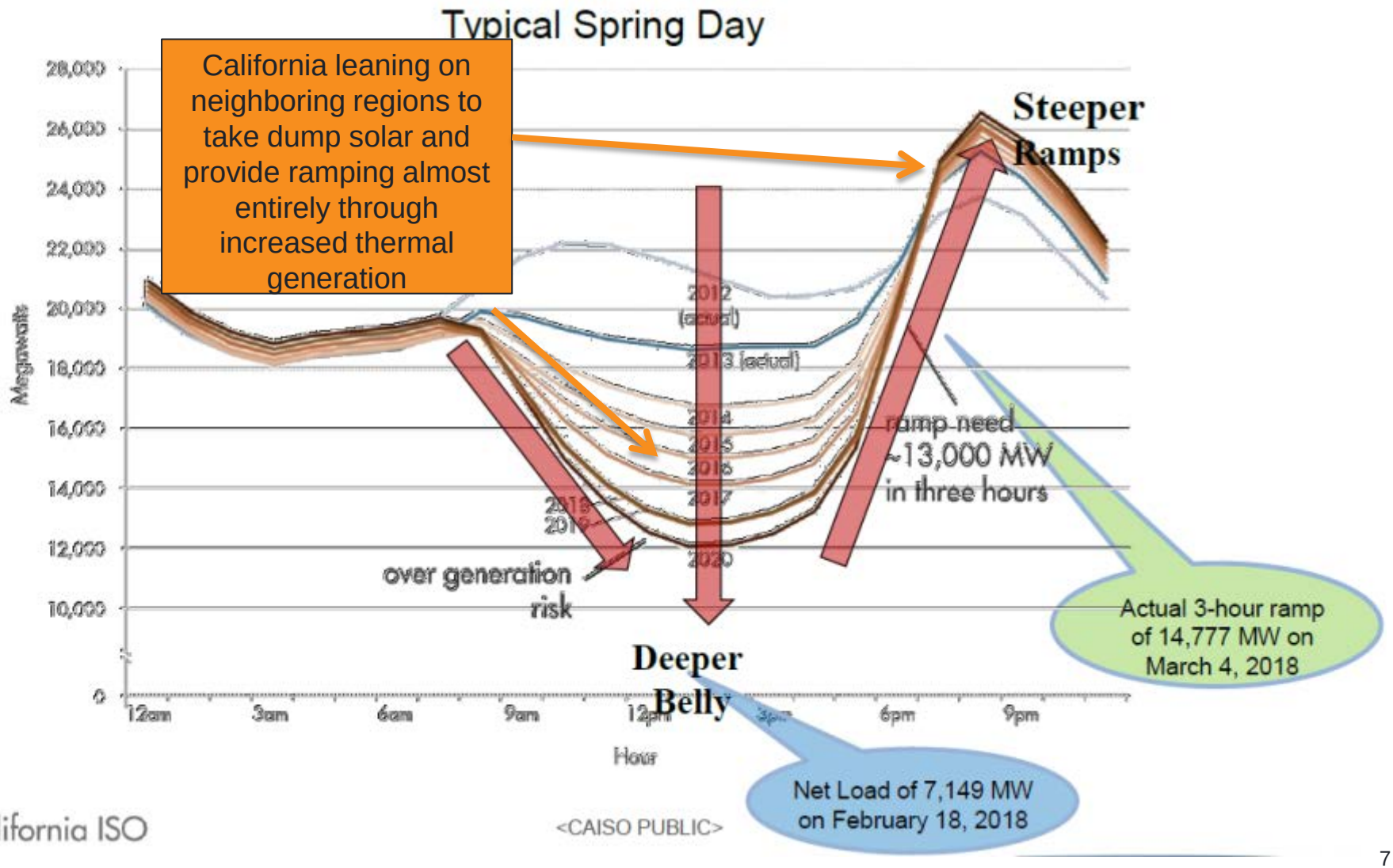
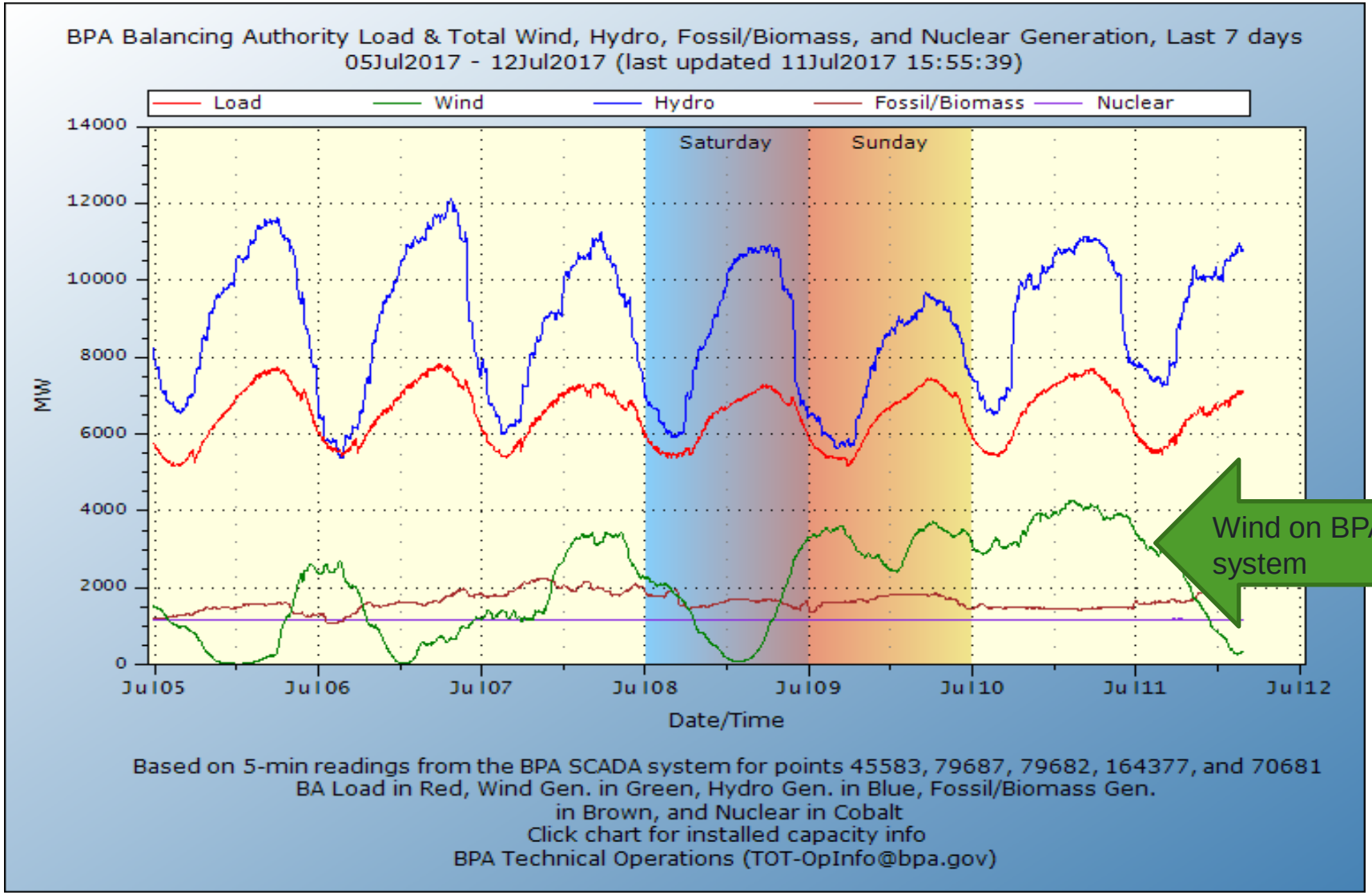
+ **Nearly 40 GW of total solar deployment by 2030**
  - Meets 50% RPS plus voluntary sustainability goals
  - Limited non-solar potential:
    - Geothermal: 1800 MW
    - Wind: < 3000 MW



Actual net-load and 3-hour ramps are about four years ahead of CA-ISO's original estimate



Pumped storage enhance value of existing wind & support integration of additional Gorge wind



Pumped storage strategically located in grid for renewable integration and new carbon-free capacity

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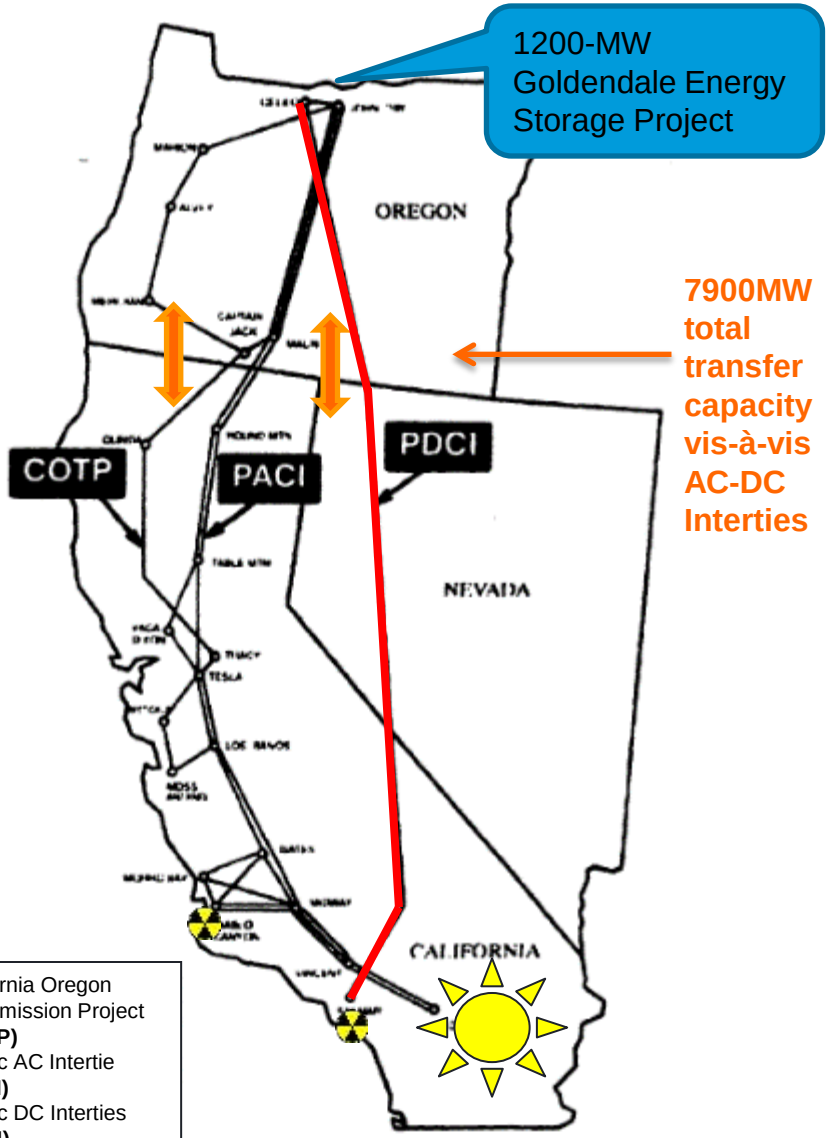

- California Oregon Transmission Project **(COTP)**
- Pacific AC Intertie **(PACI)**
- Pacific DC Interties **(PDCI)**

- Viable/constructable **"closed-loop"** project interconnecting into **existing high-voltage transmission** that leverages major import/export path to California
- Proven storage solution **strategically located in grid** to support regional **decarbonization** goals affordably and reliably
- Project support **continued history** of beneficial regional bulk power **exchanges between California and the Pacific Northwest**
- **100s of millions $ of annual potential cost-saving/revenue regionally to grid**
- **Thousands of jobs** during construction

1200-MW Goldendale Energy Storage Project highlights

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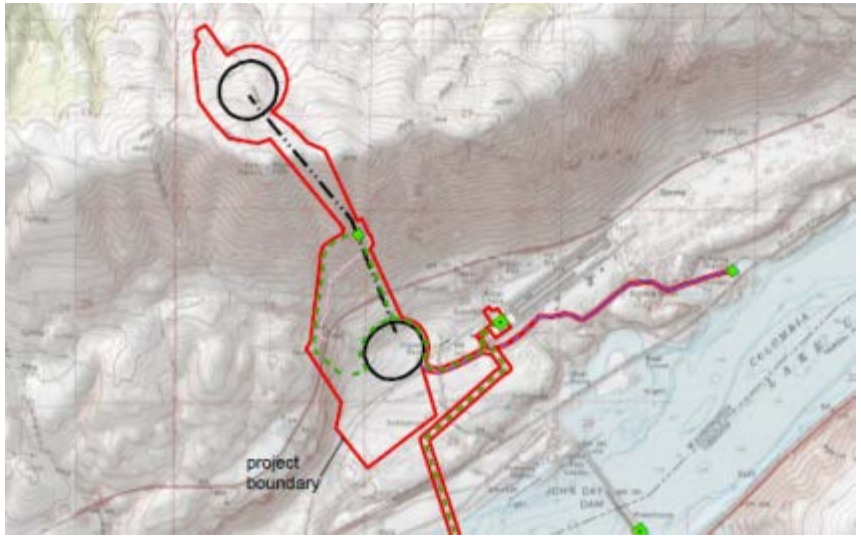
- **“Closed-loop”** / off-stream
- Site has been previously studied for energy projects; **no desktop fatal flaws**
- **Water rights secured** by KPUD for the specific purpose of a pumped storage facility by Washington law
- Site control – land lease agreed upon by landowners and KPUD
- **Broad-based favorable support** from surrounding counties (including Oregon), stakeholders, etc., lending certainty that a license will be issued by FERC in a reasonable timeframe without controversy
- Brownfield redevelopment – **former aluminum smelter clean-up aligns with project development schedule**; positive support from WA Dept. of Ecology to put site back into productive use
- FERC Preliminary Permit issued March 8, 2018



International partnership opportunity provides staggering regional economic development

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- Total 1200-MW project cost currently estimated to be **$2.1B investment**
- The cumulative economic impacts for the region over the construction cycle are estimated by ECONorthwest at $1.4B, which includes **$366.2M** in wages and **6,650** job-years
- Project represents an **enormous** international trade and West Coast clean energy project with major environmental benefits
- Additional renewable construction and operation would provide additional economic benefits
- Goldendale project area within recently designated **Opportunity Zone**

Description	Total
Direct Jobs	3,164
O&M Jobs	114
O&M Wages	$10M