

BPA Distributed Energy Resources Overview

**PNWER Summit
July 2017**



BPA Profile

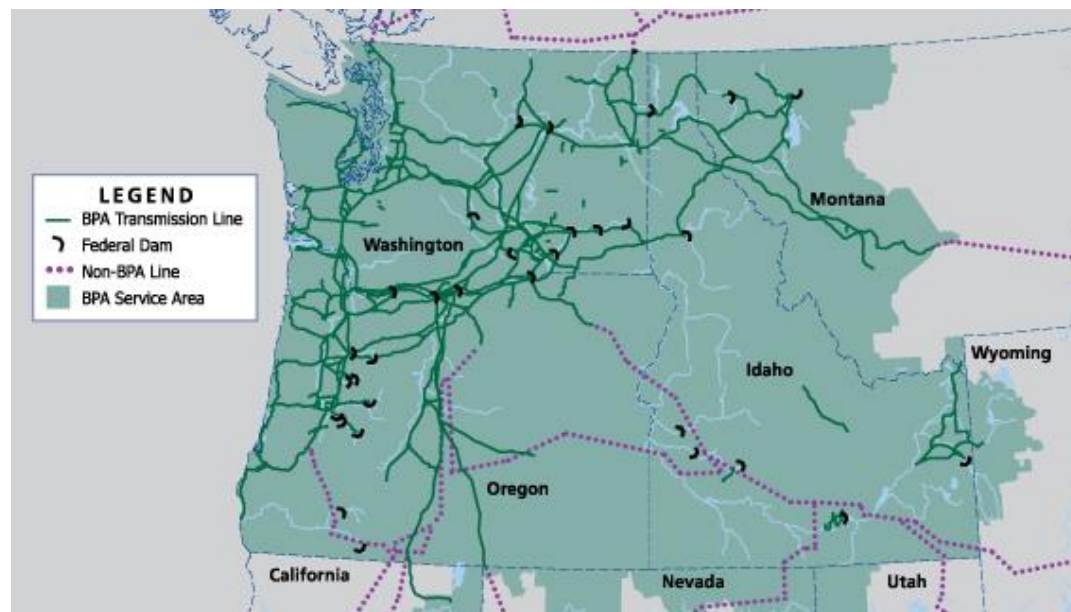
- BPA is a federal power marketing administration headquartered in Portland.
- BPA is part of the U.S. Department of Energy, but it is self-funded and covers all of its costs by selling products and services.
- Congress created BPA in 1937 to sell power at cost-based rates to publicly owned utilities and build the electric transmission system to deliver that power.
- BPA markets the largest supply of low cost, clean, carbon free energy in the nation.
- BPA operates and maintains the largest electric transmission system in the Pacific Northwest.



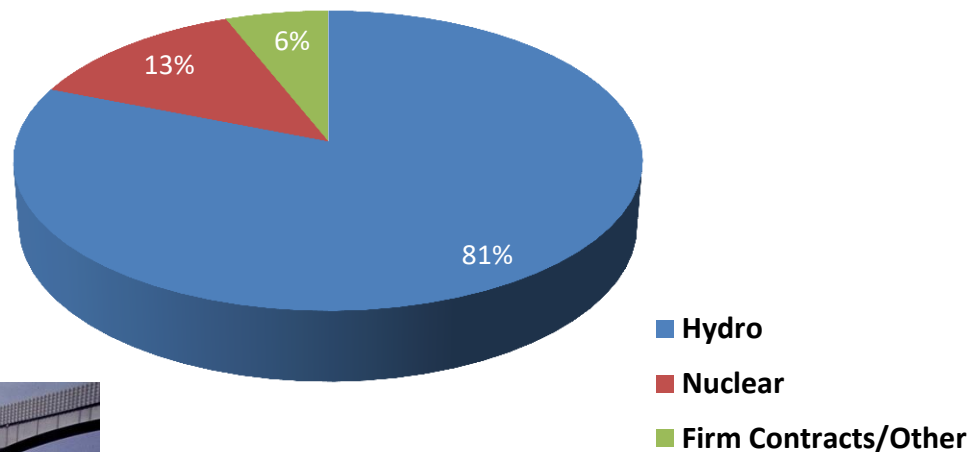
BPA Quick Facts

- 300,000 sq mile service area
- 142 public power customers
- 490 transmission customers
- 15,000 miles of high voltage transmission lines
- 31 federal dams
 - 21 US Army Corps of Engineers
 - 10 Bureau of Reclamation
- Hydro generation: 8,491 aMW
- Several large IOUs also operate in the region.

BPA Transmission System and Federal Dams



BPA Resources are Predominantly Hydro Generation in the Federal Columbia River System (FCRPS); This has been a source of low cost power for the PNW for decades.

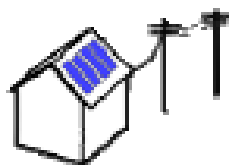


Distributed Energy Resources at BPA



Demand Response

changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time or to incentive payments



Distributed Generation

small generation systems located at a customer site

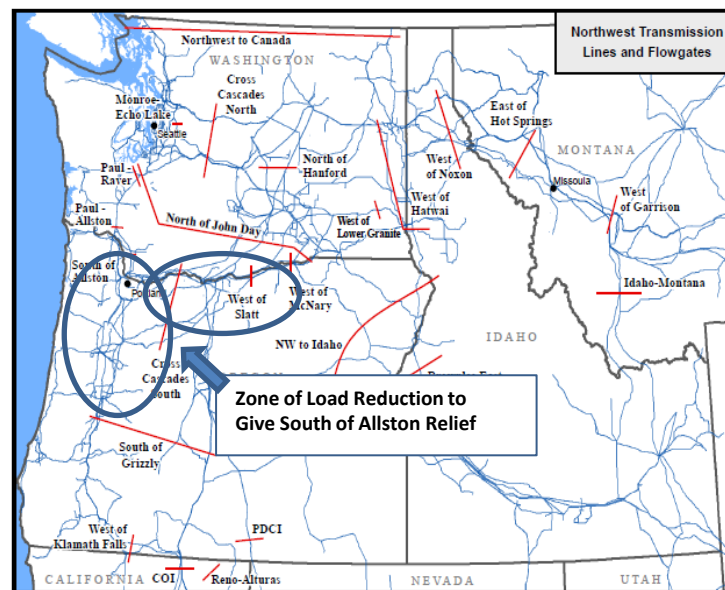


Energy Storage

technologies that allow electricity generated at one time to be used at another time

Drivers for DER at BPA

- **Transmission Opportunities & Cost of Wires Projects**
 - A non-wires measure to assist in the deferral or avoidance of a transmission build.
 - A bridge between the electrification of a new line and the need date.
- **Multi-use for Power Operations**
 - A tool to provide more flexibility in managing the FCRPS, address peaks, and help fill real-time deficits.
- **Integrating Renewables**
 - Installed wind capacity is significant, and new challenge with solar. (Currently not a strong need; however, DR has been tested and shown to be an effective tool to supplement the FCRPS in providing balancing reserves)
- **Customer utility interest**
 - Reducing demand charge (load following) and as a tool to help manage their distribution system.
- **7th Power Plan (NW Power and Conservation Council)**



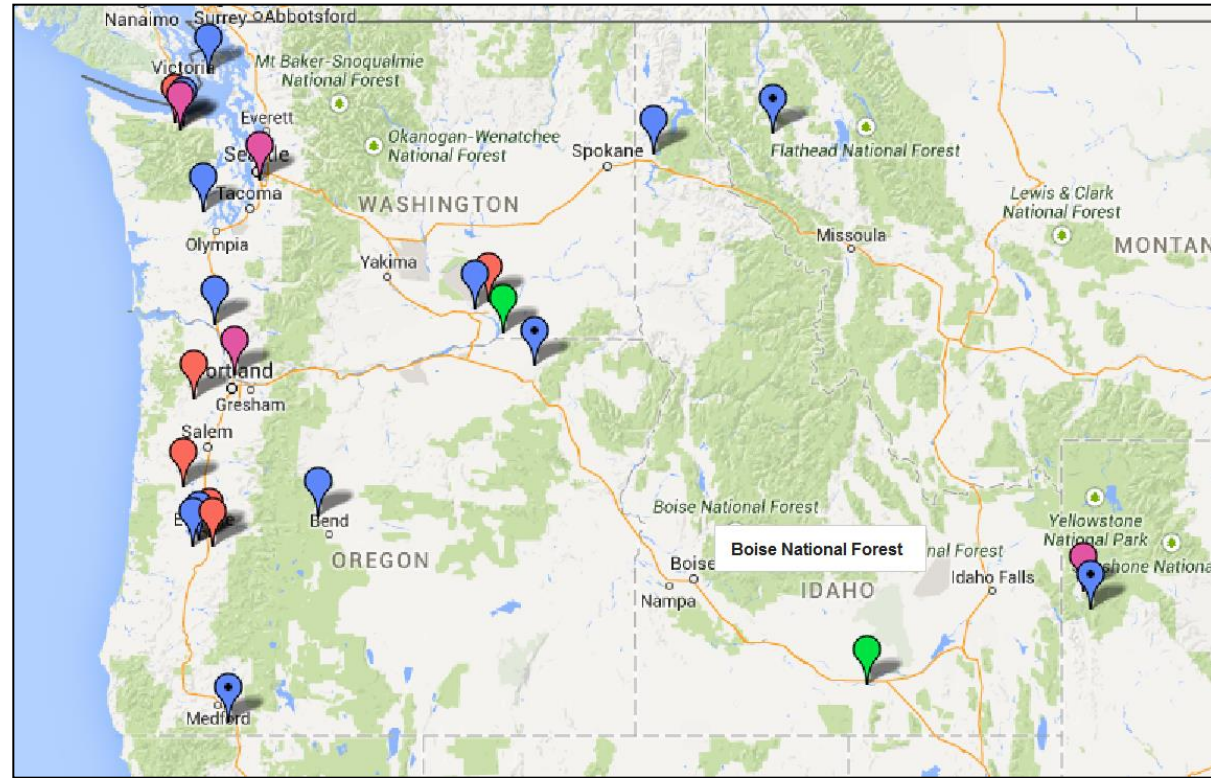
The hydro system has been stretched to its physical margin,” Mainzer said. “Our task is to bring new and cost-effective, flexible capacity from outside of the hydro system.”



Extensive DER Piloting and Testing in the Region (2009-2016) – A Partial List

FAQ

- Pilots with > **20 utilities**
- Tests in residential, public, commercial, industrial, and agriculture sectors.
- Technologies included **10 asset types**, e.g. 1000+ water heater controllers, HVAC controls, water pumping, thermal storage and building mgt. systems.
- Tests included not only peak shaving but innovative “**DR 2.0**” testing of new uses:
 - Load up (DECs)
 - Balancing Service
 - Load Shifting
- Many of these utilities have turned out to be **first movers** in DR demonstrations.



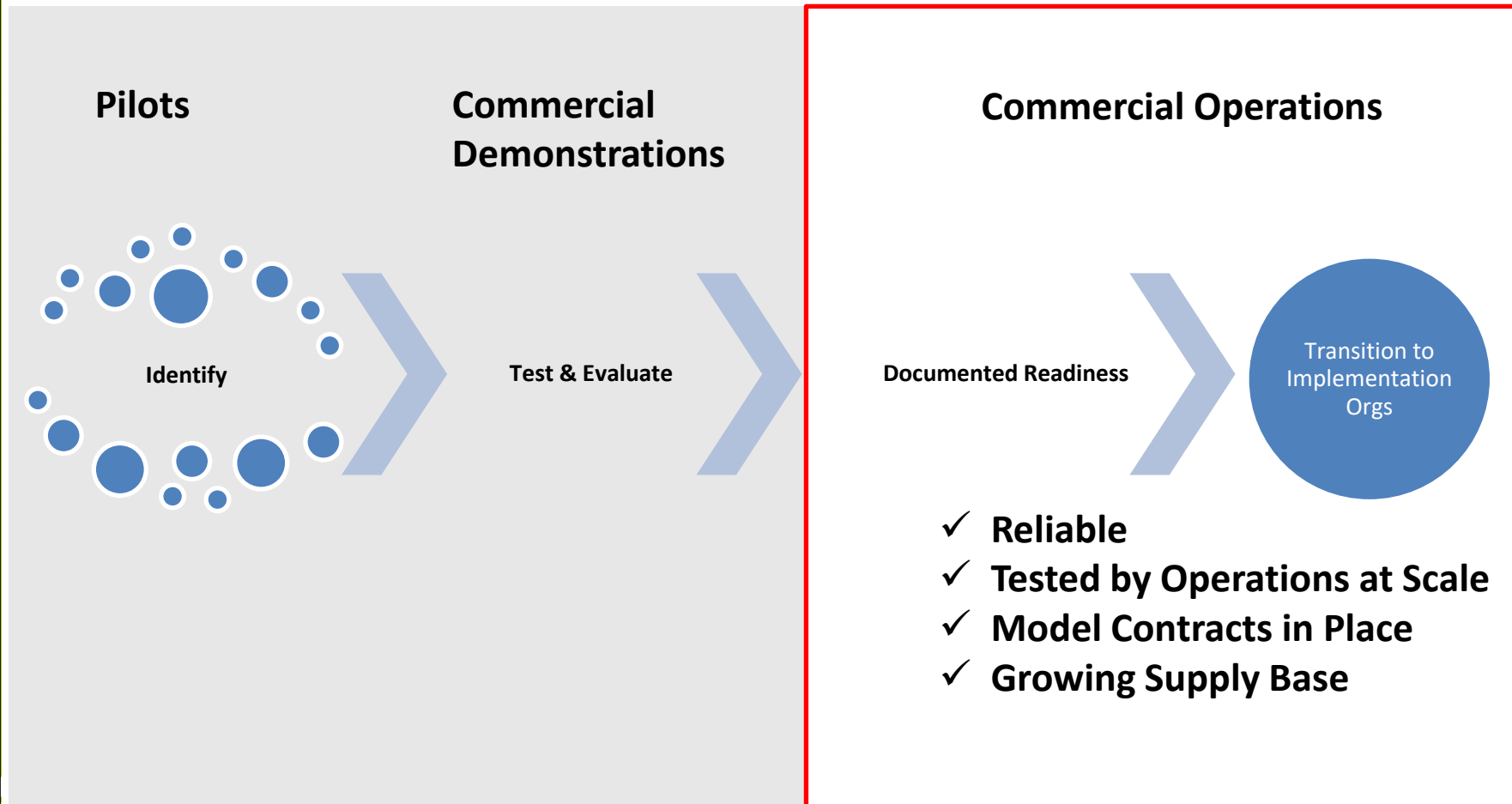
In 2014 BPA Moved to Larger and More Complex Advanced Demonstrations of DER

Entity	Status	MW	Timing	Product Demonstrated
City of Port Angeles	Complete	30	2013 - 2014	✓ Imbalance Capacity
Energy Northwest	Complete	35	2014 – Jan 2016	✓ Imbalance Capacity
EnerNOC	Complete (Report in Progress)	17	2015 - 2017	✓ Winter Peak Shave ✓ Summer Congestion Relief
Energy Northwest	Started June 1st	Up to 50	2017	✓ Summer Peak
Total Portfolio		Up to 130 MW		



DER Program and Technologies Continue to Evolve

Goal: BPA with Commercial Ready Products



Loads that are Traditionally Suitable for Demand Response

Residential



Electric Water Heaters: (.4 - .7 kW)



Air Conditioning (1 – 1.5 kW)



Electric Space Heating (1.5 – 2.5 kW)

Commercial & Industrial

Customer	Peak kW	Curtailment Amount (kW)	Loads to Consider
Food Packing Plants	3000	500	Lighting, HVAC, Equipment, Generation
Paper Mills	8000-20000	5000 +	Lighting, HVAC, Equipment, Generation
Chemical Plants	5000	1000	HVAC, Lighting, Generation, Non Critical areas
Concrete Plants	8000-20000	5000	Machinery, HVAC, Generation
Plastic Factory	5000	1000	Lighting, HVAC, Equipment, Generation
Medical Supplies	3000	1000	Lighting, HVAC, Equipment, Generation
Refrigeration Storage	2000	500	Lighting, HVAC, Equipment, Generation
Sanitation Plants	3000	1000	Lighting, HVAC, Equipment
Grocery Stores	1500	150	Lighting, Office Equip, Employee HVAC
Hotel/Motel	1500	200	Common Areas, HVAC, Lighting, Generation
Commercial Buildings	3000	1000	HVAC, Lighting, Generation
Hospitals	10000	3000	Generation mainly
Universities	3000-15000	1000	HVAC, Lighting, Generation, Non Critical areas
Laboratories	5000	2000	Lighting, HVAC, Equipment, Generation
Mall	1000-6000	500	HVAC, Lighting, Misc
Environmental Housing	3000	1000	HVAC, Lighting, Generation, Non Critical areas



Agriculture



Irrigation Pumping

Municipal



Wastewater and Water Pumps

Nationally, the Use of Distributed Energy Resources is Growing and Represent New Assets for the Grid.

- Over 2,000MW of deployed energy storage is anticipated in the US by 2020.¹
- Over 4,100 MW of solar PV installed in Q32016 in the US. California alone has an installed base of 15,200 MW, much of which is residential.²
- The US Electric Vehicle market is still small, but growing fast with 570,000 light duty plug-in vehicles registered in the US, a 3x fold increase from 2013.³



Non-Wires Opportunities Expected to Continue at BPA With Analysis of Each Opportunity

Pacific Gas & Electric Targeted Demand Side Management

PGE is using a non-wires strategy to defer substation upgrade investments in four high growth areas: Fresno, Tracy, Jackson, and Yuba City. The pilot will focus on peak reduction of **~8MW**, and will use DR and Energy Efficiency. In addition, a RFO is being released in 2016 to acquire a **10MW** / 40MWh energy storage system in Gilroy, California for a substation deferral.

New England ISO Multiple Transmission Deferrals

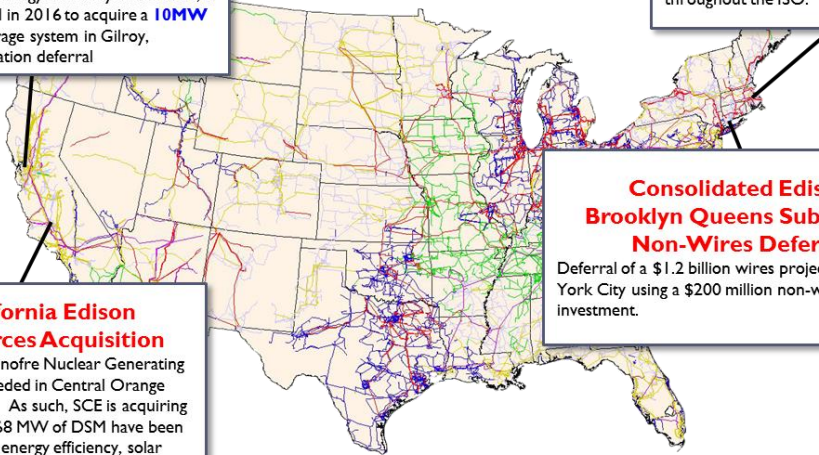
\$425 million in transmission and distribution investment deferrals in the past four years throughout the ISO.

Consolidated Edison Brooklyn Queens Substation Non-Wires Deferral

Deferral of a \$1.2 billion wires project in New York City using a \$200 million non-wires investment.

Southern California Edison Preferred Resources Acquisition

SCE will be retiring the San Onofre Nuclear Generating Station, and resources are needed in Central Orange County for 10am-6pm peaks. As such, SCE is acquiring **250MW** of DER. Thus far, 68 MW of DSM have been contracted, including storage, energy efficiency, solar gen, and permanent load shift.

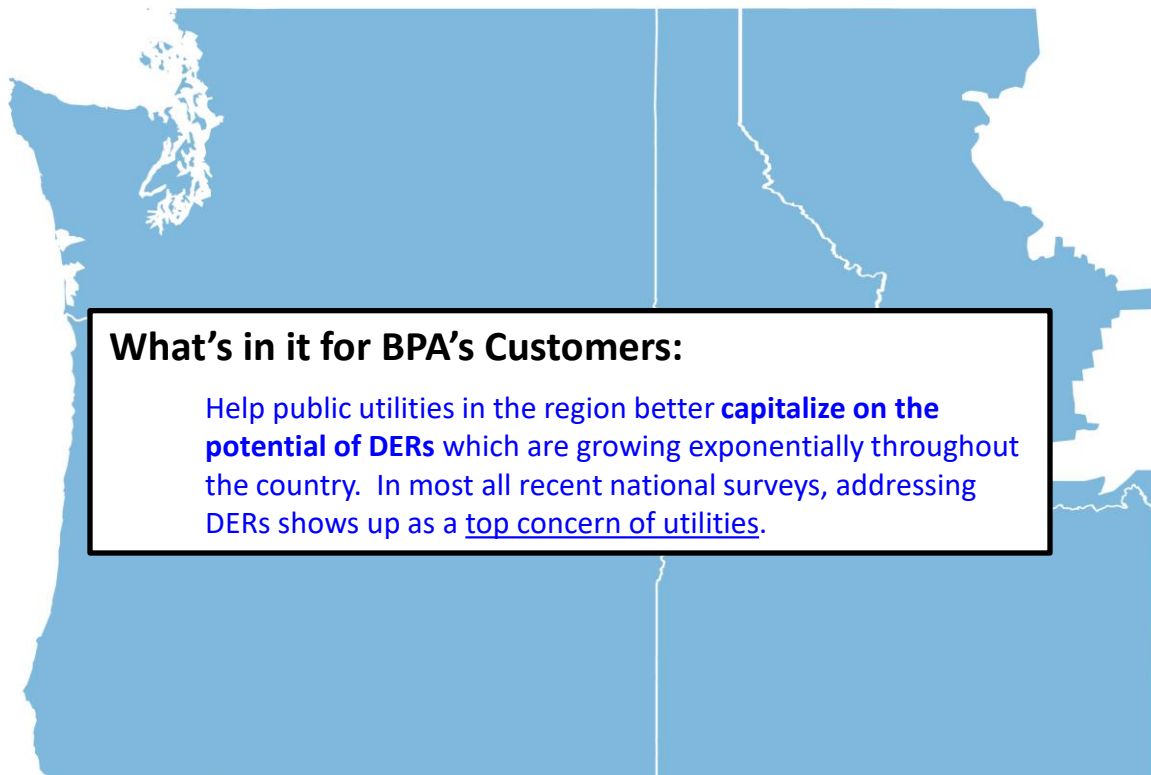


Non-Wires is a strategy that is growing nationally:

- **Availability of attractive non-wire alternatives, the growing cost and time to build lines and a legislative/policy push** are leading to growth of T&D deferrals nationally.
- **Over 60 Transmission non-wire deferrals in the Eastern US alone.** NE-ISO has had \$400 million in non-wires transmission deferrals over the last three years.
- **Con-Ed** has deferred a \$1.2B substation investment in Brooklyn-Queens with Non-wires.
- **Southern Cal Edison** is going out for 250MW of non-wires measures in Orange County.



A DER Potential Study in BPA Service Territory is Now Underway (Will Support Non-Wires)



Two Components

1. **Potential assessment**
 - *supply curves and achievable quantities for winter and summer seasons*
2. **Barriers assessment.**

Three Asset Categories – All Sectors

1. Demand Response (primary)
2. Battery Storage
3. Distributed Generation (e.g. solar)

Data Sources

1. Literature review.
2. BPA, Customers, PNW stakeholders, and selected end consumer interviews (50-60) and surveys.

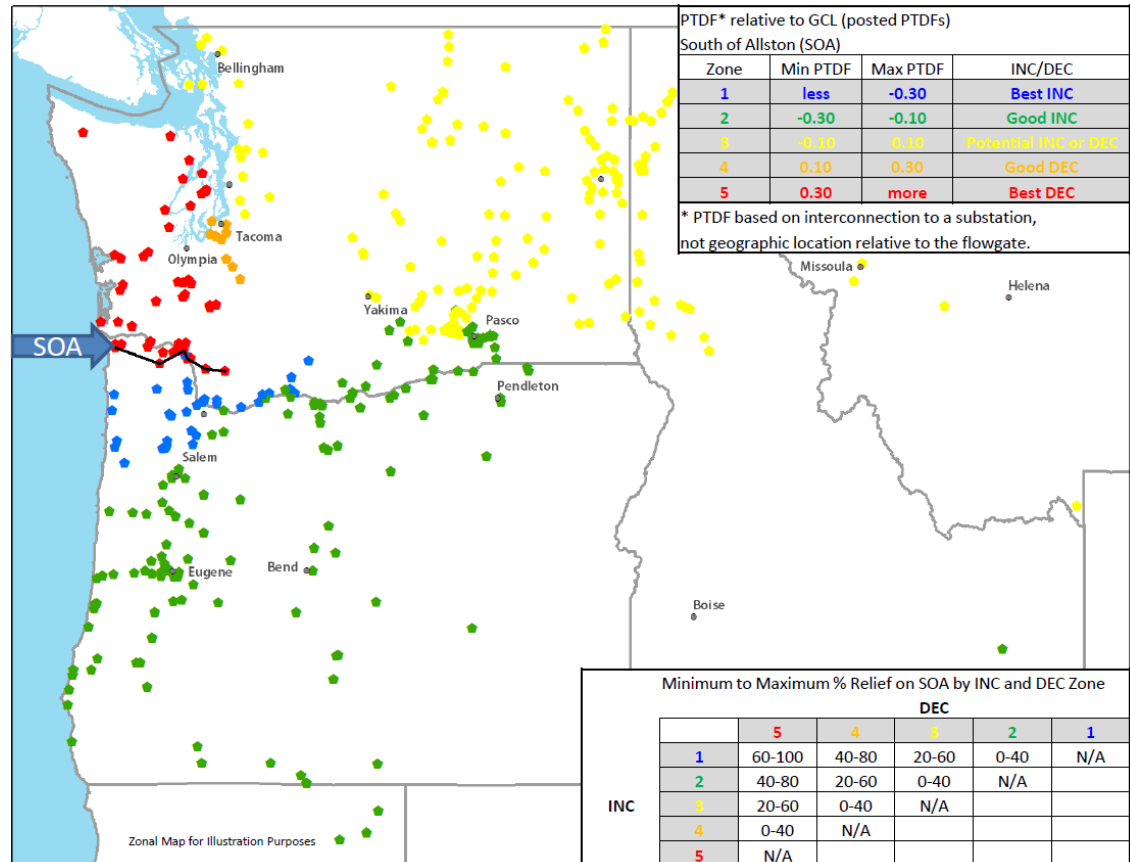
Vendor Chosen through RFP

Cadmus



South of Allston: Demand Side Assets as Part of Non-Wires Strategy

- BPA is adjusting its transmission planning process to include assessment of non-wires options.
- First application is the South of Allston flowgate.
- Each MW of DR translates to <1MW of flow relief when paired with generation north of Allston.
- Map depicts locational effectiveness of resources.




In 2016, BPA Went to the Market for Non-Wires Resources for South of Allston (I-5 Corridor)

- All Sources Request For Offers (RFO) including Demand Response - April 2016.
- Significant Market interest across asset types.
- Implementation in Summer 2017.

Fast Facts:

Timeframe	5 year demonstration with initial 2 year acquisition
Product	Day-ahead
Deployment	Mon-Friday, June – Sept, 14:00 - 22:00, 4-6 hour duration
Scale	200MW pairing of INC/DECs that provide 100MW of path relief
Portfolio Assets	Generation Demand Response (46MW) Battery Storage



Department of Energy
 Bonneville Power Administration
 P.O. Box 3621
 Portland, Oregon 97208-3621

April 26, 2016

SUBJECT: INDICATIVE TERMS, REQUEST FOR OFFER
 INC Capacity, DEC Capacity, and/or Demand Response Capacity

Interested Parties:

The Bonneville Power Administration (BPA) is interested in acquiring summer peak congestion relief on the South of Allston (SOA) flowgate. This Request for Offer (RFO), and the resulting 5-year pilot program, are intended to help inform BPA on the availability and cost-effectiveness of non-wires congestion management tools.

Instructions for submitting responses to the RFO are included in the attached term sheets. BPA invites indicative offers pursuant to the specific parameters outlined below. BPA is also open to general comments or information outside the intended offer parameters specified, but will not use such feedback for purposes of indicative offer evaluation.

Subject to confidentiality provisions outlined in the attached, BPA will not disclose specific information marked "Proprietary" or "Confidential."

Responses due: May 26, 2016 by 5:00 pm Prevailing Pacific Time.

BPA will notify parties whose indicative offers are considered best qualified within 30 days of closing the RFO. Upon notification, respondents will be required to submit a "best and final" offer no later than 3 business days from the date of notification. BPA expects to execute final agreements by no later than December 31, 2016.

This Request for Offer (RFO) consists of the following Attachments:

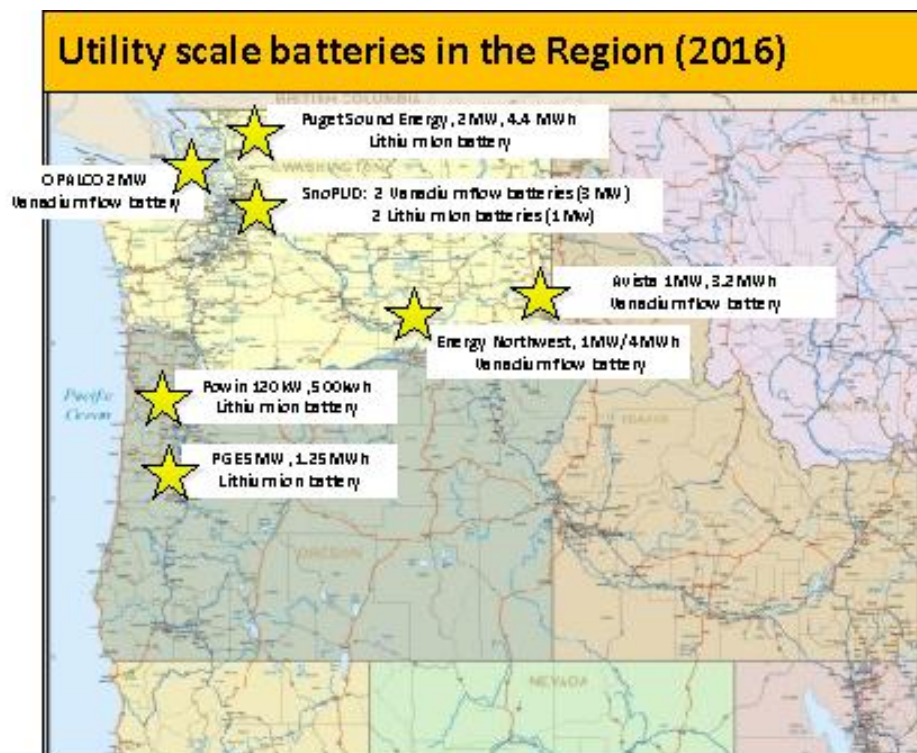
1. RFO, INCREMENTAL CAPACITY TO THE BONNEVILLE POWER ADMINISTRATION
2. RFO, DECREMENTAL CAPACITY TO THE BONNEVILLE POWER ADMINISTRATION
3. RFO, DEMAND RESPONSE CAPACITY TO THE BONNEVILLE POWER ADMINISTRATION

If parties are unsure of which term sheet to respond to, a zonal map that illustrates potential Incremental Capacity (INC) and Decremental Capacity (DEC) resources is posted to our external website. For illustrative purposes, five zones have been developed to match to the Long Term Power Transfer Distribution Factors (PTDF) Table. Parties can utilize these tools to help prepare responses.

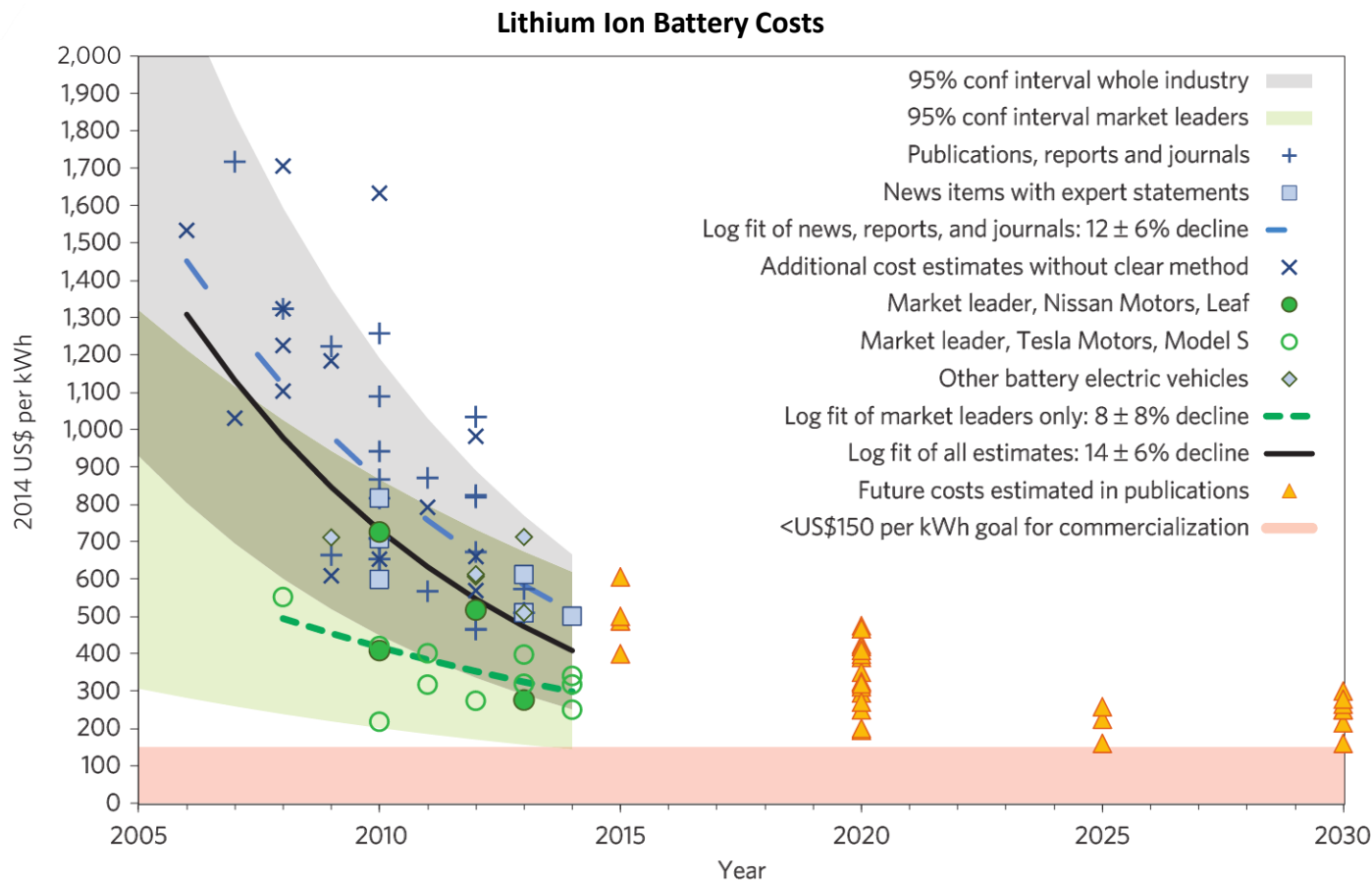
In addition, the following draft Transmission Business Practices are "Out for Comment" to help parties fully evaluate and respond to this RFO. BPA will provide, through Tech Forum, public notice of a conference call in early May. We are considering sometime between May 2 through May 4. The comment period will close May 17. Business Practices are expected to be final by May 25.

The Future: Energy Storage and Electric Vehicles are on the Horizon

- Cost of storage is coming down and is becoming competitive on longer term contracts (e.g. 10 years).
- BPA cross-agency team is established to advance energy storage.

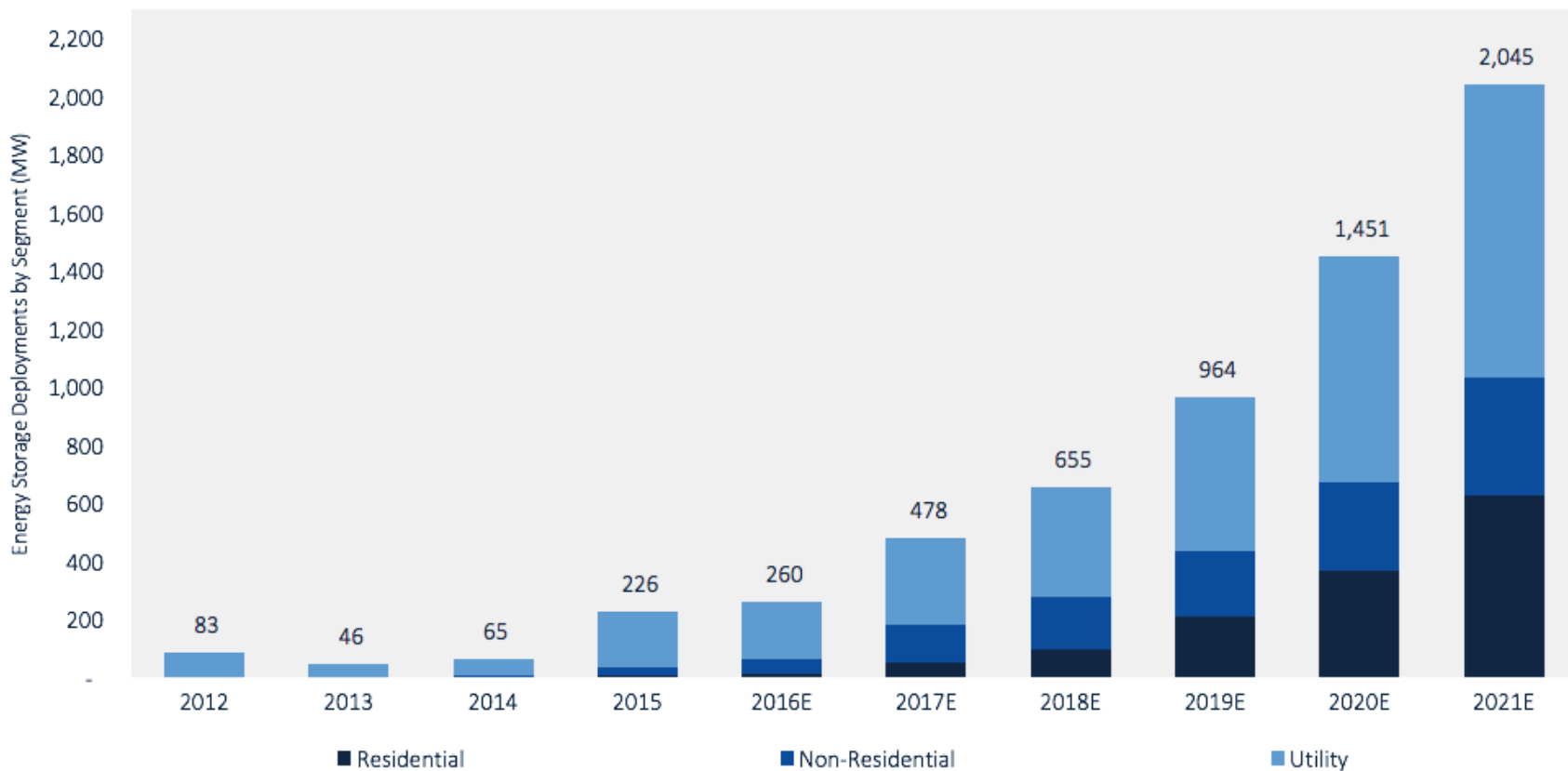


Storage Costs Continue to Fall and Trend is Expected to Continue with Scale



Source: Nature Climate Change report, NyKvist & Nilsson, March 2015

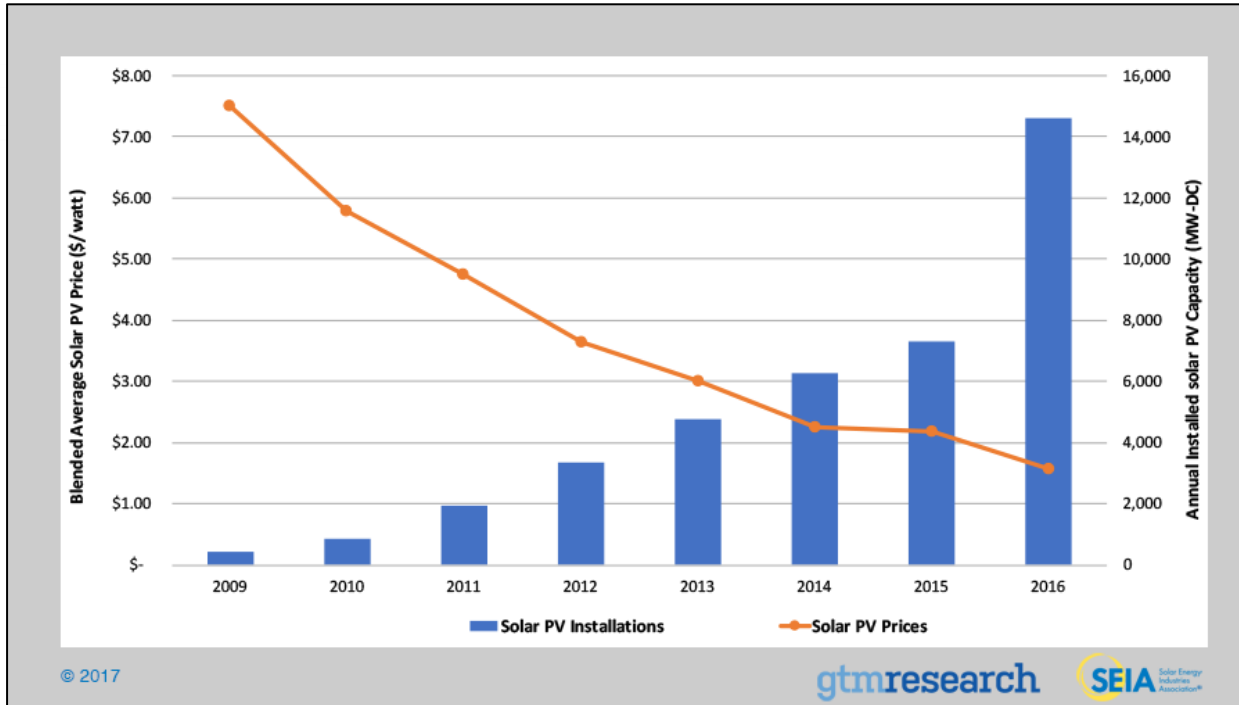
The Future: Nationally Energy Storage is Projected to Experience Strong Growth In the Coming Years



Source: GTM Research, March 2017

Solar Also Continues to Grow at a Rapid Pace and Prices Continue to Fall

USA Solar PV Annual Installations



Regional Solar

State	MW Cumulative Solar Installed	State Rank
California	18,919	1
Idaho	359	17
Oregon	271	20
Washington	96	30
Montana	25	38

Source: Solar Energy Industry Association



Summary

- DER is **mainstream** and for many needs is profitable today.
- BPA is **well-positioned** for the future.
- There is **more to come** with emerging technologies and reduced costs to deploy.
- Currently, BPA's **strongest case for DER** is in Non-wires alternatives (NWA)



Thank you