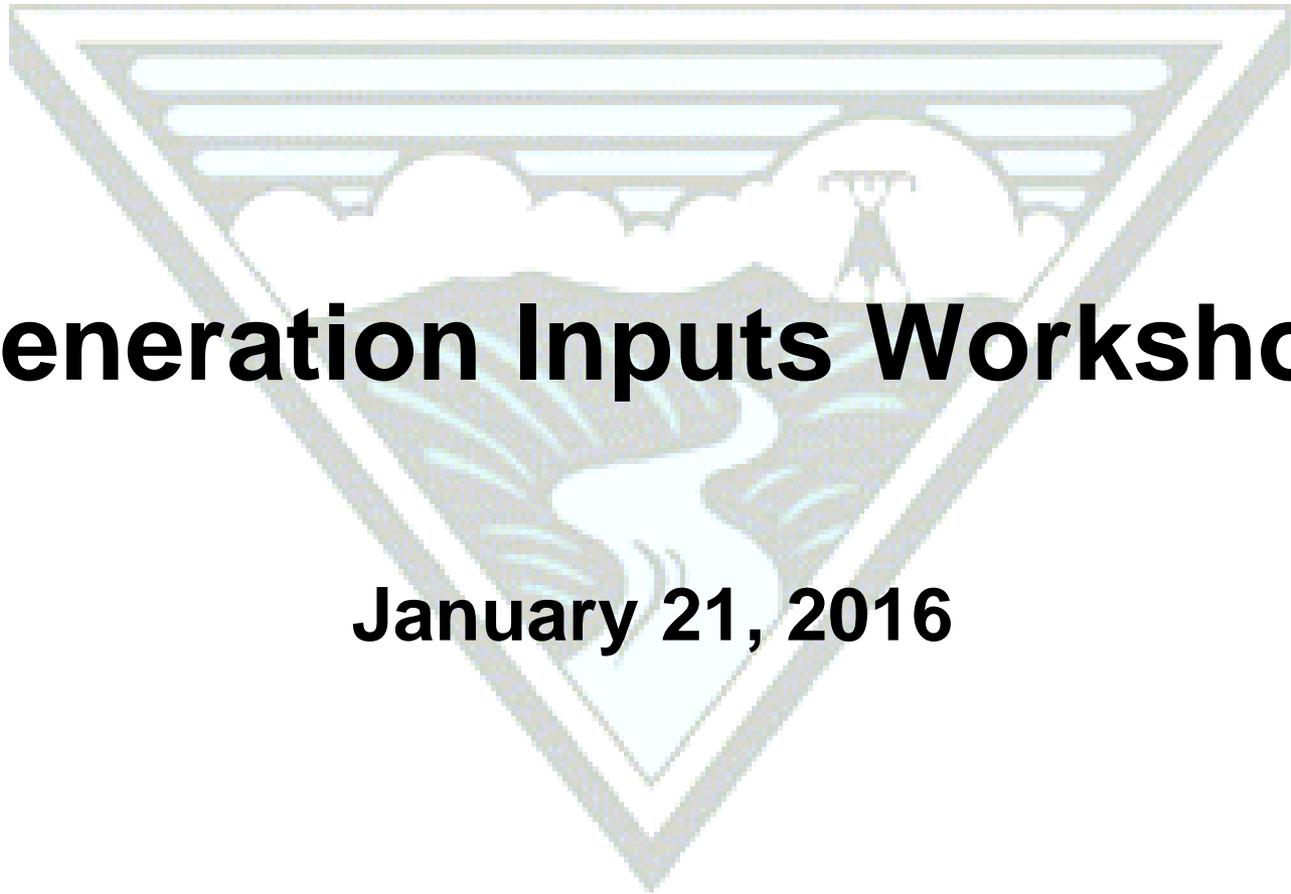


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P O W E R A D M I N I S T R A T I O N

Generation Inputs Workshop

January 21, 2016



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Landscape for BP-18

Daniel Fisher

BP-18 Landscape Changes

- We anticipate a reduction in the amount of reserves needed to balance the system.
 - Wind farms leaving the BPA Balancing Authority Area
 - More efficient scheduling elections
 - Changes in BAL-001 reliability standard
- Not likely to need to make third-party capacity acquisitions outside the spring period.
- Experience with new spring acquisition strategy.
- Experience with Intentional Deviation.

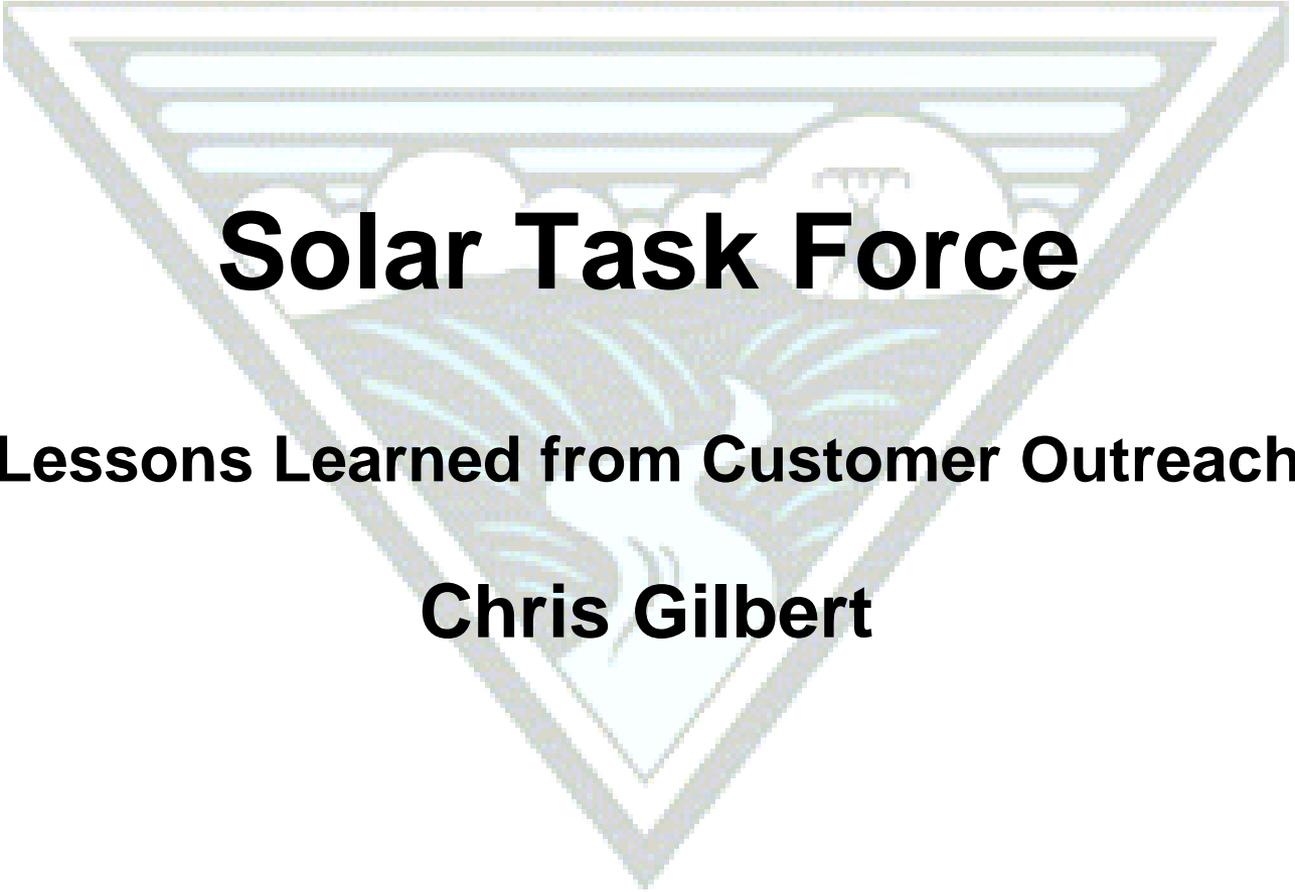


BP-18 Landscape Changes (cont.)

- DERBS – Chehalis and Hermiston plants no longer in BPA BAA (foundation of settled rates based with these plants included). Systematic mismatch between revenue collection and calculated reserve requirements, due to the dispatchable nature of the DERBS plants and their ability to avoid the rate.
- BAL-002 impact on Contingency Reserves.
- BAL-003 accounting of Frequency Response Reserves.
- Expansion of California Energy Imbalance Market into the Pacific Northwest.
- No near-term formation of a Centrally Cleared Energy Dispatch (CCED) or Security Constrained Economic Dispatch (SCED).
- Potential new perspective on DEC capacity.
- Growing interest in solar resource development.



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Solar Task Force

Lessons Learned from Customer Outreach

Chris Gilbert

Overview

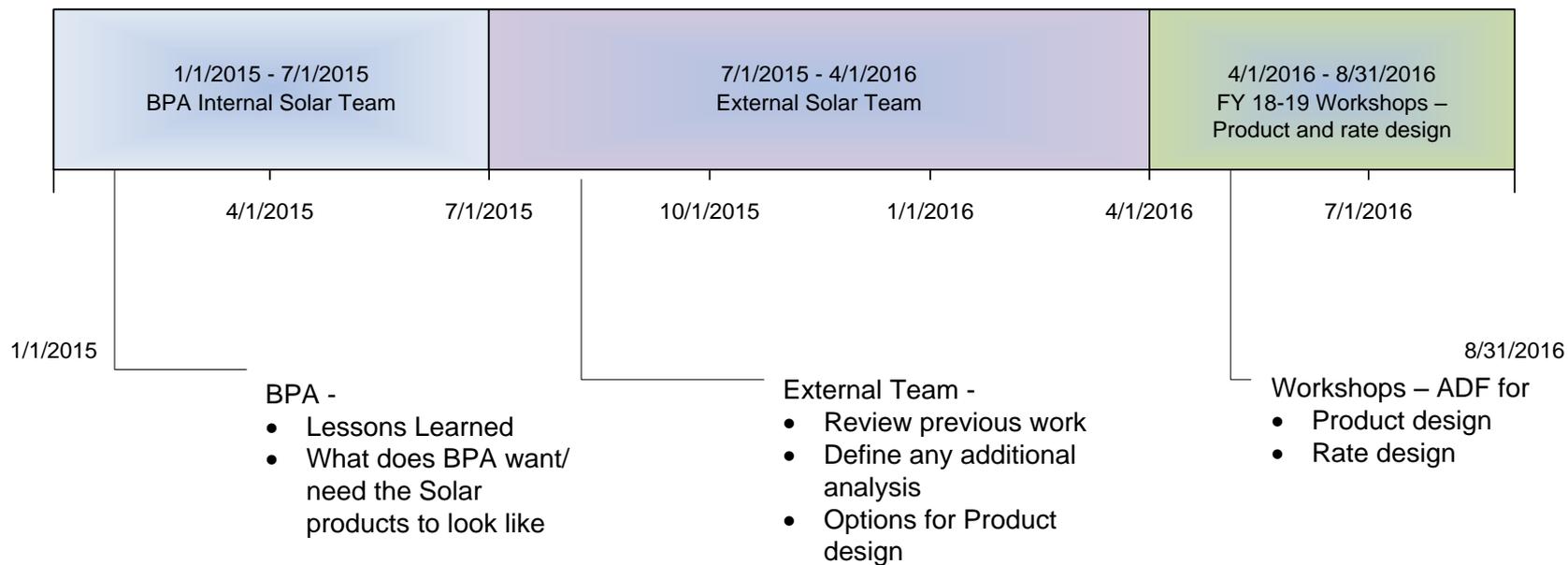
- Purpose
- Time Line
- Principles
- Who BPA met with and what we heard
- Siting Maps
- Next Steps



Purpose

- BP-16 Generation Inputs Partial Settlement Agreement Attachment 1 Section 13.a
 - “Bonneville and customers will establish a solar Task Force to discuss transmission and integration issues related to solar energy development in Bonneville’s Balancing Authority Area, including the discussion of customer proposals on Solar Verbs rate design.”

Solar Task Force



BPA's Solar Task Force Principles

1. Establish policies for utility-scale solar installation in the BPA BAA.
2. Honor preference customers' priority access to federal generation capacity.
3. Maintain alignment with the agency's decisions regarding imbalance markets.
4. Maintain BPA BAA reliability.
5. Eliminate the transfer of marketing risk into the dispatch of reserves.
6. Minimize implementation burden (no more products/services than is necessary).
7. Provide comparable service.
8. Provide an efficient BPA Open Access Transmission Tariff compliant interconnection process.
9. Devise policies, rates and supporting processes for the installation of Solar and associated technologies, including battery storage and inverter technologies.
10. Devise policies, rates and supporting processes to incentivize the best available scheduling practices.
11. Establish data requirements to support operational visibility of Solar installations.
12. Honor the intent and content of the Regional Dialogue Contracts when planning solar resource development.



Who we met with...



**NRU Northwest
Requirements
Utilities**



What we heard from constituents...

- How much solar is in the Northwest.
- Policy Development
- Siting and Interconnection
- Resource Sizes
- Solar Support Products
- Rate Structures



What we heard from constituents...

- How much Solar in the Northwest?
 - More than we realize
 - BPA has 5 MW of solar currently
 - Oregon organizations are tracking 178 MW
 - 43 Washington public utilities have installed solar
 - Washington has 37.4 MW of installed solar
 - More is on the way
 - BPA is anticipating 98 MW on-line by 2020
 - 19 utilities developing community solar project plans, mostly in Washington
 - Nearly all grant applications are for solar installations
 - 30% Federal Investment Tax Credit extended to 2022



What we heard from constituents...

- Recommended areas to focus Solar policy development:
 - Policies that signal Solar has a place in the Northwest.
 - Policies that are adaptable from rate case to rate case.
 - Clear definitions of Utility, Community, Commercial, and Distributed solar.
 - Policies that support the use of latest technologies.
 - Policies that provide for the netting of solar with other resources.
 - Policies that recognize Solar can provide system benefits.
 - Impact on Operational Controls for Balancing Reserves and Oversupply.



What we heard from constituents...

- Siting and Interconnection
 - Site resources for need – non-wires solutions and benefits.
 - Incentivize siting, types of equipment, system benefits.
 - Increase efficiency of the queue process for small solar resources.
 - Provide improved clarity of interconnection requirements and related costs.



What we heard from constituents...

- Resource Sizes
 - Fresh evaluation of resource size on rate design and transmission interconnection requirements.
 - Evaluate application of 200 kW limit in power sales contract and transmission interconnection.
 - Evaluate the impact of different types of Solar resources on BPA's load growth definitions.



What we heard from constituents...

- Solar Support Products
 - Evaluate the development of a Solar-specific storage and shaping service.

 - Evaluate solar's affect on Demand Charges and Resource Support Services.

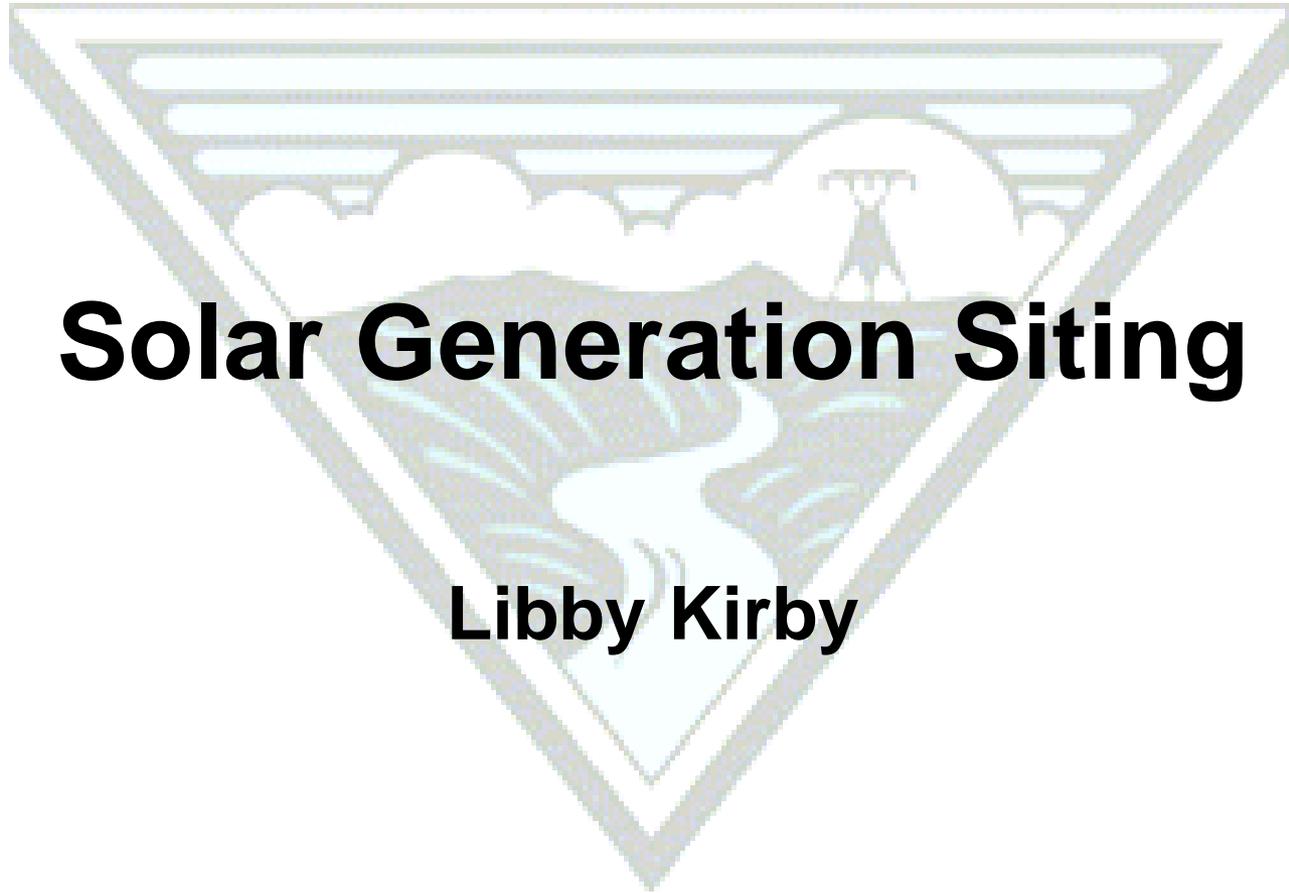


What we heard from constituents...

- Rate Structures
 - Establish VERBS (Variable Energy Resource Balancing Service) pricing based on a capacity factor or actual use.
 - Develop options for the self-supply of VERBS.
 - Incentivize the siting of projects for transmission system benefits.
 - Incentivize the use of latest technologies.
 - Evaluate how the different types of solar resources fit in the Tiered Rates Methodology.



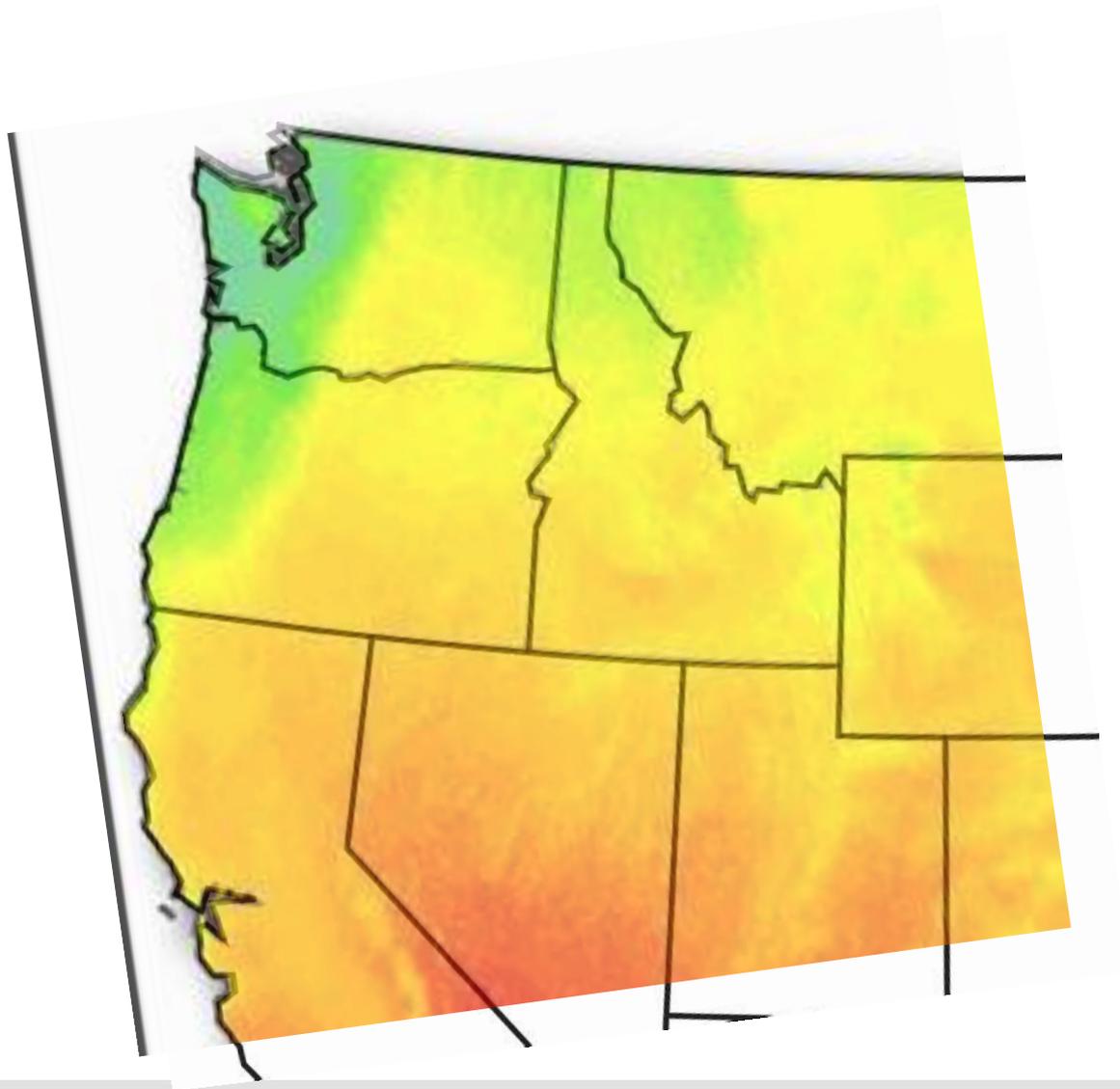
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Solar Generation Siting

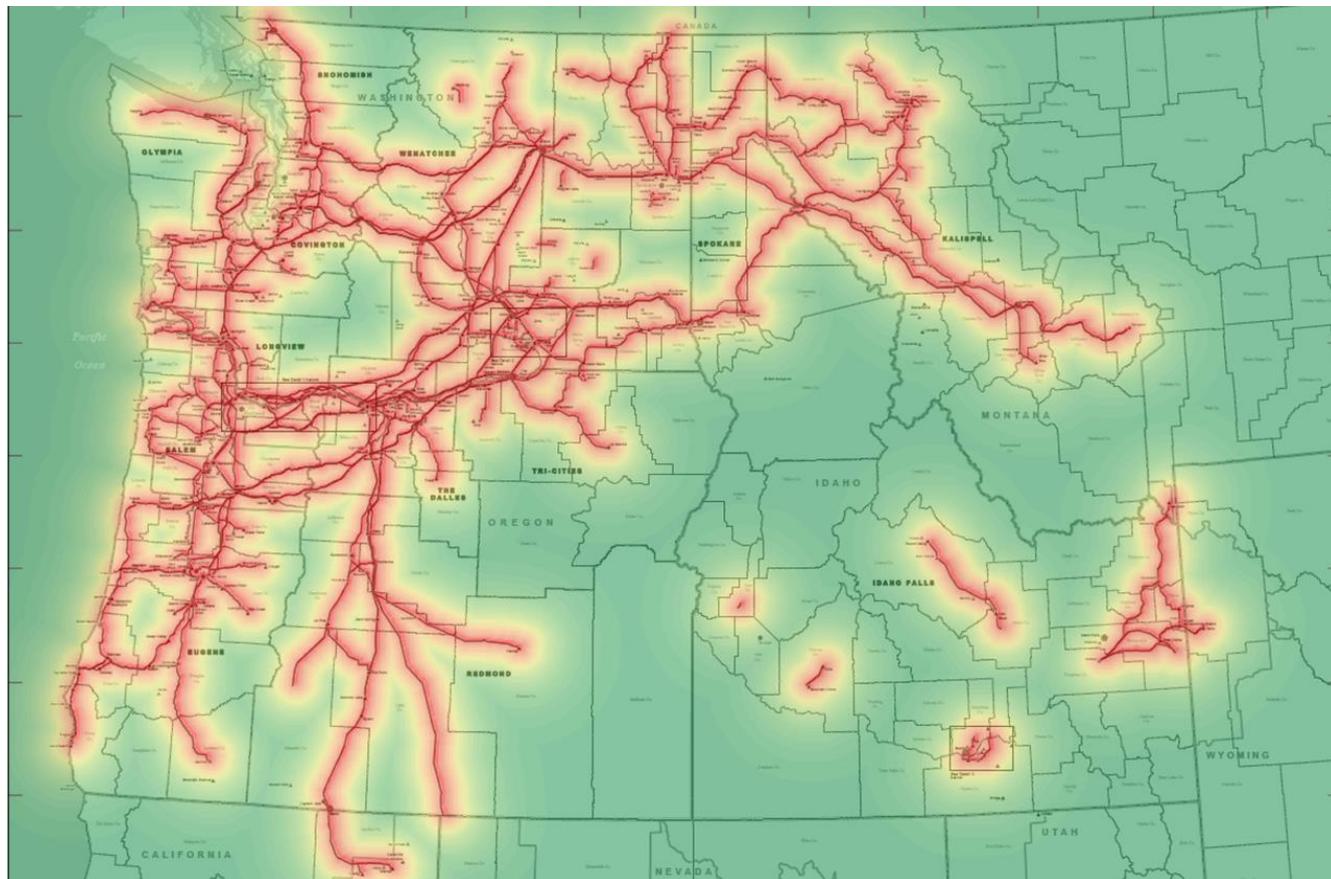
Libby Kirby

Solar Irradiance

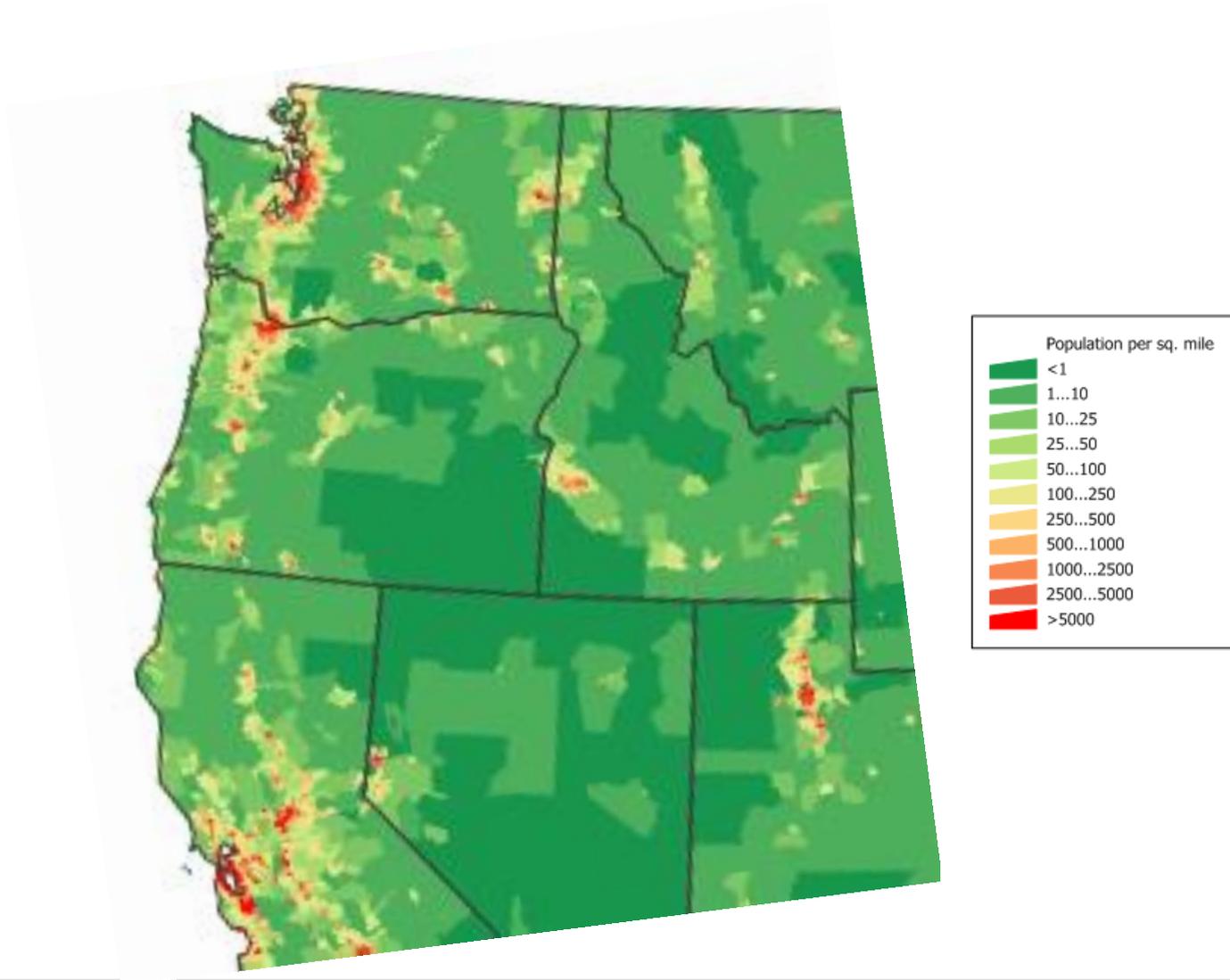


Transmission Lines

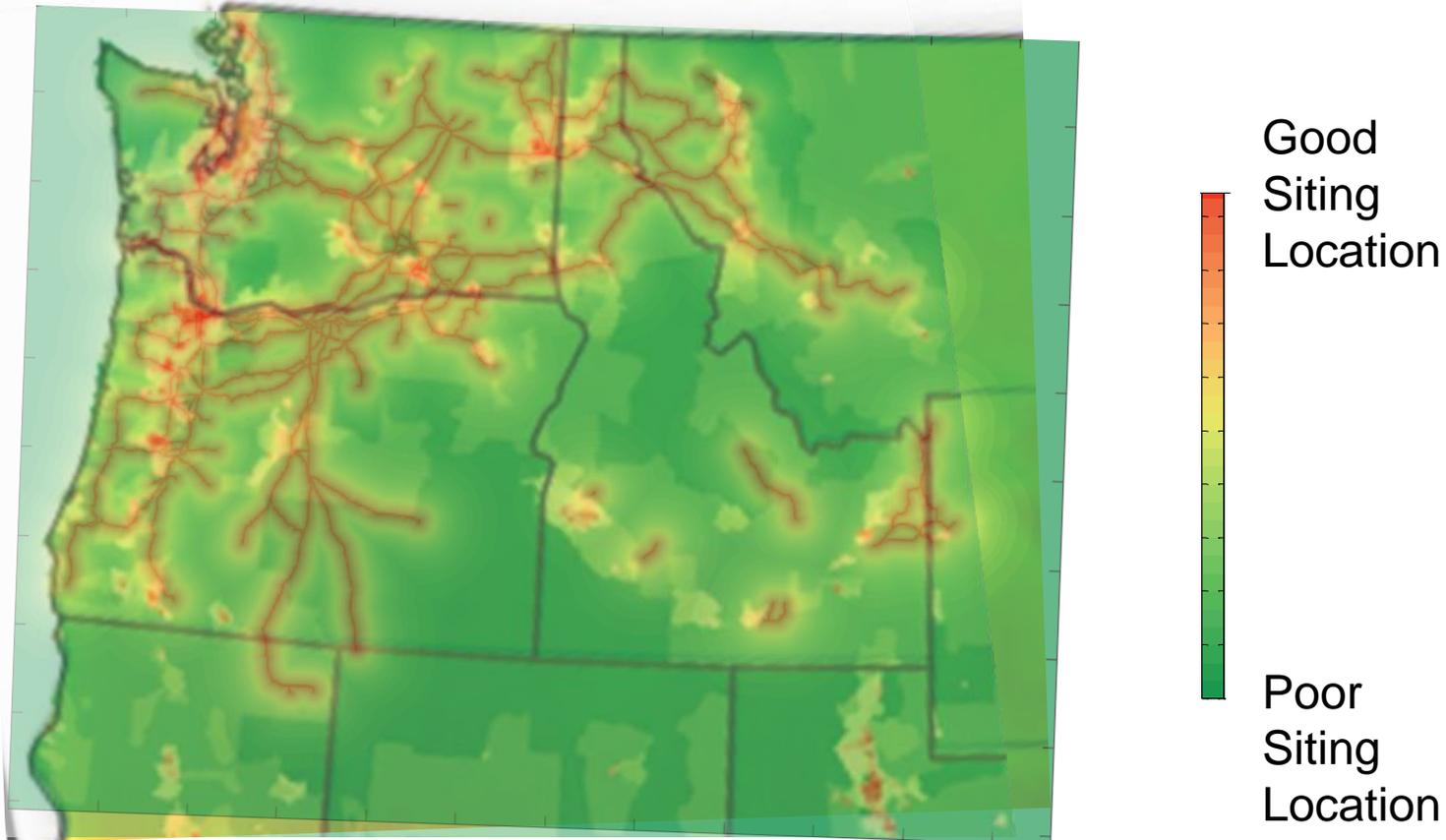
- Proximity to 500 kV transmission lines



Load Centers/Flow Gate Constraints



Goal: Overlay



Note: Currently, literally an overlay for 3 color maps, but future task to create a single, high-resolution color map, produced via Matlab.

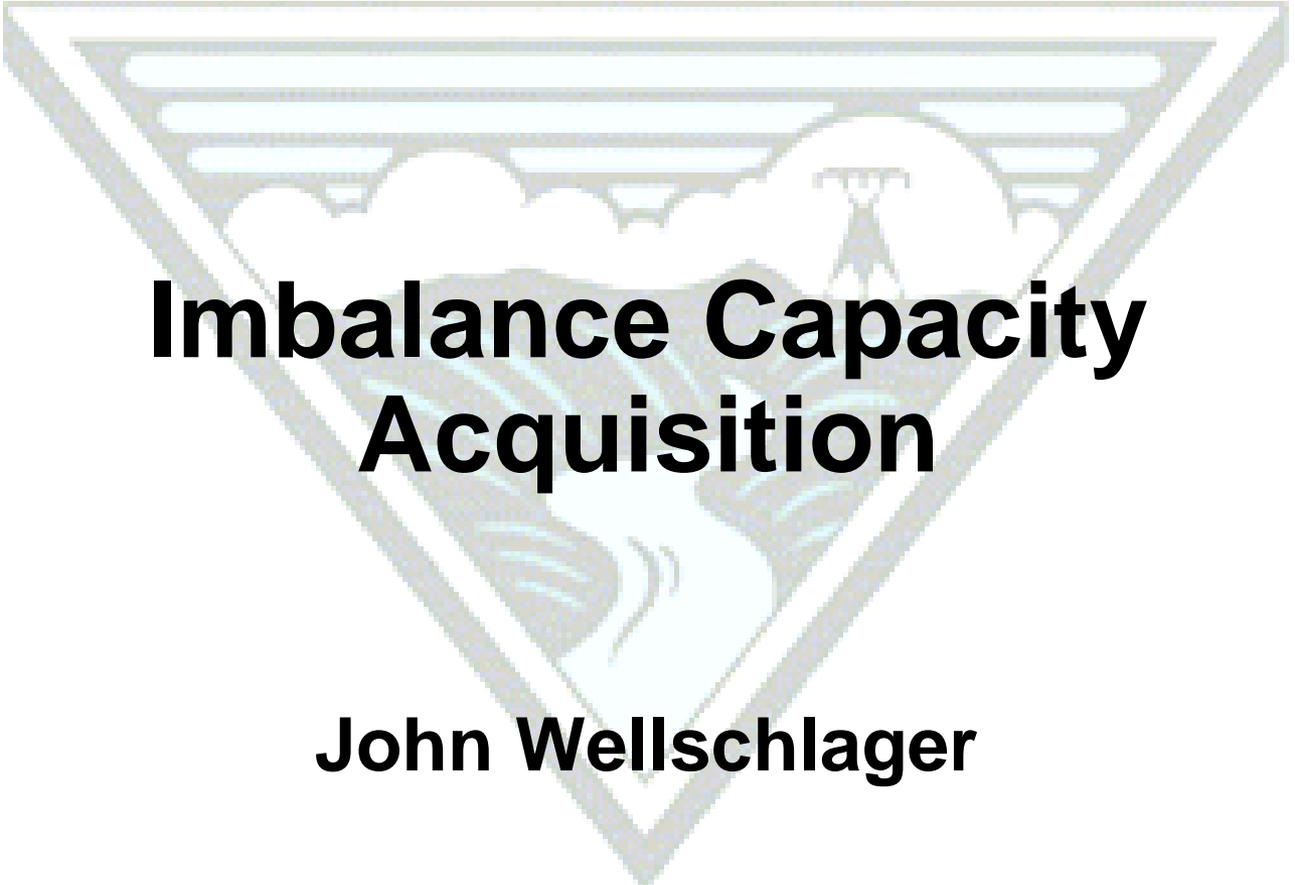


Next Steps

- Short-term focus:
 - Follow requirements and timeline for BP-18
 - Scheduling requirements
 - VERBS rate design
 - Self-supply options
 - Develop definitions useful in solar policy
 - Continued development of a solar heat map
 - Lay policy foundation for BP-20
- Long-term focus:
 - Location and siting for system benefit
 - Use of latest equipment/technology for system benefit
 - Explore solar's fit in the Tiered Rates Methodology
 - Explore the development of Solar Support Products



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Imbalance Capacity Acquisition

John Wellschlager

Objectives for Today's Discussion

- Provide a high-level overview of BPA's quarterly acquisitions of within-hour Imbalance Capacity that started delivery in October 2013.
- Share high-level information on observed market liquidity for these acquisitions.
- Report on existing spring acquisitions to date, and the future acquisition timeline.



Overview of BPA's 3rd Party Acquisition of Imbalance Capacity

- Beginning in July 2013, Request for Offers (RFOs) have been issued on a quarterly basis for the acquisition of Imbalance Capacity (deliveries began on October 1, 2013).
- During the BP-14 rate period the amount purchased ranged from 39 MW up to 54 MW.
- Several “Unplanned” acquisitions were also made during this period with largest being 25 MW.
- Starting in BP-16 the quarterly acquisition was reduced to only 10 MW.
- During the Spring Months 200 MW is targeted.
- Responses to the RFOs over this 2+ year period ranged from a low of 2 offers, with up to 6 offers on multiple occasions, and with the average response being in the 3-4 counterparty range.
- Over this timeframe, offers ranged from a low of \$1.84/kW-mo to a high of over \$14/kW-mo.
- With the exception of two purchases, all winning offers have been within approximately \$0.75/kW-mo of each other.



2015 Spring & Preschedule RFO Acquisitions

- Rough estimates in February 2015 appeared to support the need for a small spring forward purchase to firm up reserve levels to 900 MW of *incs*.
- Recall that part of our strategy was to buy further ahead in time of the projected spring need while suppliers still had capacity available.
- This strategy effectively trades one risk for another. Namely, buying ahead at a cheaper rate but risking not needing what we purchase.
- One 25 MW spring block purchase was made in early March 2015 for the May 1 – June 30 timeframe.
- We received four offers. Pricing ranged from the high side of \$3/kW-mo up to the mid \$14/kW-mo level.
- Due to the low and slow system runoff, the FCRPS (Federal Columbia River Power System) wasn't operationally constrained during the 2015 spring runoff period. This doesn't happen often, but it does happen occasionally.
- As such, no preschedule acquisitions were made in the spring of 2015 due to lack of need.



Future Acquisitions

Quarterly Capacity Acquisitions:

- The amount of quarterly RFOs for the 2016 rate period (Oct. 1, 2015 – Sept. 30, 2017) is planned to be 10 MW each quarter. (See Settlement, Attachment 1, section 4.b) However, the amount we purchase could increase or decrease over this period depending upon mid-rate period elections and FCRPS conditions. Two acquisitions have been made for this period to date.

Long-Term Forward Spring Acquisitions:

- BPA is required to attempt to acquire at least 200 MW of Imbalance Capacity. The purchase period is defined as the months of April, May and June. Minimum bid amounts will be 25 MW flat.
- The RFOs for Spring 2016 acquisitions were scheduled to go out in two time frames. The first went out in early November. We purchased a total of 100 MW from a combined two counterparties. The second RFO will go out around the end of February or early March to solicit offers for 110 MW. This amount includes 10 MW for our required quarterly purchase.
- RFOs for long-term spring acquisitions will only be for April, May and June since the FCRPS has a high probability of supplying most of July.

Preschedule Acquisitions:

- We will continue our Preschedule acquisition program for Spring Months based on short-term projected need. Minimum bid amounts will be 25 MW on either a diurnal or flat basis (HLH, LLH or flat).
- Volume purchased for this timeframe will be based on FCRPS conditions, projected need for the buying period and remaining budget. This could be up to 300 MW assuming we are successful with our preseason acquisition of the 200 MW.



Product Specifics

Capacity Acquisitions	Capacity bid format	Energy bid format	Minimum bid amount	Max deployment	Number deployments/hour	Ramp rate
Quarterly	\$/kW-mo	% of Powerdex Mid-C hrly OR HR & Gas Index*	25 MW flat	Up to 90 min	1 (deployment must be for the full amount)	10 min
Preschedule	\$/kW-day	% of Powerdex Mid-C hrly index	25 MW HLH, LLH or flat	Up to 90 min	1 (deployment for each 25 MW increment)	10 min

* Allowable gas indexes are Stanfield and Malin for the “flow date” as reported by Intercontinental Exchange (ICE) daily indices.

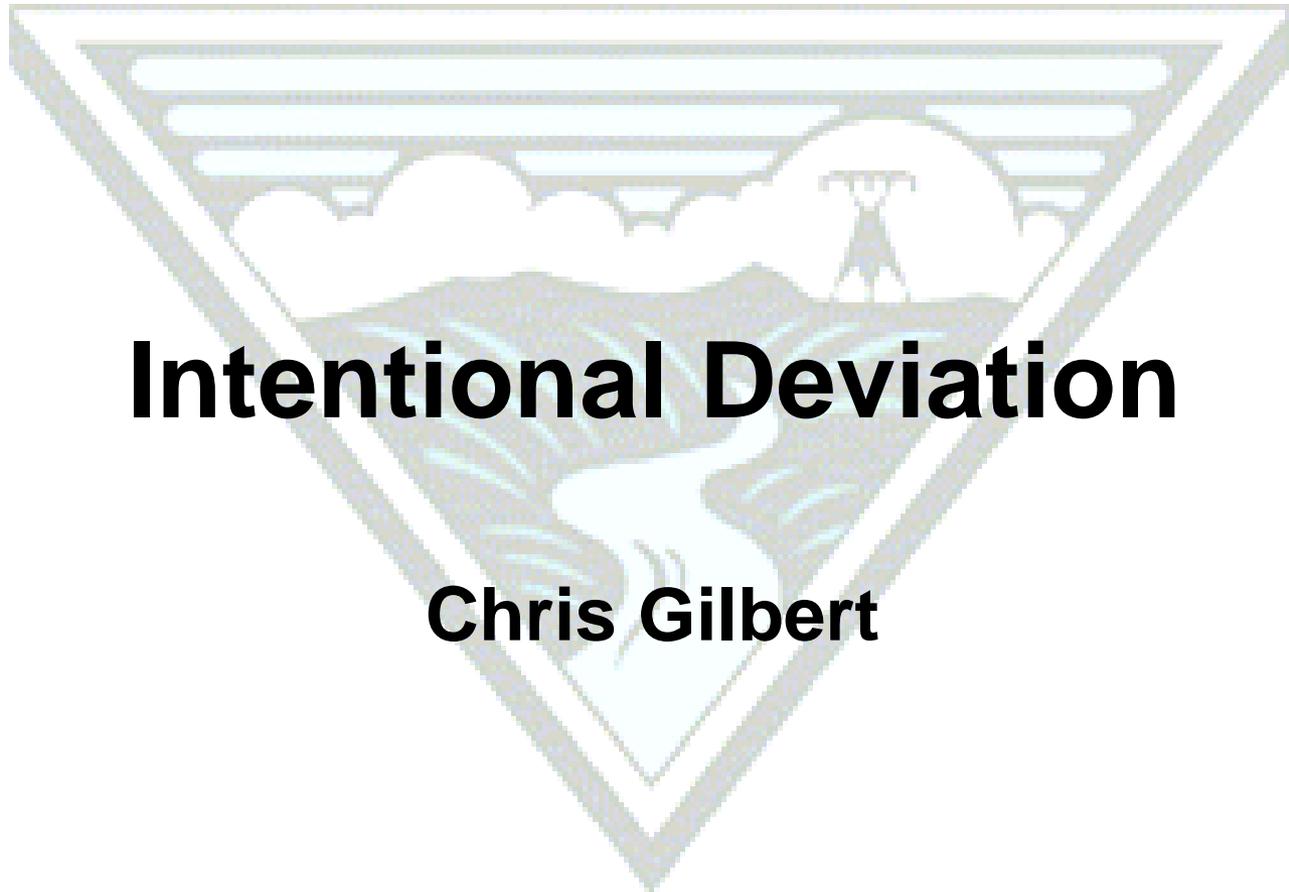


General Observations

- Five different counterparties have won the quarterly RFOs issued over the last two plus years.
- Participation in the quarterly RFO process tends to vary by season, but has generally increased slightly over this time period.
- A total of 10 different counterparties have submitted bids in the last 2+ years.
- The primary impacts on the frequency of resource deployment are the variability of wind and the location of these resources in BPA's resource stack.
- To date, the need to deploy these contract resources has been limited during the fall, winter, and summer periods. Spring period acquisitions tend to be deployed more frequently during most years.
- Deployment of the resources has generally gone well to date.
- As noted before, counterparties new to this product require a much higher level of internal review and approval prior to submitting capacity offers on BPA RFOs. This is a new product for many of them.
- Thermal units have not participated in the process to date unless part of a larger resource base.



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Intentional Deviation

Chris Gilbert

Overview

- Application of the Intentional Deviation (ID) Penalty Charge and the Imbalance Exemption
- Review of Intentional Deviation events
- Sample of charge/savings of 3 MW DEC
- Feathering during Intentional Deviation events

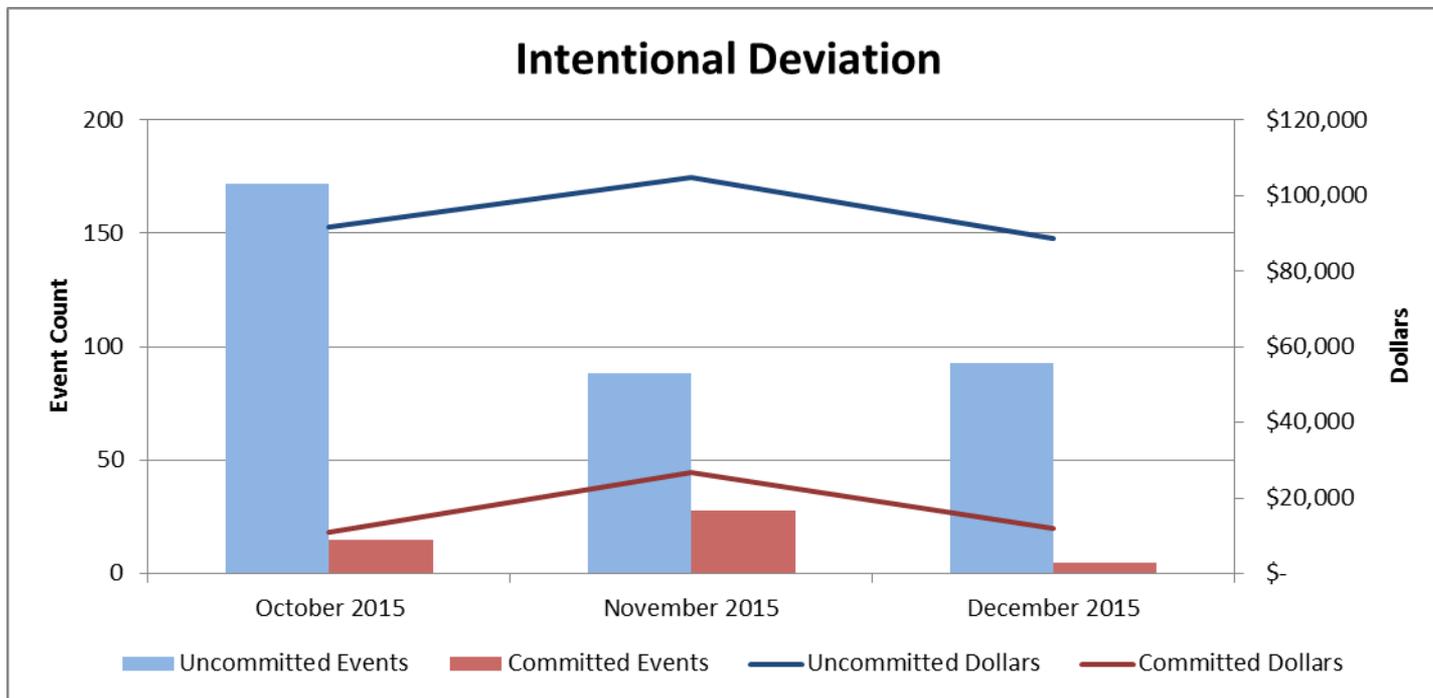


Application of ID

- Step 1
 - Did the resource schedule to the BPA Provided Schedule Value?
 - Yes = No ID penalty charge
 - No = Apply Imbalance Exemption (Step 2)
- Step 2
 - Did the imbalance from the resource's sum of schedules meet or beat the imbalance that would have otherwise occurred had the resource scheduled to the BPA Provided Schedule Value?
 - Yes = No ID Penalty Charge
 - No = ID Penalty Charge



Review of ID Events



	October 2015	November 2015	December 2015
Uncommitted Events	172	88	93
Committed Events	15	28	5
Events Total	187	116	98
	October 2015	November 2015	December 2015
Uncommitted Dollars	\$ 91,475	\$ 104,825	\$ 88,725
Committed Dollars	\$ 11,100	\$ 26,725	\$ 11,850
Dollars Total	\$ 102,575	\$ 131,550	\$ 100,575

Example of Imbalance Exemption

Facts

30/60 Committed Scheduling

Forecast = 120 MW

Scheduled = 60 MW

Actual Generation = 92 MWh

ID Penalty Charge = \$5,900

$$((120 \text{ MW} - 60 \text{ MW}) - 1) * \$100$$

Station Control Error = 32 MW

$$(60 \text{ MW} - 92 \text{ MWh})$$

Assumed Mid-C = \$30/ MWh

Generation Imbalance Credit = \$864

$$(\$30 \text{ MWh} * 90\%) * 32 \text{ MW}$$

Summary

Feathering 3 MW would have...

a) cost this resource \$81 of Generation Imbalance Credit

b) saved this resource \$5,900 of Intentional Deviation Penalty Charges



Feathering During ID Events

Feathering to Prevent ID			
	Oct-15	Nov-15	Dec-15
Periods	87	55	52
MWh	1,196	1,360	1,030
ID Penalty Charge	\$ 58,675.00	\$ 98,825.00	\$ 30,350.00
<i>% of Total ID Penalty Charges</i>	<i>57%</i>	<i>75%</i>	<i>30%</i>
GI Credit (Assumed \$30/MWh)	\$ 32,292.00	\$ 36,720.00	\$ 27,810.00
Cost to Resource	\$ 26,383.00	\$ 62,105.00	\$ 2,540.00

