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OREGON CONVENTION CENTER
PORTLAND, OR, USA

OCEAN RENEWABLE ENERGY CONFERENCE X – OREGON WAVE ENERGY TRUST

SESSION 5C

# EMERGING MARKET CONCERNS

## -- INTEGRATION,
## -- VARIABILITY, and
## -- THE COST OF ENERGY

BPA CUSTOMER SERVICE ENGINEERING & PLANNING - EUGENE OREGON –

JULY 16, 2015 -- JOHN SCHAAD

Owned & Produced by: PennWell
Presented by: Hydro Review
HRW
HydroWorld.com
Media Partners: Renewable Energy World Magazine, RenewableEnergyWorld.com, Power Engineering

# Federal Columbia River Power System (FCRPS)

- BPA markets power from 31 Federal Hydro plants (21 Corps of Engineers-10 Bureau of Reclamation) (6,845 avg. MW; 15,696 sustained peak), the Columbia Generating Station Nuclear Plant, some non-Federal hydro facilities, and several wind projects.
- About 80% of the power BPA sells is hydroelectric.
- BPA accounts for about 30% of the electric power consumed within the region.
- Canada has 15% of Columbia River Basin area, but provides 39% of 132 million acre feet (MAF) average annual flow at The Dalles.

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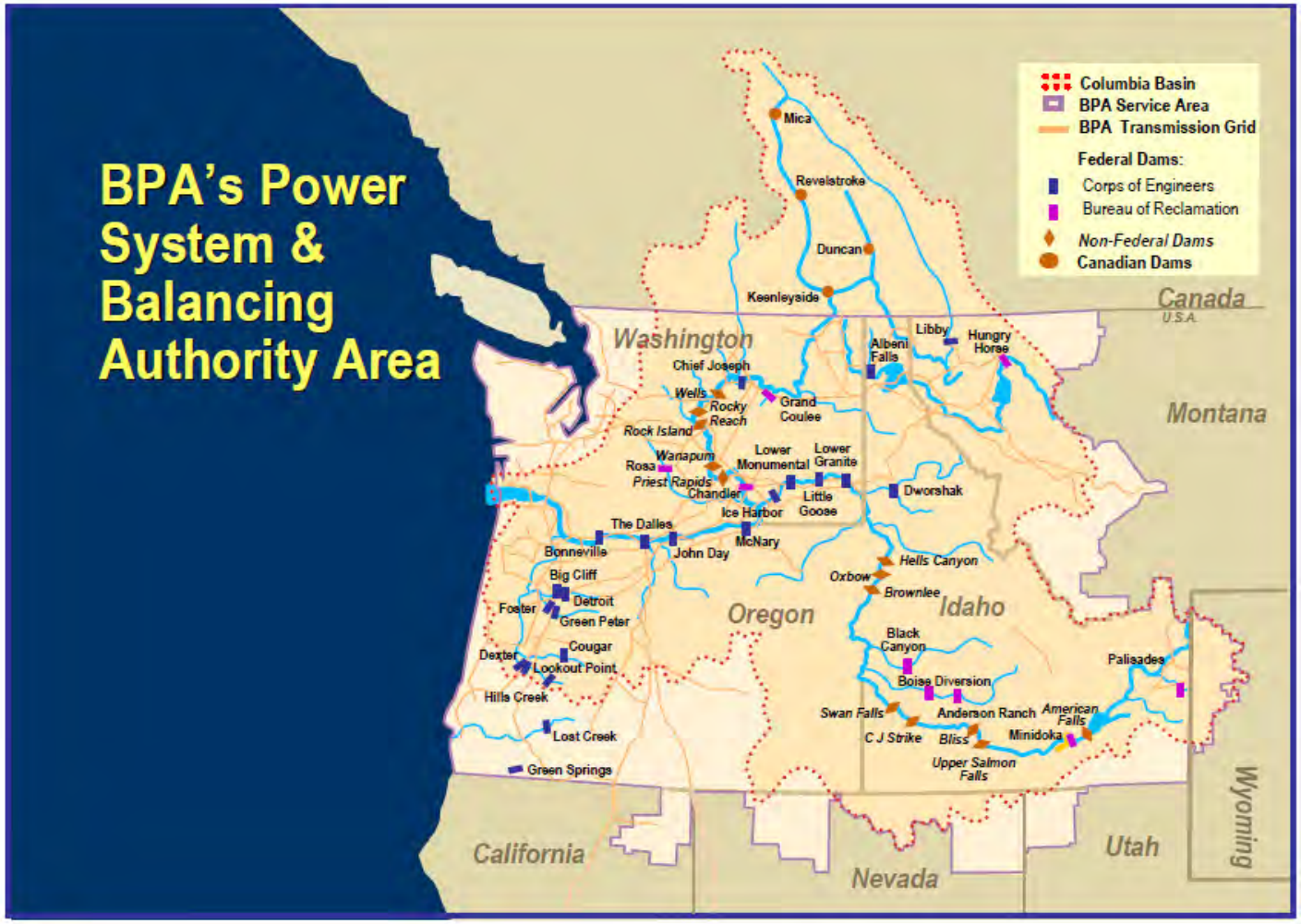
# BPA's Power System & Balancing Authority Area

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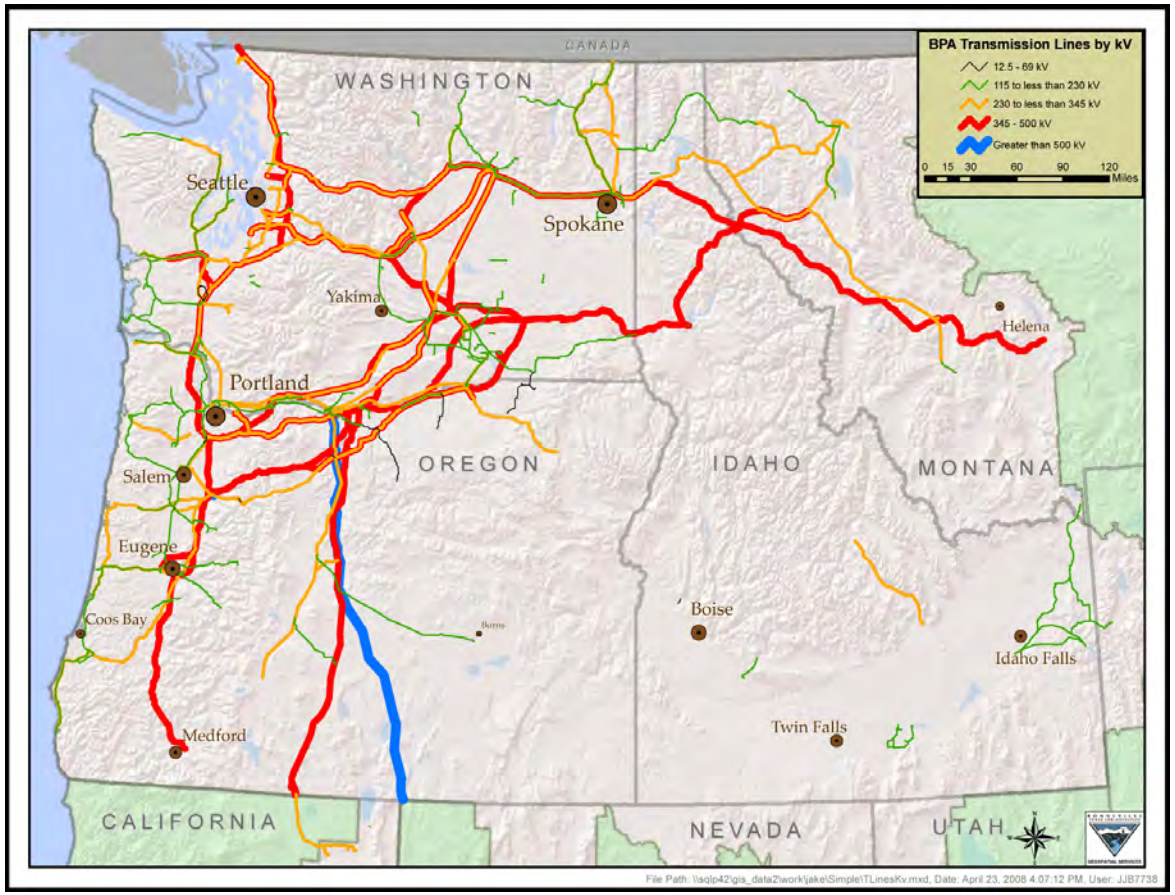
# BPA'S TRANSMISSION SYSTEM MAP

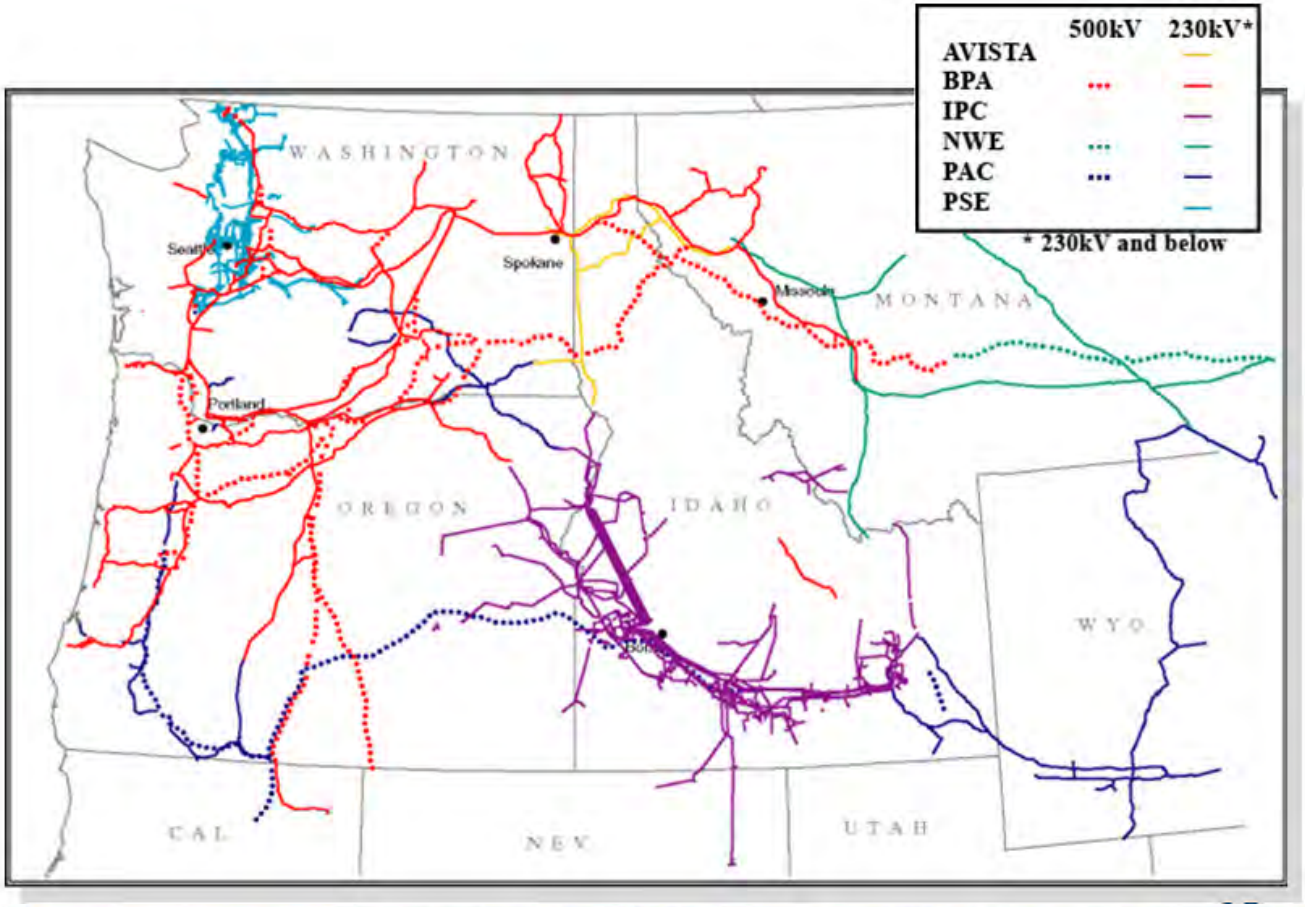



## Transmission System

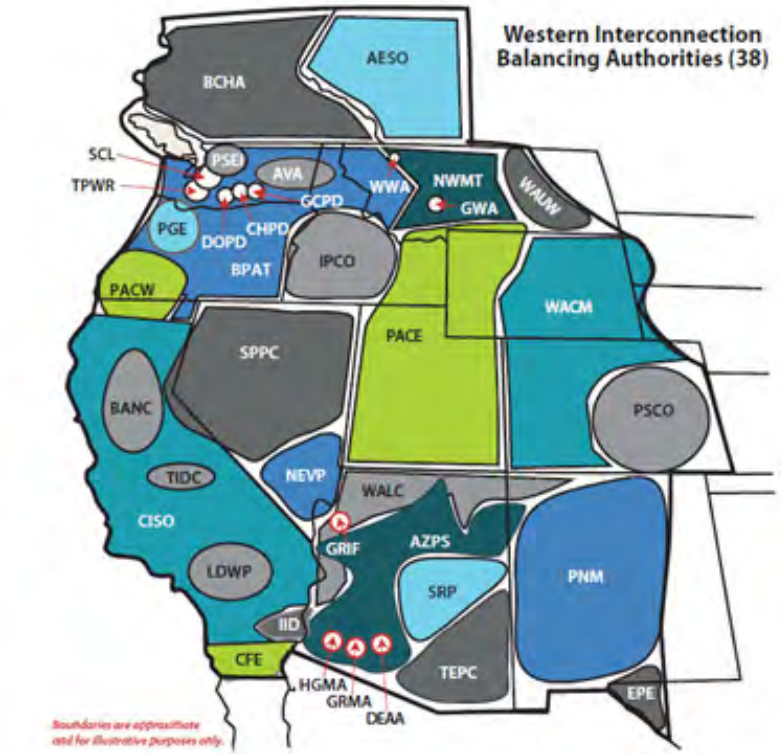
| Operating voltage | Circuit miles |
|---|---|
| 1,000 kV | 264* |
| 500 kV | 4,735 |
| 345 kV | 570 |
| 287 kV | 229 |
| 230 kV | 5,324 |
| 161 kV | 119 |
| 138 kV | 50 |
| 115 kV | 3,556 |
| below 115 kV | 368 |
| Total | 15,215 |

* BPA's portion of the PNW/PSW direct-current intertie. The total length of this line from The Dalles, Ore. to Los Angeles is 846 miles.

# THE COMBINED PACIFIC NORTHWEST TRANSMISSION SYSTEM



# BALANCING AUTHORITY AREAS (BAA's) – 38 IN WESTERN INTERCONNECTION



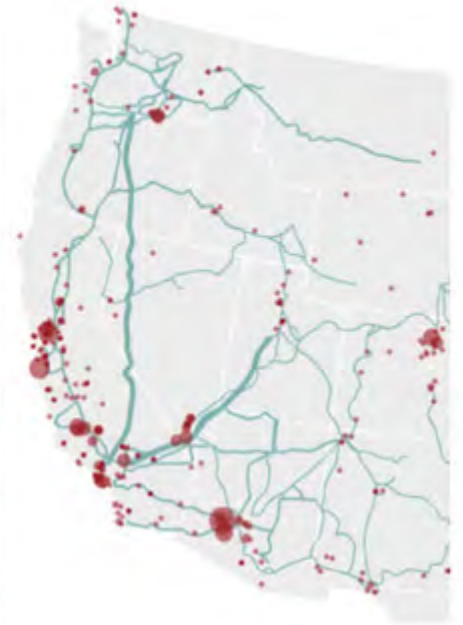
# PREDOMINANT TYPES OF GENERATION

HYDRO

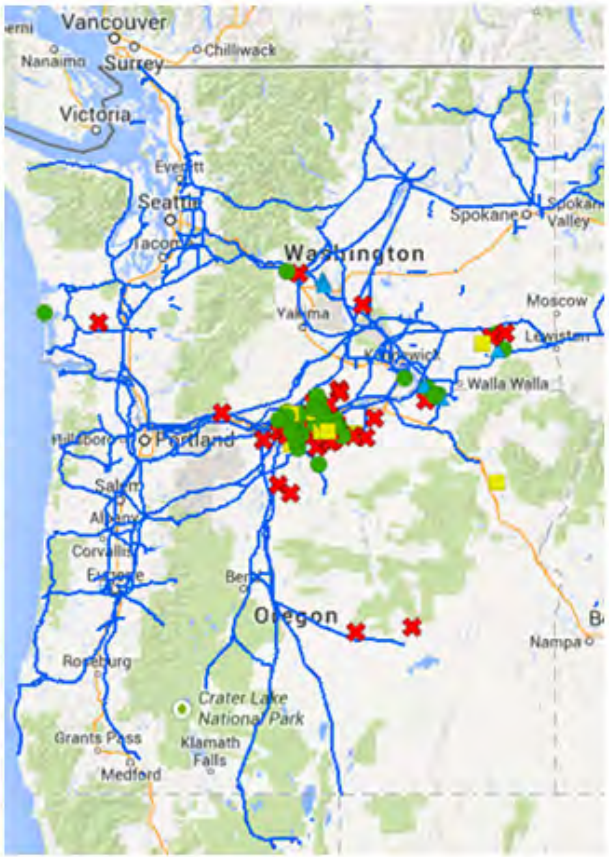
COAL

NUCLEAR

NATURAL GAS

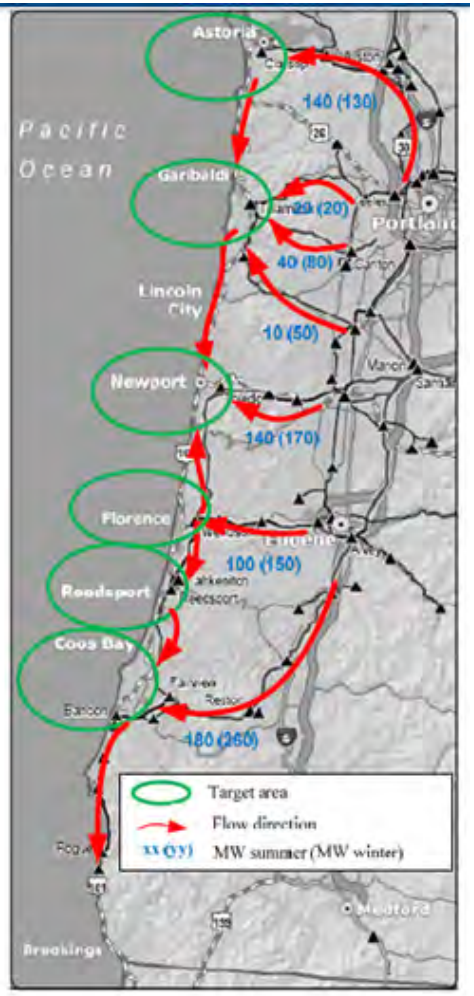


# BPA – EAST/WEST CONSTRAINED TRANSMISSION PATHS & EXSITING GENERATION

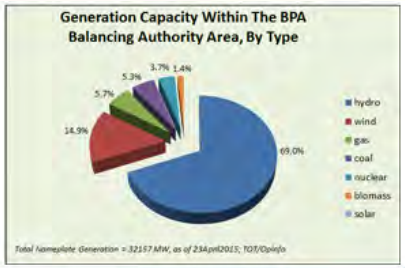



EXISTING GENERATION (2009)

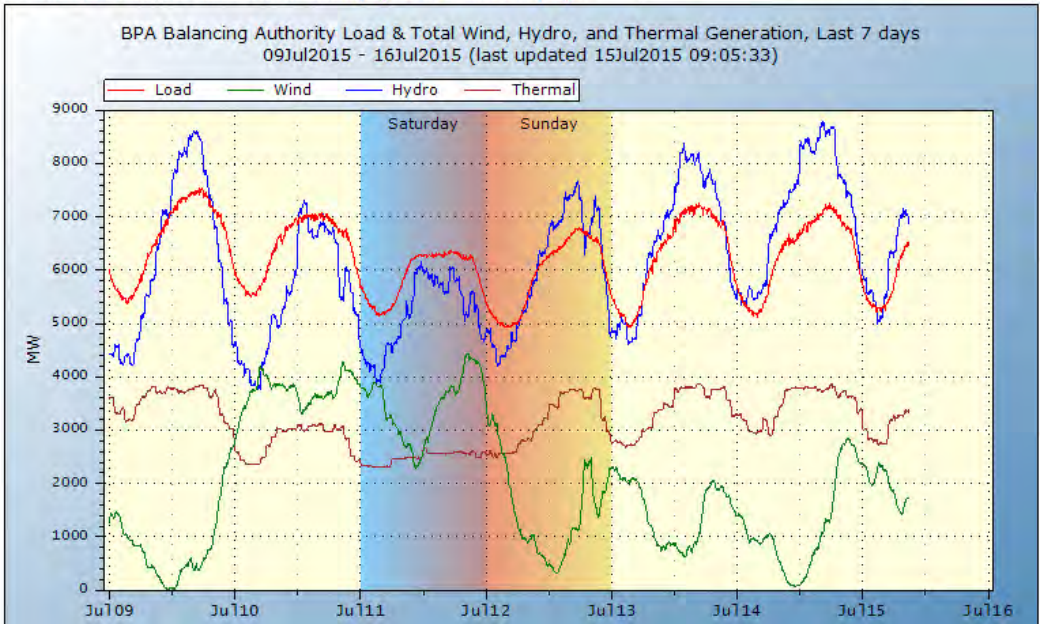
# OREGON COAST – LOADS & POWER FLOWS



**BPA Balancing Authority Load and Total Wind, Hydro, and Thermal Generation, Near-Real-Time**




*Data automatically refreshes every 5 minutes...*
Download data (tab separated values)
For Historical Data, See Item#5 on the Wind page of transmission.bpa.gov




http://transmission.bpa.gov/Business/Operations/Wind/baltwg.aspx
http://transmission.bpa.gov/Business/Operations/Wind/default.aspx

GENERATION INTERCONNECTION
INTERCONNECTION REQUEST

1) FEASIBILITY STUDY
2) SYSTEM IMPACT STUDY
3) FACILITIES STUDY & NEPA STUDY
4) CONSTRUCTION AGREEMENT
5) CONSTRUCTION
6) ENERGIZATION

| SMALL GEN. | LARGE GEN. |
|---|---|
| 0-MW TO 200-KW | ABOVE 20-MW |
| 200-KW TO 1-MW | |
| 1-MW TO 3-MW | |
| 3-MW TO 20-MW | |

GENERATION INTERCONNECTION

GENERATION POWER OUTPUT MARKETING
- AGREEMENTS:

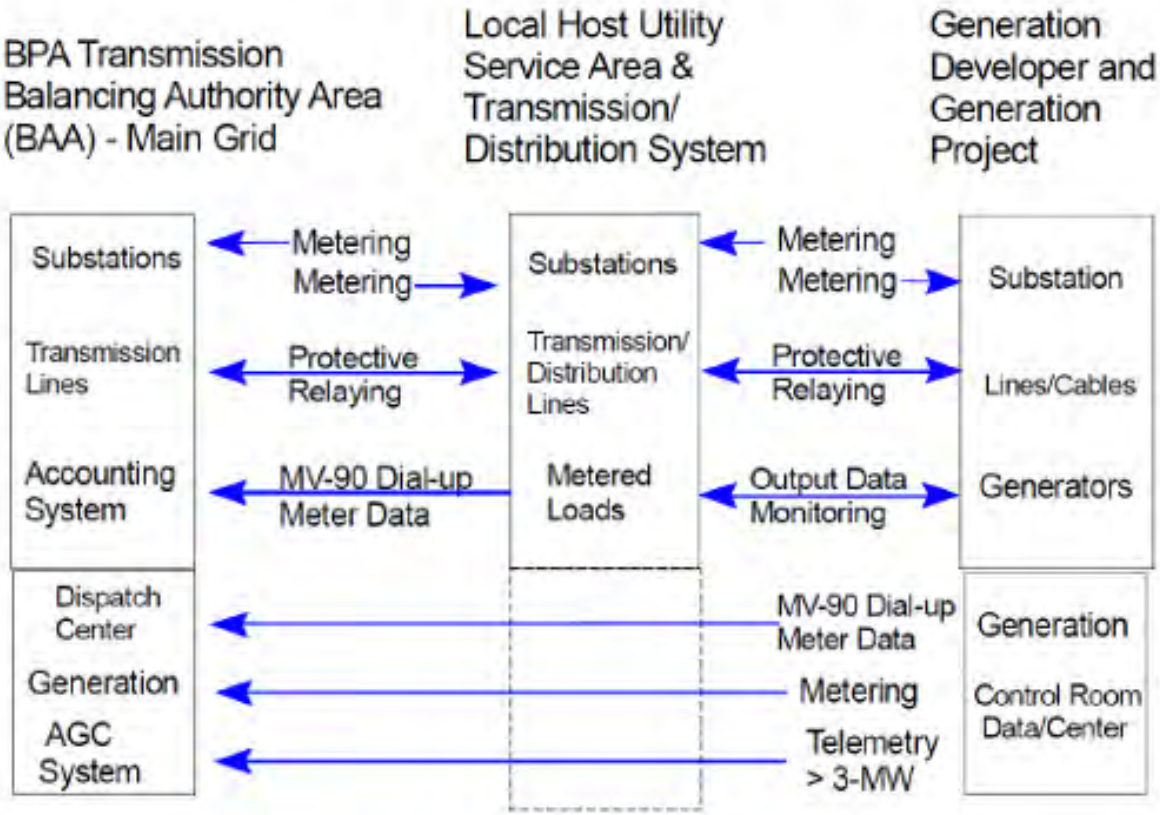
1) POWER PURCHASE AGREEMENT (PPA)
2) TRANSMISSION SERVICES AGREEMENT

3) BALANCING AREA SERVICES AGREEMENT

- Generation Imbalance Service;
- Energy Imbalance Service;
- Operating Reserves - Spinning Reserves;
- Operating reserves - Supplemental Reserves;
- Wind Integration - Within-hour Balancing Service

http://www.bpa.gov/transmission/Doing%20Business/Interconnection/Pages/default.aspx

# Balancing Authority Area - BAA (Control Area)



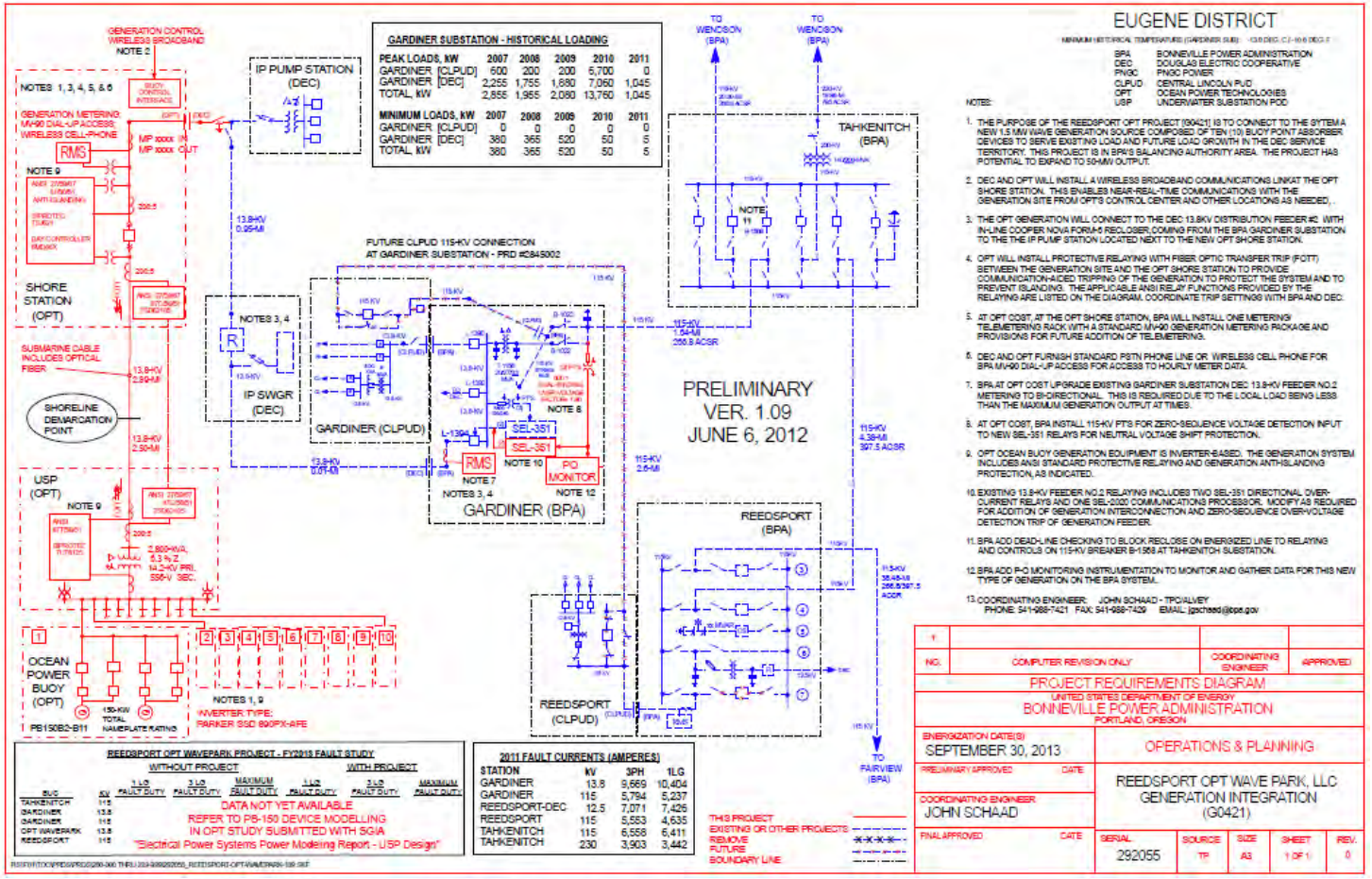
**OPT Reedsport Wave Park; Douglas Electric Cooperative; Bonneville Power Administration Transmission (BPAT)**

EXAMPLE-1
OPT-REEDSPORT
WAVE PARK
PHASE-1

SGIA – 1.5-MW
STUDIES
COMPLETED:

- FEASIBILITY
- SYSTEM IMPACT
- FACILITIES

**PB150- "150-kW"**
**Tested: 840-kW**

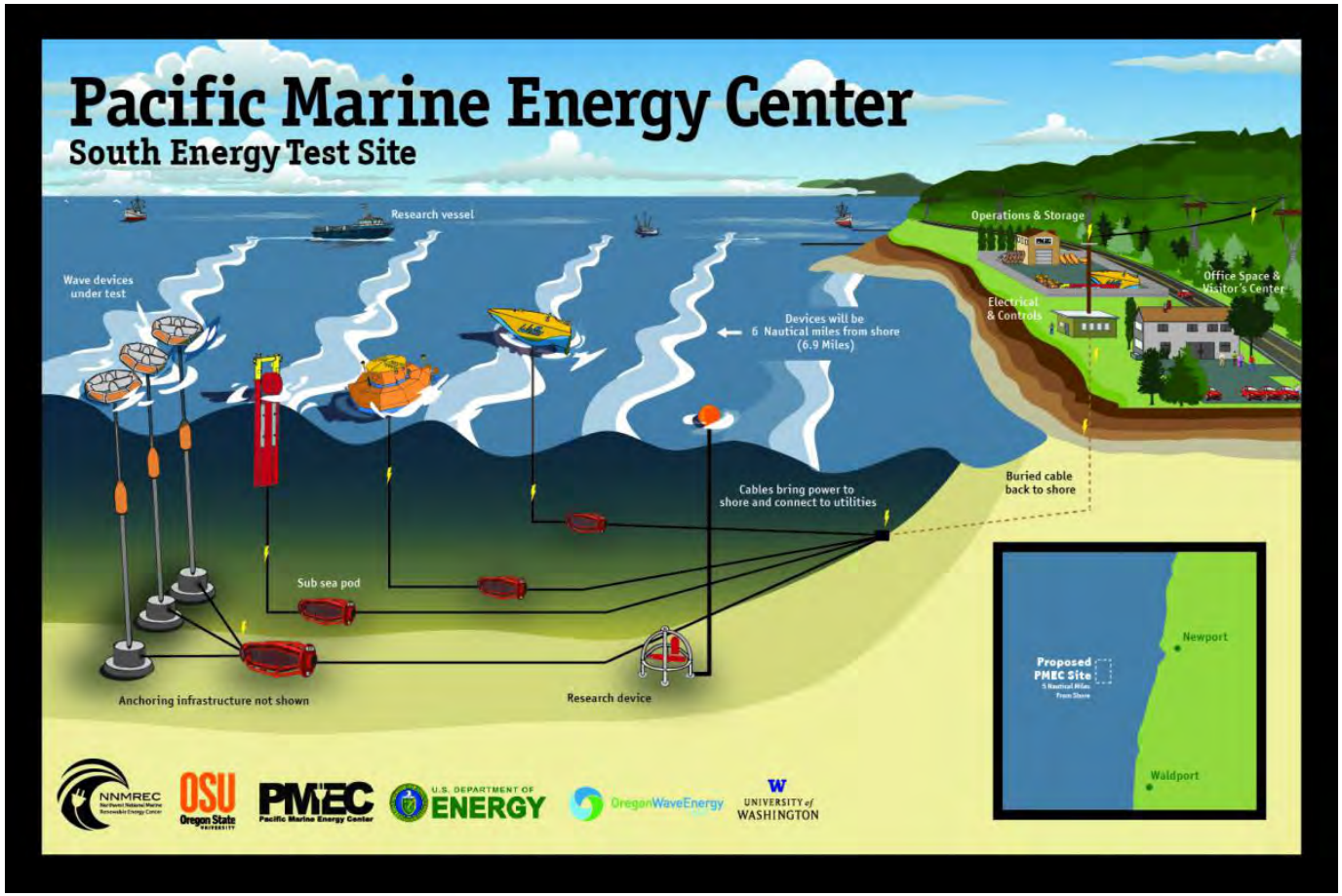


Pacific Marine Energy Center (PMEC-SETS); Central Lincoln People's Utility District (CLPUD); Bonneville Power Admin. (BPAT)

EXAMPLE-2:
OSU-PMEC-SETS
GRID-
CONNECTED
TEST SITE

SGIA – 20-MW
STUDIES
COMPLETED:

- FEASIBILITY
- SYSTEM IMPACT
--



## OPPORTUNITY – and – CHALLENGE FOR ALL FORMS OF MARINE RENEWABLE ENERGY:

**-- IN THE EVENT OF , AND PREPARATION FOR A CASCADIA SUBDUCTION ZONE EARTHQUAKE,**

-- HOW COULD OFF-SHORE MARINE RENEWABLE ENERGY BE DEVELOPED SO AS TO CONTRIBUTE TO FASTER RECOVERY ?
-- ESPECIALLY FOR THE OREGON COASTAL AREA……..?

**BPA - CASCADIA SUBDUCTION ZONE PREPAREDNESS SUMMIT – FEB. 2015**

http://www.westernenergy.org/ics/bpa_earthquake_summit.html

http://www.katu.com/news/local/New-Yorker-article-brings-up-talks-of-the-next-big-one-for-the-Northwest-megathrust-earthquake-along-Cascadia-subduction-zone-315003491.html

http://www.newyorker.com/magazine/2015/07/20/the-really-big-one

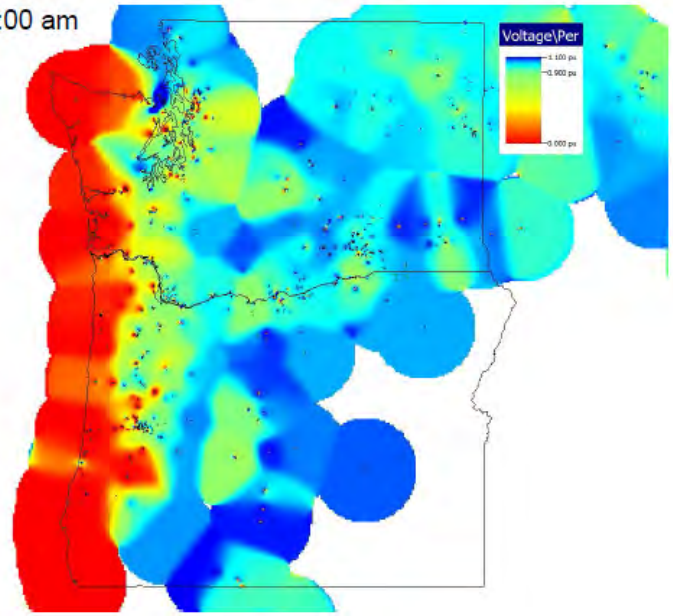
# GRID IMPACTS

Cascadia Subduction Zone Preparedness Summit 2015

James Wong

## Voltage/Outage Maps

-June12, 2014 @ 3:00 am
-Damage modeled
-Light loads



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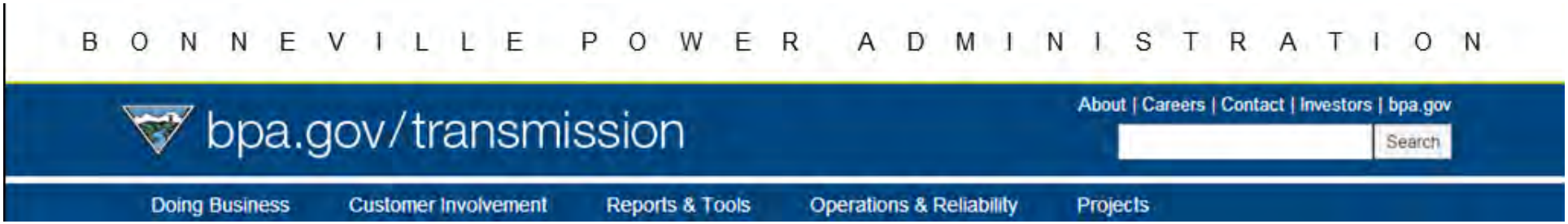


http://www.bpa.gov/transmission/Pages/default.aspx

**YOUR FEEDBACK AND QUESTIONS ARE WELCOME!**

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Customer Service Engineering & Planning
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