Northwest **Power** and **Conservation** Council

October 2, 2018

MEMORANDUM

TO: **Council Members**

FROM: **Gillian Charles, Elizabeth Osborne**

SUBJECT: **Presentation by Snohomish PUD on New Small Hydro Projects**

BACKGROUND:

Presenter: Scott Spahr, Snohomish PUD, Manager – General Engineering
Anna Berg, Snohomish PUD, Senior Manager Power Supply

Summary: Snohomish PUD recently completed development of two small, run-of-river hydroelectric projects in Washington – Calligan Creek (6 MW) and Hancock Creek (6 MW). The projects began commercial operation in March 2018. Scott Spahr and Anna Berg will discuss the development and operation of the projects, and how they fit into Snohomish PUD's resource portfolio.

Some Council members and staff will be touring the projects on October 8.

Workplan: Power division work plan. A.4. Track emerging technologies and development trends related to generating resources and utility scale storage.

More Info: For more information on Calligan Creek and Hancock Creek, see
https://www.snopud.com/PowerSupply/hydro/cchp.ashx?p=3316
https://www.snopud.com/PowerSupply/hydro/hchp.ashx?p=3315

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Snohomish PUD: New Hydro Resources and Future Power Supply

SCOTT SPAHR, P.E.
MANAGER GENERATION ENGINEERING

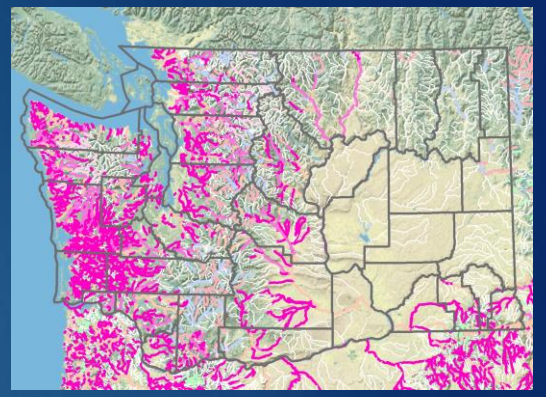
ANNA BERG,
SENIOR MANAGER POWER SUPPLY

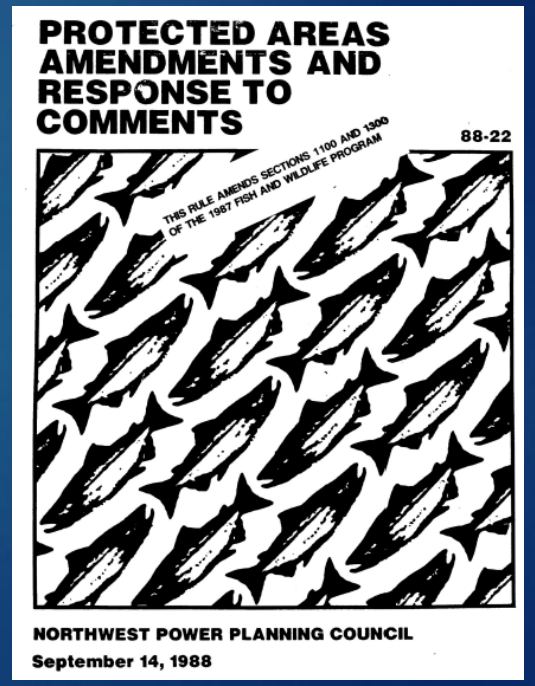
Overview

- PUD's Evaluation of Potential New Hydro Sites
- Calligan Creek and Hancock Creek
  - History, Layout, Licensing, Mitigation
  - Development and Construction
  - Operating Characteristics
- Future Demands, MicroGrid, Transportation Electrification

Low Impact Hydro Assessment

- Identified 145 sites in 4-county area
- Review criteria:
  - Upstream of or at a natural barrier to anadromous fish
  - Outside Federal Wilderness & Federal Wild and Scenic River designations
  - Near existing transmission
- Outreach: 2008-2010 with Federal and State agencies, tribes and NGOs
- Started FERC licensing processes

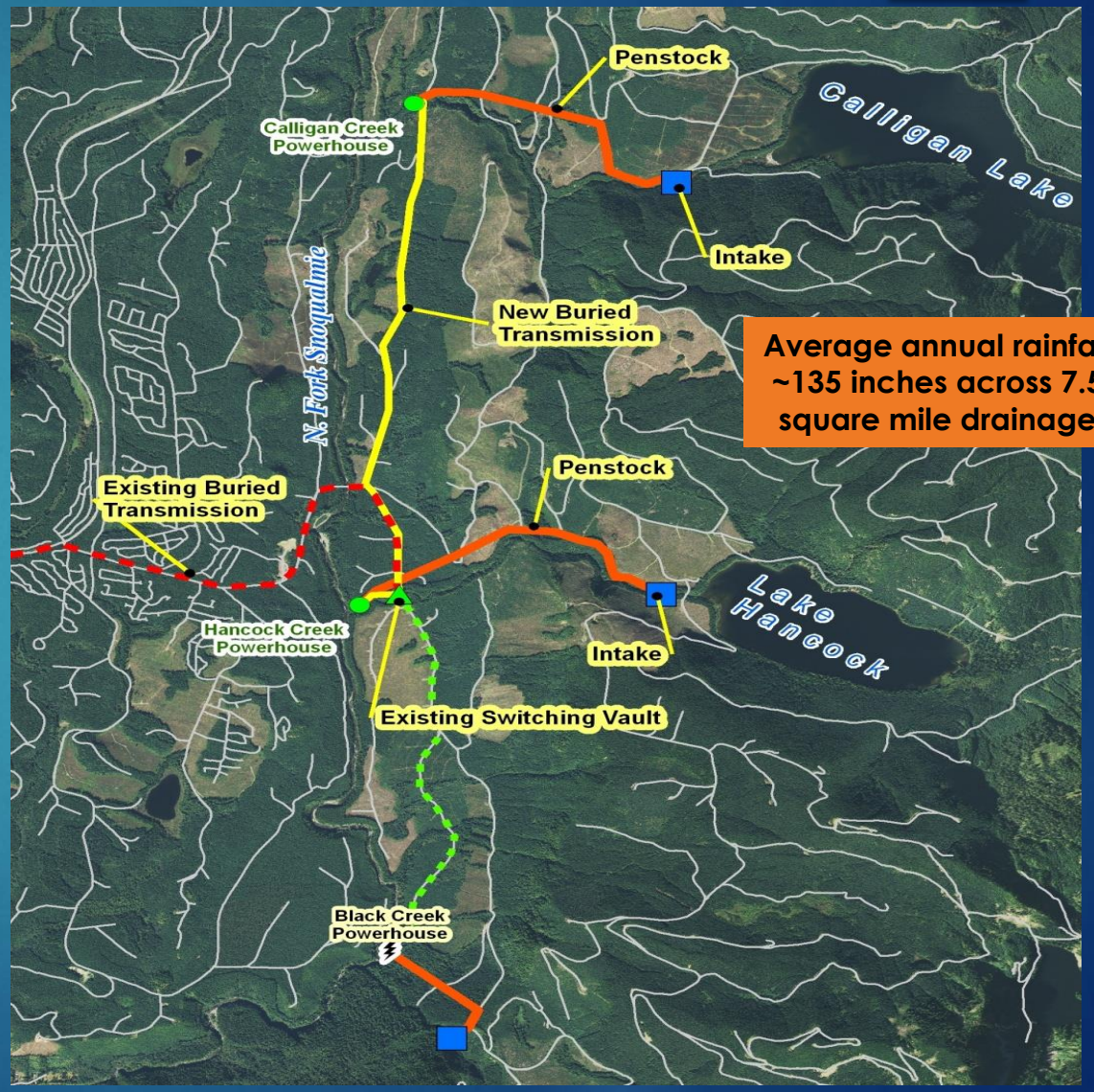




Hancock and Calligan History & Layout

Licensing Background:

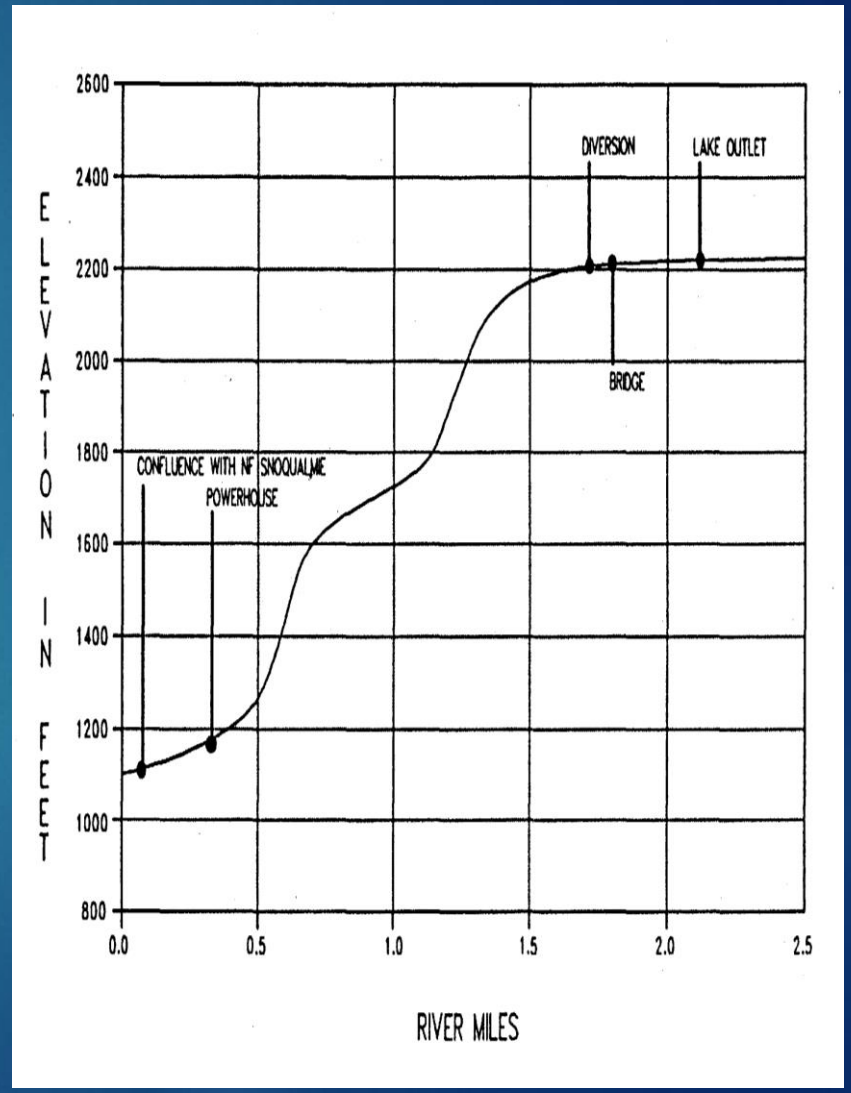
- Previously licensed to Weyerhaeuser in 1993 (Black Creek Hydro built)
- FERC terminated licenses in 2004 for failure to construct
- Following due diligence, assets purchased by District in 2010
- Preliminary permits issued by FERC in 2011
- Final License Applications submitted August 1, 2013
- FERC issued 50 year licenses in June 2015



Average annual rainfall ~135 inches across 7.5 square mile drainage

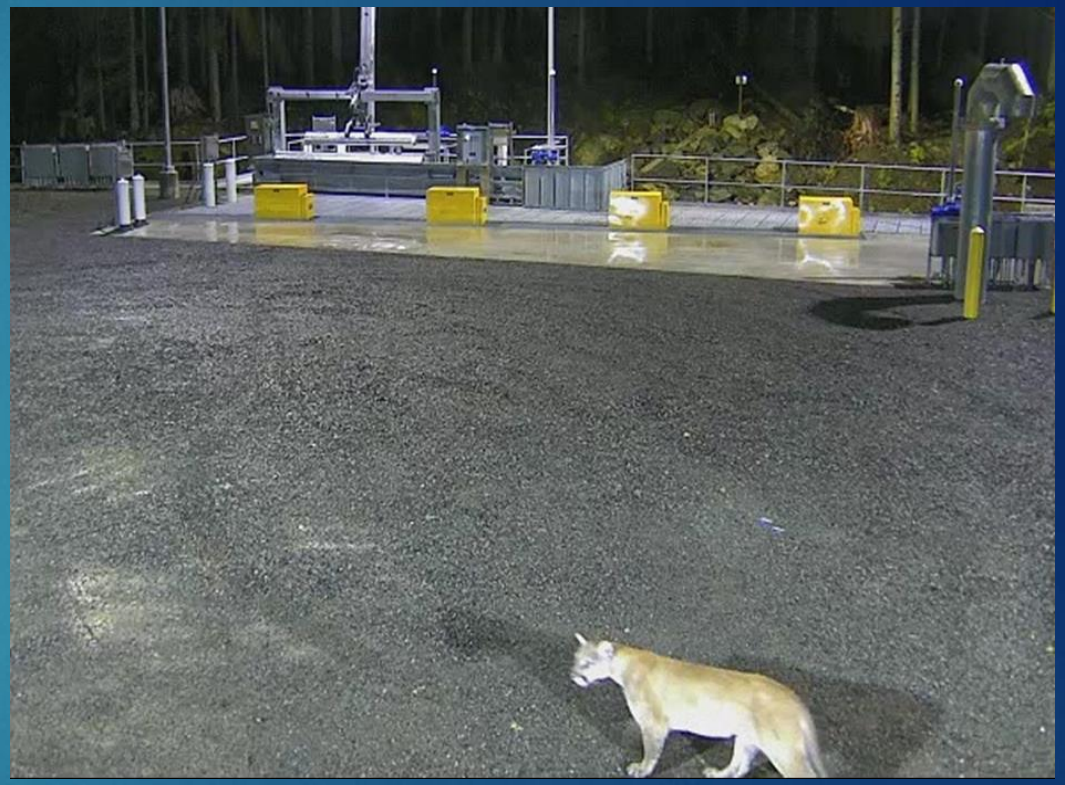
Fisheries

- Annual snorkel surveys indicate low population densities of rainbow trout (0-21 Calligan; 16 – 128 Hancock)
- Rainbow trout stocked in lakes 1930s-1990s
- Distance between intake and clearly impassable barriers on Hancock Creek is 762 feet; Calligan Creek is 1,351 feet
  - By agreement with WDFW the pool & weir ladder operates as fish passage at both intakes; fish exclusion screens and tailrace barriers are included
- Trout monitoring
- Minimum instream flows
- Downramping
- Sediment flushing

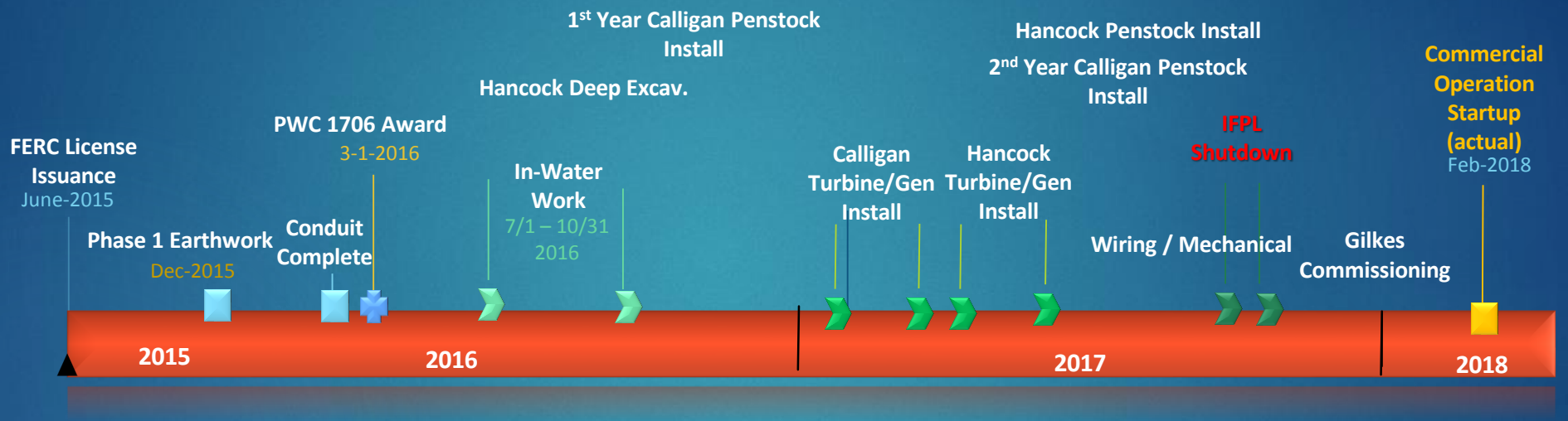


Other PM&Es

- Rerouted penstock and moved powerhouse to avoid wetlands
- Buried transmission lines and penstock for wildlife movement
- Expanded buffers around wetlands and creeks
- Revegetated disturbed soils
- Ongoing noxious weed management
- Recreational access to penstock corridor
- Unanticipated discovery plan for cultural resources
- Water quality monitoring
- Permanent preservation of 6.6 acres



Construction Timeline



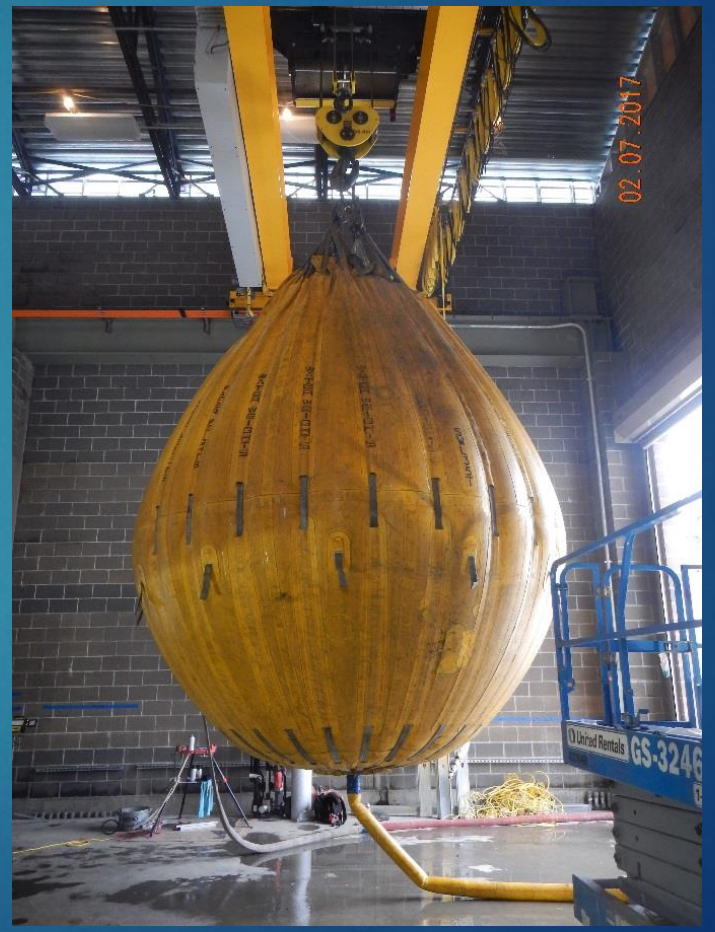
- Both intakes built in summer 2016
- Calligan powerhouse preceded Hancock with staggered crews
- Hancock deep excavation in 2016, majority of penstock in 2017
- Startup in February 2018

Calligan Powerhouse Construction

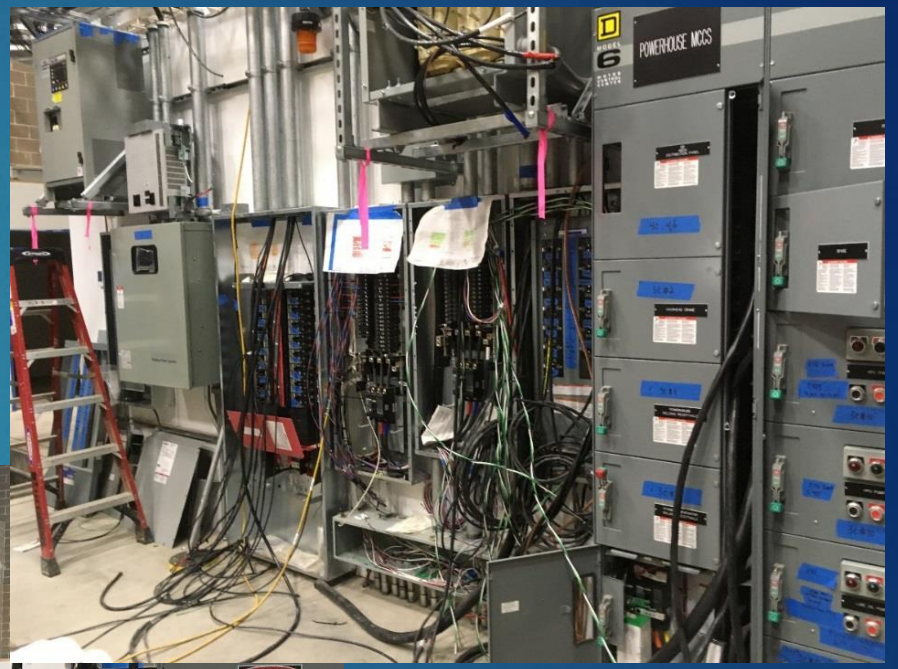
Start: May 2016

25% Complete: September 2016

Calligan Powerhouse Construction 50% Complete: January 2017



Calligan Powerhouse Construction 75% Complete: March-June, 2017



Calligan Powerhouse Construction Completed: September 2017

Calligan Intake – Start July 1, 2016

Calligan Intake
Instream work completed: Oct 2016

Mechanical Systems Spring - Fall 2017

Intake Completed: Dec 2017

HDPE Penstock
Fused and dragged into place

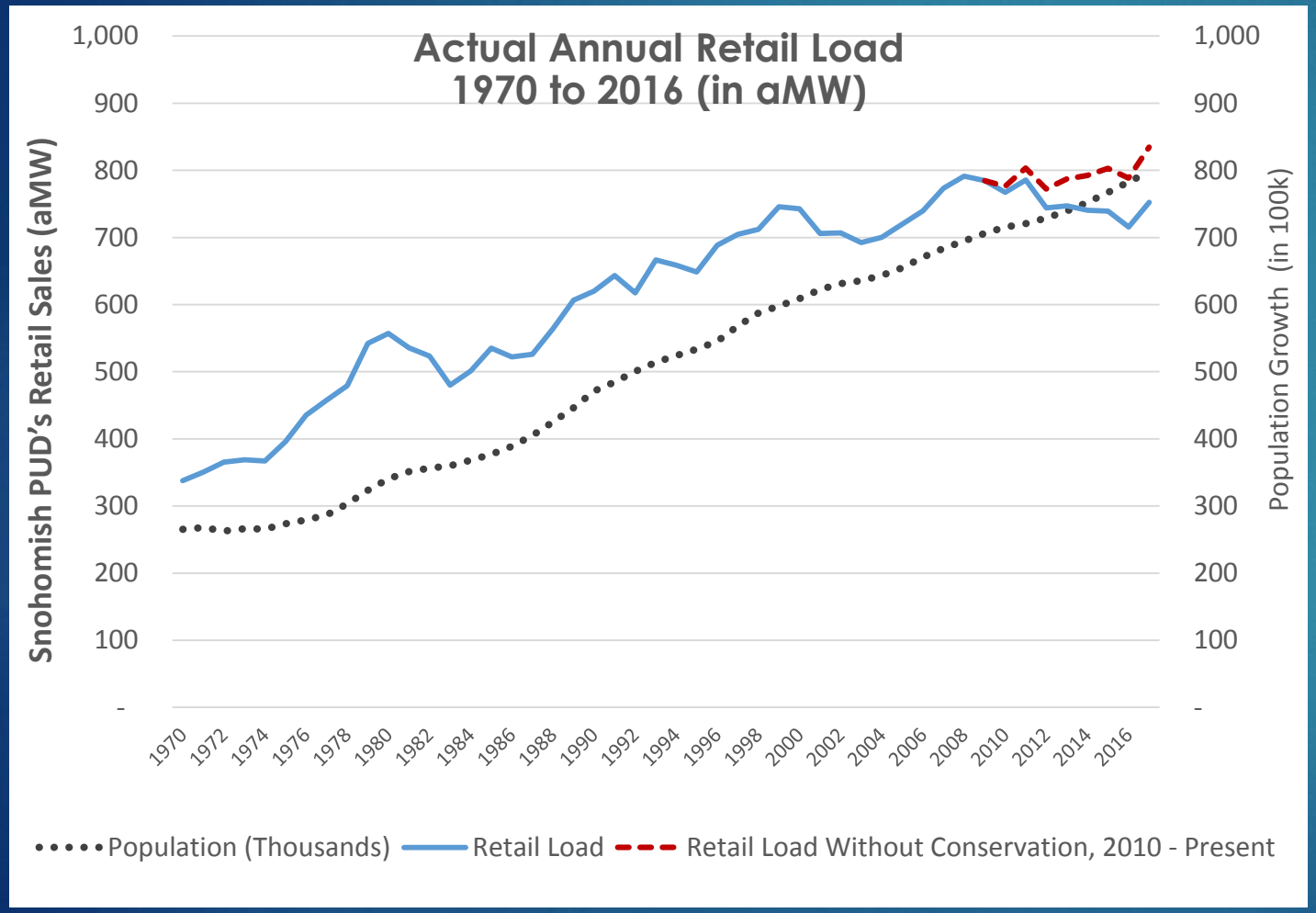
Steel pipe on steep slopes

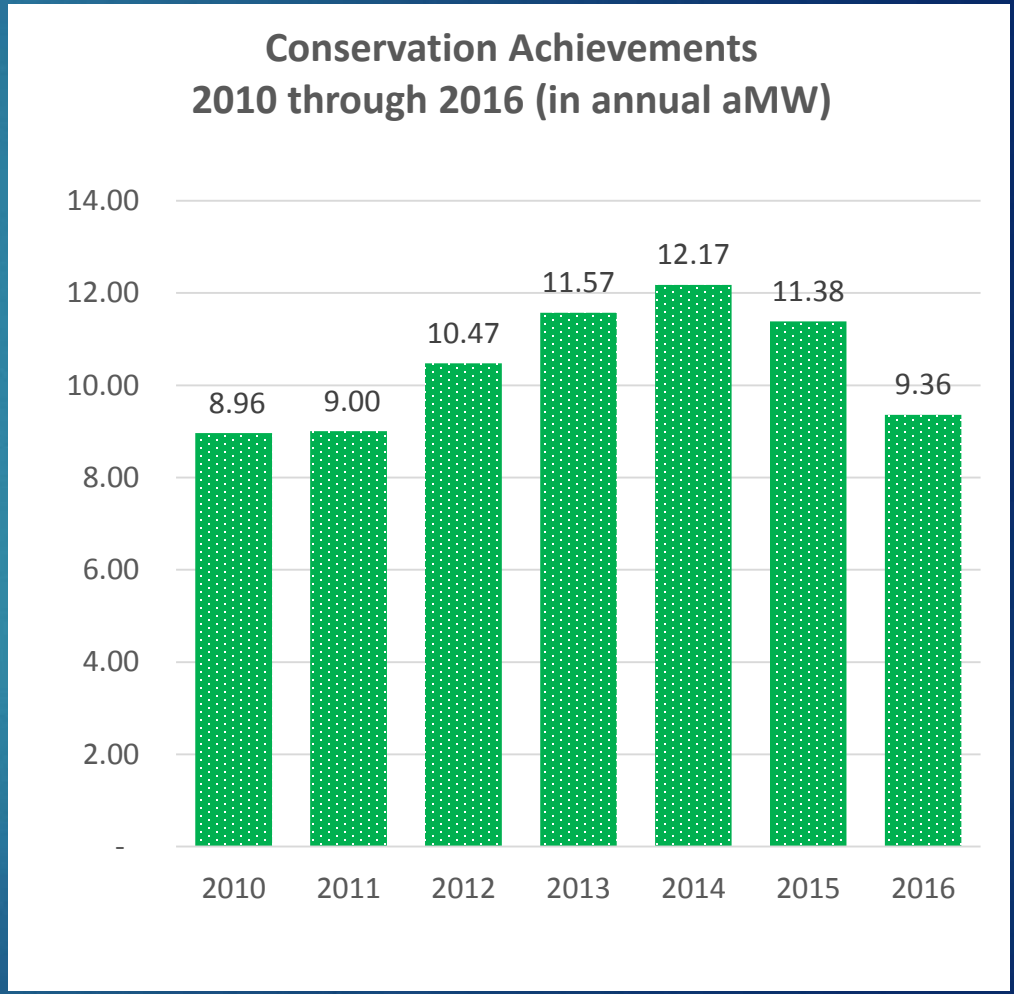
Facts and Figures

- Hancock Creek, Calligan Creek, and Youngs Creek are first new run-of-river hydroelectric projects built in Washington state in last 20 years.
- Operate ~9 months per year (typically shutdown July-Sep due to low flows)
- 680 calendar days construction
- 14,100 feet of pipe installed
- 4,460 cubic yards of concrete poured
- 280,000 cubic yards of earth moved
- 56 PUD employees charged 5,500 hours to project
- Calligan Creek production ~ 20.7 GWh average annually
- Hancock Creek production ~22.1 GWh average annually
- $60M cost, LCOE $77 to 88/MWh*

*Depending on contingencies, term & discount rate

Snohomish PUD's Historical Growth





2017 IRP Analysis
Summary of Portfolio Additions by Scenario

Scenario	20 year New Cumulative Conservation Annual aMW	Short Term Capacity Contract Dec HLH aMW	Long Term Capacity Resource Dec HLH aMW	Renewables Annual aMW	RECs Annual aMW
BAU with No Carbon	92	25	232	0	78
Climate Change w/Low Carbon	**114**	**50**	**116**	**3**	**68**
Low Growth w/Low Carbon	121	25	0	0	68
BAU with CA Carbon 2022	152	0	97	1	72
High Growth w/Mid-High Carbon	152	0	396	68	22

New conservation is single largest resource addition for every portfolio.

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Supplemental Slide

Arlington Microgrid

Components

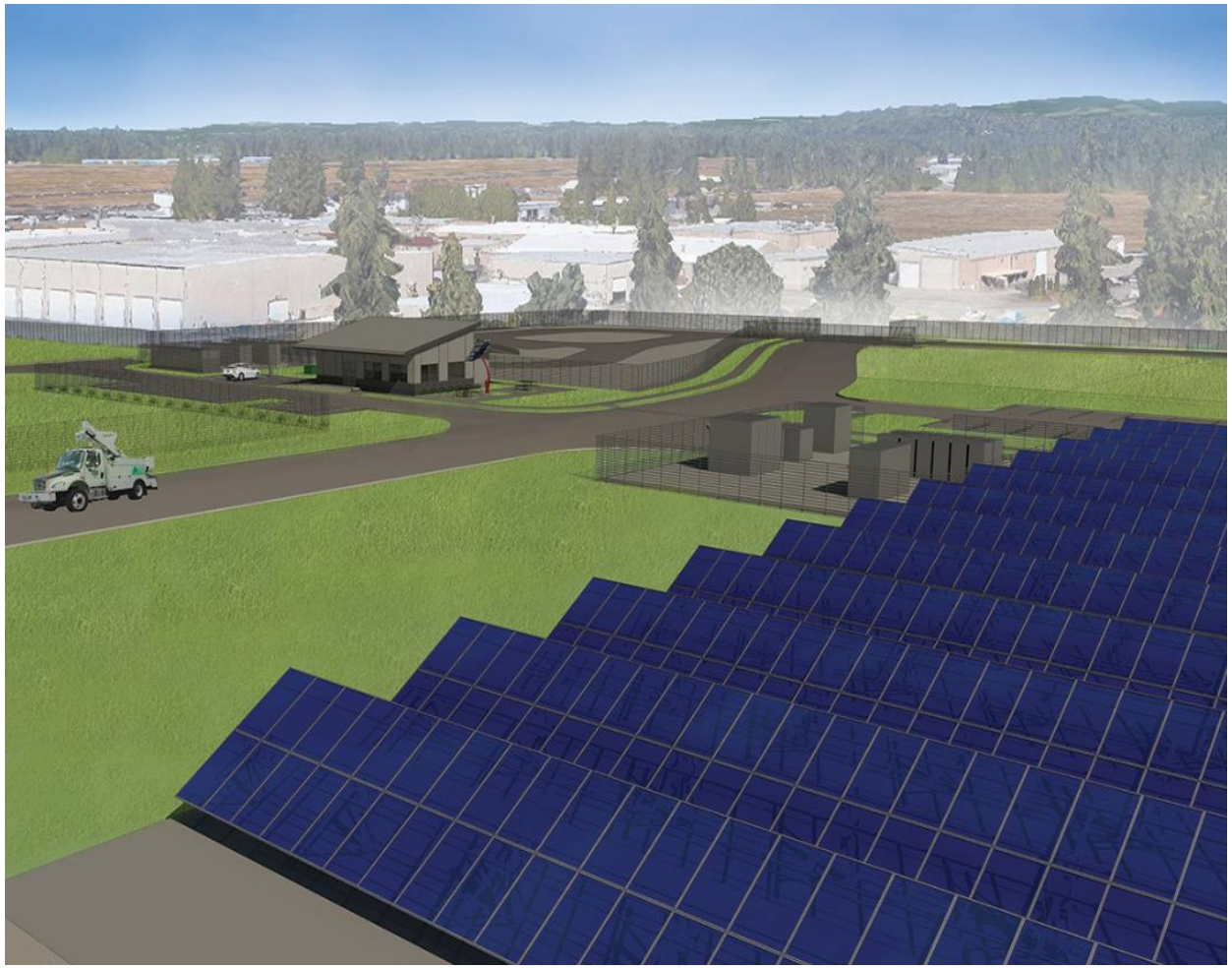
Battery Energy Storage System
1 MW/1MWh

Utility Scale Solar Array
500 kW with SMART Inverters

Vehicle-to-Grid System (V2G)

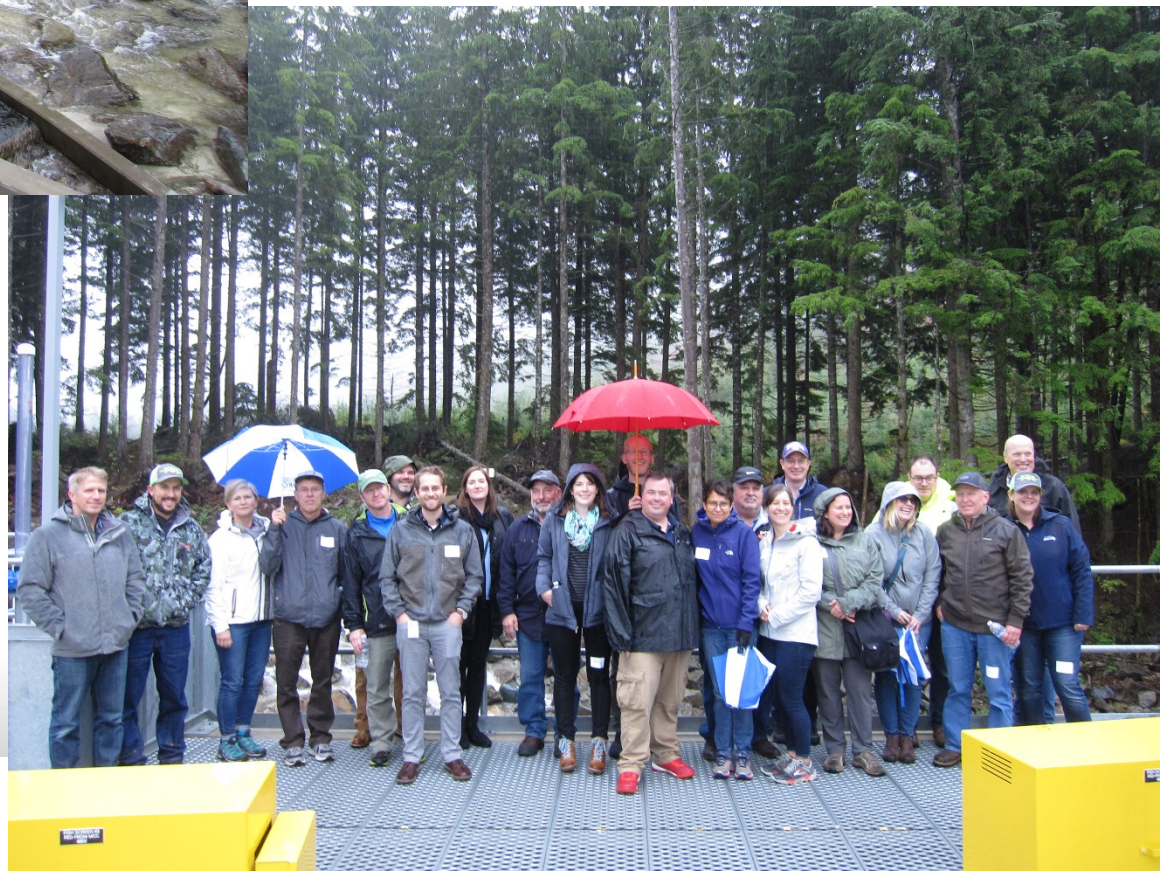
Microgrid Control System and Building Energy Management System

Snohomish PUD Clean Energy Technology Center



Tour of Calligan Creek and Hancock Creek hydro projects, 10/8/18

Thank you Snohomish PUD!



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