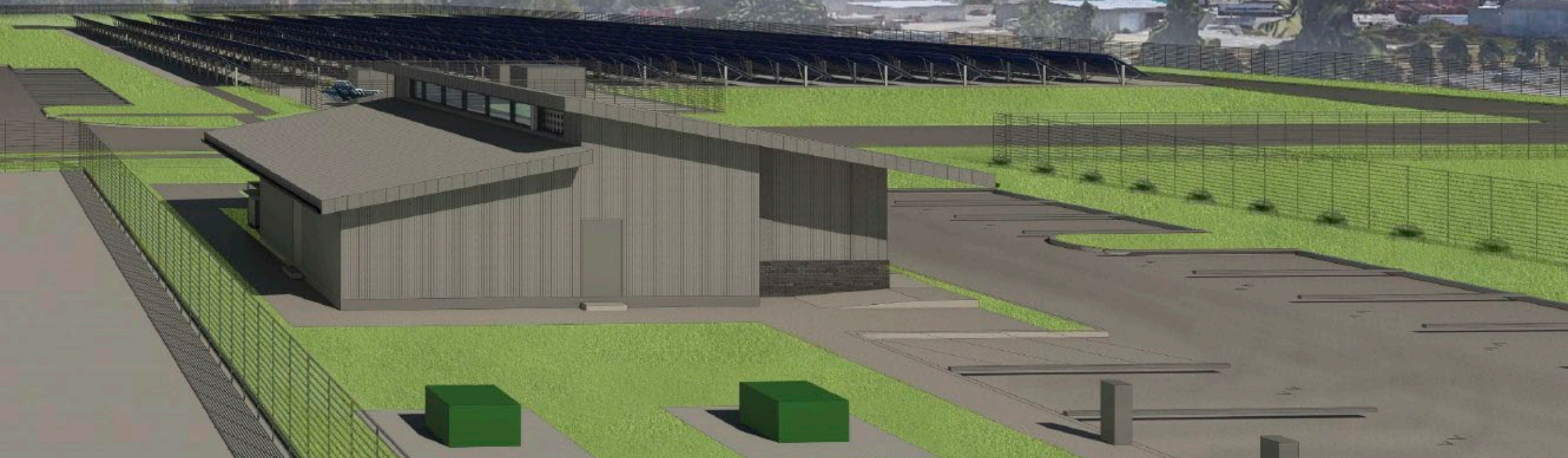


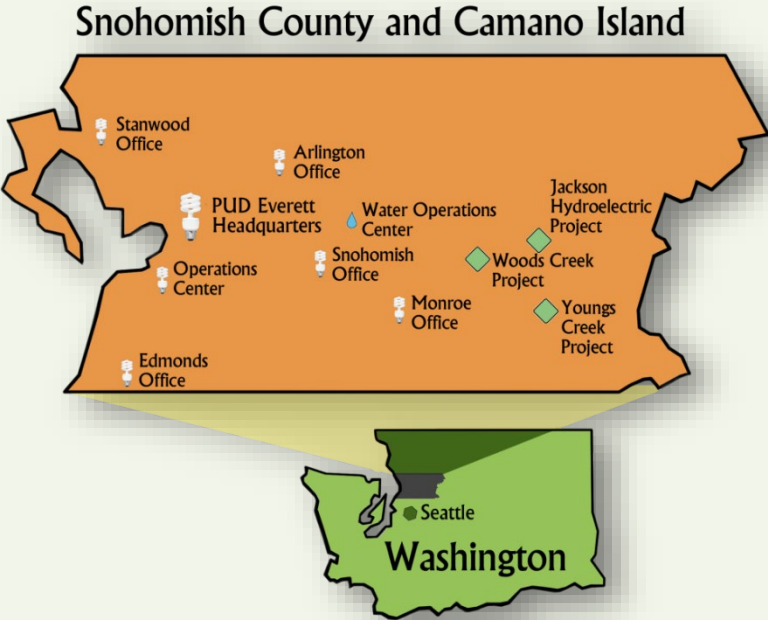
# Energy Storage Safety & Reliability

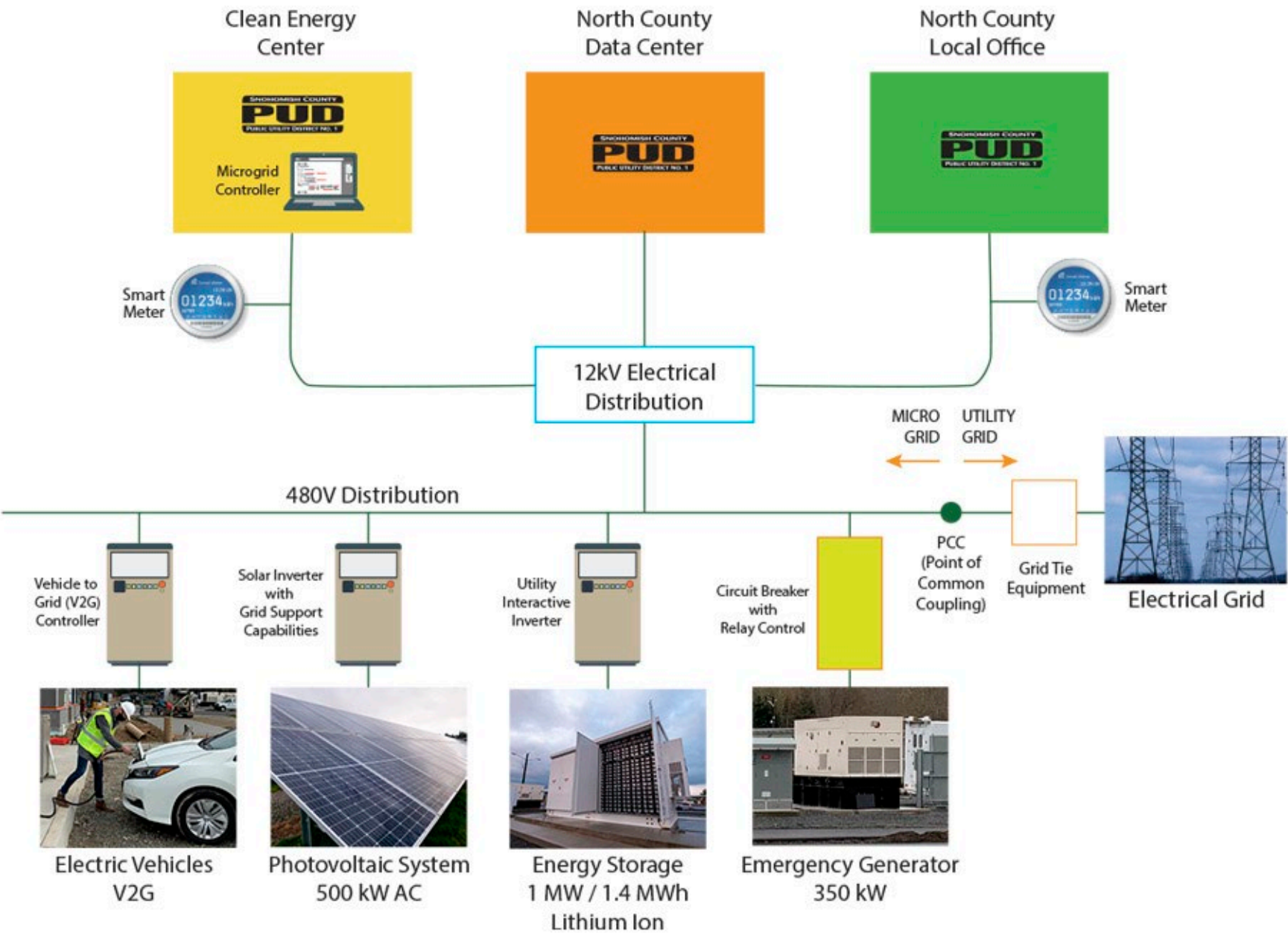
## *The Arlington Microgrid > Lessons Learned*



# About Snohomish County PUD

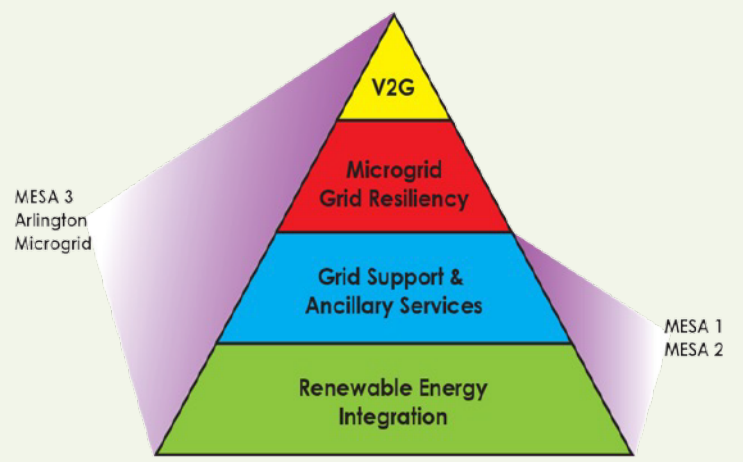
- **Snohomish County & Camano Island**
- Second largest PUD in the state.
- **Began operation in 1949**
- Serves population of about 907,000
- **361,000 customers and growing**
- ~ 85% of our power is from Bonneville Power Administration
- **3-Elected commissioners**
- **Five hydro generation systems**
  - Jackson – 100 MW
  - Young’s Creek – 8 MW
  - Hancock Creek – 6 MW
  - Calligan Creek– 6 MW
  - Woods Creek - 650 kW
- **Two existing battery energy storage systems**
  - MESA 1 and Arlington Microgrid

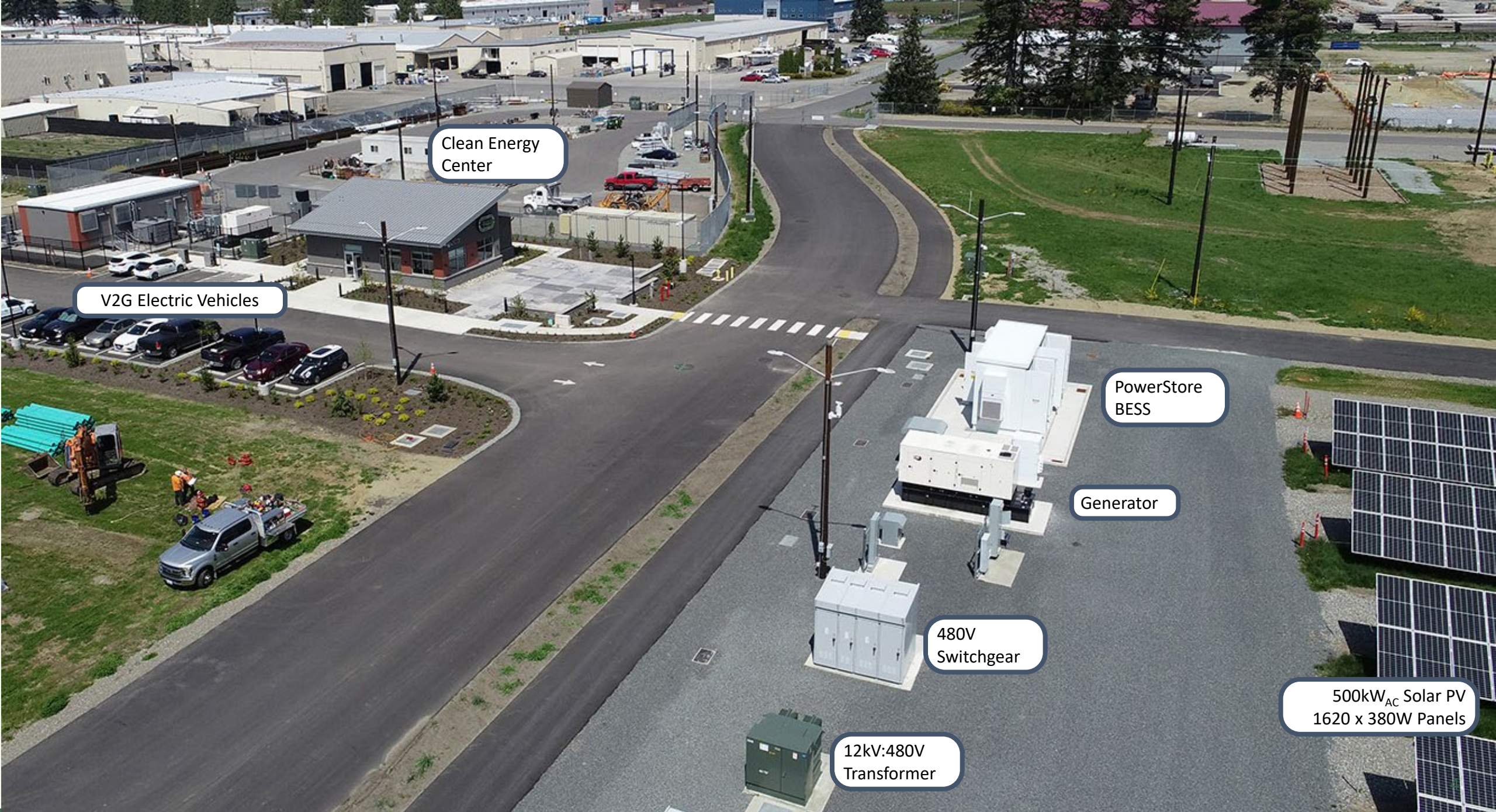




# Arlington Microgrid

## The multiple uses of energy storage





Clean Energy Center

V2G Electric Vehicles

PowerStore BESS

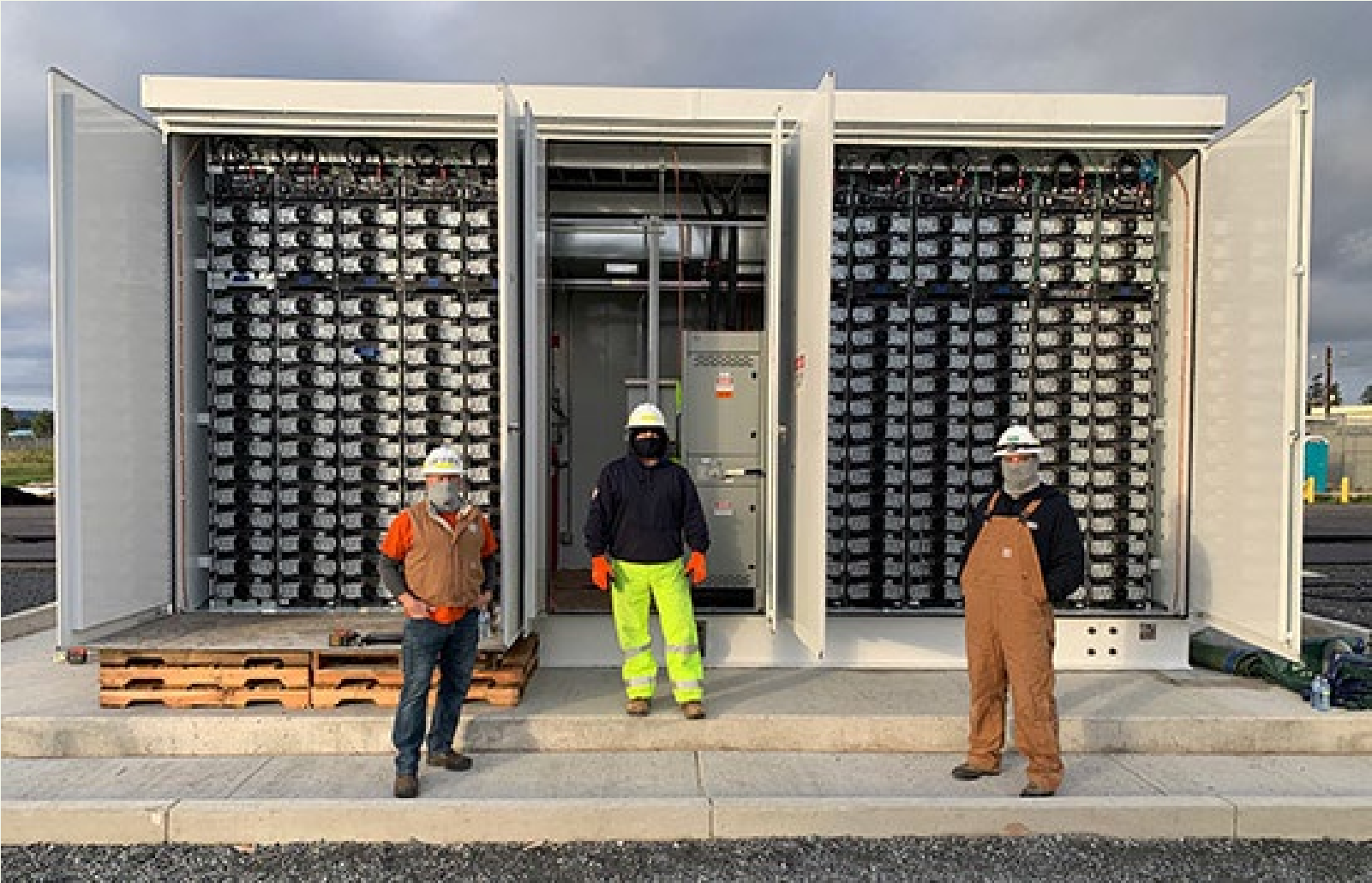
Generator

480V Switchgear

500kW<sub>AC</sub> Solar PV  
1620 x 380W Panels

12kV:480V Transformer

# 1MW / 1.4MWh - Battery Energy Storage System



# Initial - Fire Suppression System Basis of Design

- Built prior to Arizona Public Service McMicken Battery Storage Facility Incident (April 19, 2019)
- 2015 Washington State Fire Code (adopted in 2016)
  - Did not address lithium-ion batteries
- Design included minimal fire safety equipment
  - Smoke detection
  - Clean Agent – FM 200

# Final - Fire Suppression System Basis of Design

- **Post Arizona Public Service McMicken Battery Storage Event (April 19, 2019)**
- **DNV GL Final Report for Consolidated Edison, New York, NY**
  - **Considerations for ESS Fire Safety**
  - Report No. OAPUS301WIKO (PP151894), Rev 3, January 18, 2017
- **New York Fire Department**
  - 608-01 **outdoor stationary battery systems** 4-23-19 publication draft
  - Notice of Public Hearing and Opportunity to Comment on Proposed Rule
  - Section 608-01 to Title 3 - *Rules of the City of New York - Outdoor Stationary Battery Systems*

# BESS Safety: Four-stage System

## 1st Stage: Early warning

Li-ion Tamer to detect off-gas before thermal runaway

Stop charging or discharging

Open AC / DC contactors

## 2nd Stage: Smoke Detection

VESDA (Very Early Smoke Detection Apparatus)

Novec 1230 Clean Agent Fire suppression system

Horn strobe on outside of container

Signal to Fire Department and Snohomish PUD

## 3rd Stage: Gas Venting

10-minutes after Novec 1230

Mechanical exhaust to remove explosive gases, with back-up manual switch.

**PNNL Intellivent, automatically opens all container doors to remove explosive gases and provide visual inside container**

## 4th Stage: Water/Deluge

Fire sprinkler water deluge System

Dry pipe to a Fire Department Connection (FDC) ~100' away from container

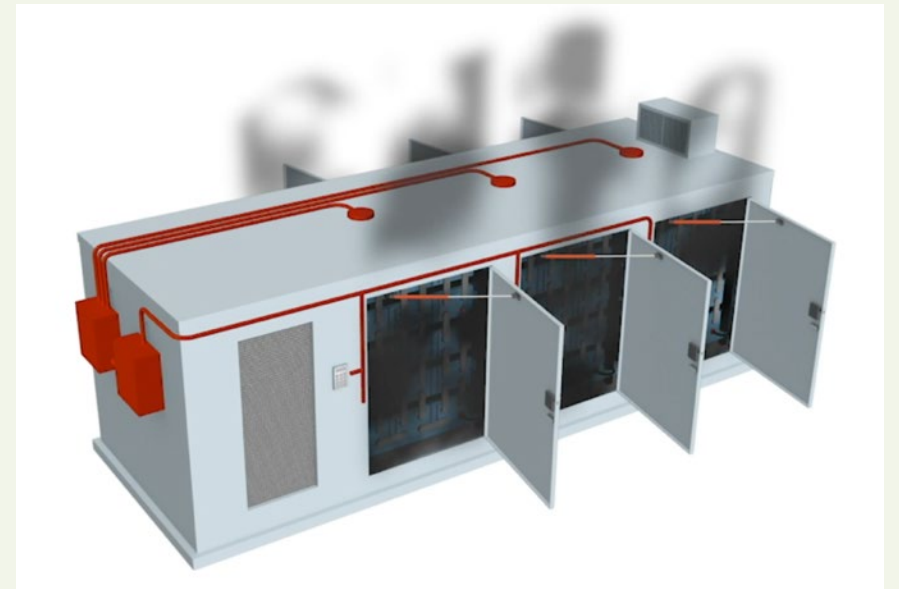
Water can also be sprayed directly on batteries through open doors.



# Additional Fire Safety Equipment Added

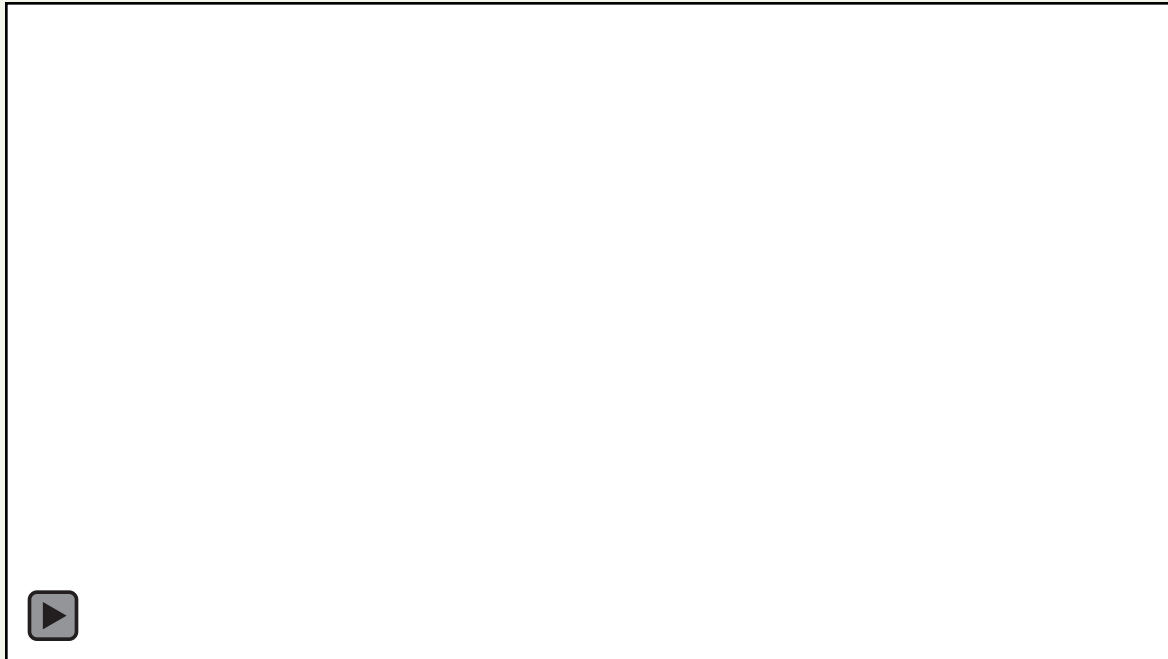
- **PNNL IntelliVent™ System**

- Meet future code requirements for deflagration gas venting
- Currently - open all battery container doors 10 min. after clean agent is triggered
- Doors are held closed with magnetic locks
- Adding future system to immediately open doors if heat is detected on battery modules

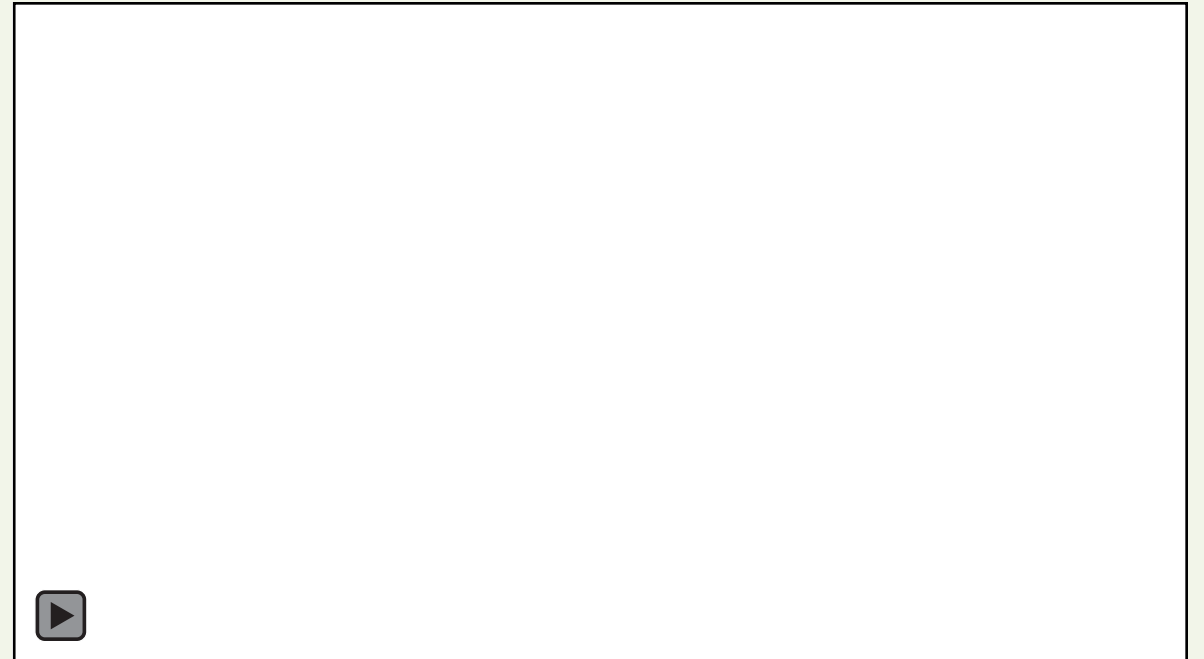


# IntelliVent™ Testing at SnoPUD

Smoke Test – Interior View



Smoke Test – Exterior View



# BESS Fire Safety > Lessons Learned > Design, Planning & Training

- **Comprehensive System Level Approach**
  - Select reputable, well-established vendors
  - Focused on quality and safety
  - Modules and Battery Mgmt System
  - UL 9540 Listing - Future Systems
- **Proper environmental controls**
  - Heating, cooling and humidity
- **Engage Authorities Having Jurisdiction (AHJ)**
  - Codes – WA State Fire Code, NFPA 855
- **Continuous Training**
  - First responders – Fire Department
  - SnoPUD crews





**Thank you !**

H. Scott Gibson  
[hsgibson@snopud.com](mailto:hsgibson@snopud.com)