Resiliency Planning & Engineering at Central Lincoln PUD

Coastlines
August 2015

An aerial view of Heceta Head Lighthouse (left) and the Heceta Head Keeper's House, twelve miles north of Florence. Photo © Ken Gagne
Central Lincoln

- Formed in 1940
- Serving ~38,600 customers
- 120 miles of Oregon coastline
- 700 square miles
- 6 PUD’s in Oregon
- Parts(s) of 4 Oregon Counties
- 4th largest Oregon electric utility
- 270 MW (winter) Peak Load
- 130 employees
Central Lincoln’s Electric System
Central Lincoln’s Electric System-North
The Threat - Natural Disasters

- High Winds
- Snow/Ice
- Wild Fires
- Flooding
- Earthquake
- Tsunami
What We Expect

9.0+ Earthquake

- Tsunami to follow
- Bridges heavily damaged
- Roads impassible
- Broken water/sewer pipes
- Mass casualties
- Communications down
- Multi-state power outage
The Threat

TSUNAMI, Japan, 2011

SUBSTATIONS
Power Resiliency!
V.R.A. - Vulnerability Risk Assessment

• 2016
  – Substations
  – Transmission System
  – Communication System

• 2018
  – Substations
  – Transmission System
  – Communication System
  – Distribution System
  – IT

VRA CIP ENGINEERING
Resiliency Planning

• Central Lincoln Buildings: South Beach Operations and Warehouse 23’ above mean sea level.
Resiliency Planning

• Central Lincoln Buildings: NOC 133’ above mean sea level.
SS138-Mossy Lane → SS139-Arcadia
Resiliency Planning

• Substations:
  – Rigid Bus -> Expansion Joints -> Flexible Bus
Resiliency Planning

- Substations
  - Flexible Bus
Resiliency Planning

• Electrical Engineering Seismic Specification
  – IEEE Std. 693-2005

• Design of Flexible Buswork
  – IEEE Std. 1527-2006
Reliability = Loops
Bolt your Transformers down
Resiliency Planning

• Substations:
  12.5, 69kV & 115kV Breakers
Resiliency Planning

• Substations:
  – Seismic Relay Panel Racks & 48 VDC Batteries
Resiliency Planning

- Substations:
  - Porcelain vs. Silicon Polymer: Bushings
Resiliency Planning

• Substations:

Porcelain vs. Silicon Polymer: Bushings & Insulators
Resiliency Guidebook

Seismic Sensors

Figure 1 - CLFUD substation map (subset of stations)

Figure 2 - PNGN outdoor strong-motion station schematic drawing
Earthquake Resilience of the Western Power Grid

- Oregon State University collaboration with Central Lincoln PUD, BPA, PGE, DOGAMI, Cascadia Lifelines Program (CLiP)
- PIs: Ted Brekken, Eduardo Cotilla-Sanchez, Mike Olsen, Armin Stuedlein
- Funded by the National Science Foundation: 3 years, $434k
- Goals: determine range of failure scenarios for the western grid under a CSZ earthquake, determine weak locations/components, determine range of recovery scenarios
- Analysis: Monte Carlo combination of structural failure simulation and power flow
- Extension of analysis done with PGE in 2017-2019
Preparing Employees

Training Day
Speakers

Incident Command System (ICS) Training for All
After the Disaster....What next???

#1.) Of Course; Make sure your Families are safe. #1.
2.) Report to work NOC, Florence, Reedsports. + ICS.
3.) Similar to a large storm...access the damage.
4.) Take inventory of damages.
5.) Is BPA up?... Then Pickup CLPUD Substations and Large Transmission.
6.) Engineering + Operations has the say on when to reenergize Lines, equipment & Substations.

7.) Establish Mutual Aid Agreements and Purchasing agreements early.

...Rebuild the System!
THANK YOU

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