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

August 8, 2017

MEMORANDUM

TO: **Council members**

FROM: **Massoud Jourabchi**

SUBJECT: **Resiliency of Northwest Power System**

BACKGROUND:

Presenters: State and utility expert panel

Summary: Recovery from a crisis requires resiliency of the power system. To get a better idea on what Northwest utilities are planning in respond to cyberattacks or Cascadia rising we have assembled a panel of experts from the state of Oregon, BPA, and municipal and investor owned utilities to see what individuals and communities can do to participate in the recovery. We will learn how Japan is using grid-connected electric vehicles as part of their response to disasters.

Relevance: Planning for and actions taken in response to future uncertainties is a cornerstone of the Council's activities.

Workplan: Tracking emerging trends and markets

Background: Water, Transportation, Communication and Electricity form the lifeline priorities of recovery from any interruption. Without electricity, none of the other sectors in today's society can function properly. Due to its geography and geology, Northwest faces risk of major interruptions in its power system. Investments in increasing resiliency of the power system pays dividend in short and long-term. Utility investments now, firming up transmission and distribution grid, distributed generation and investments in

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efficiency and DR are necessary steps in increasing resiliency of the power system. But response to catastrophes, large and small, are not responsibility of the utilities or state or local public entities alone. Consumer readiness, investments in efficiency, rooftop/community solar, micro-grids, backup batteries, light and heaving duty electric vehicles are complementary steps in reducing impact from future catastrophes and speed up recover from small localized to large region-wide disasters.

To discuss resiliency plans of regional utilities and what communities and individuals can do in preparation for a disaster, we have gathered a panel of experts. Brief bio of the panel members is presented below.

Diane Broad and **Mr. Adam Schultz** will present on Oregon's Resiliency Plan

Ms. Diane Broad is a Sr. Policy Analyst at the Oregon Department of Energy where she focuses on integration of renewable energy, energy markets, smart grid, DR, storage and energy resiliency. Prior to joining the Department, Diane built expertise over 16 years as an engineering consultant serving electric utilities and renewable energy developers. Diane has a BS in Electrical Engineering from Colorado State University and is a registered Professional Engineer in the State of Oregon.

Mr. Adam Schultz is a Senior Policy Analyst at the Oregon Department of Energy where his work portfolio focuses on grid integration and resiliency. In particular, his portfolio includes representing the Department on issues related to energy storage, demand response, time variant pricing, and smart grid. He also represents the Department in PGE's Integrated Resource Planning proceeding, advises the Energy Trust of Oregon on its investments in renewable energy projects, and is a member of both the Demand Response and Resource Adequacy Advisory Committees of the Northwest Power and Conservation Council.

Will Price (EWEB)- will present on EWEB activities such as micro-grid and solar plus battery activities in the event of a major earthquake.

Mr. Price brings 25 years of experience in the electric utility sector, specializing in Research and Development (R&D) Projects as foundational proof of concept prior to launching full scale utility programs. He brings to the team, over 20 years of experience as an energy management engineer, working with EWEB's commercial and industrial customers. He has a deep level of expertise in controls, measurement and verification (M&V), contracts, and energy systems. Will has worked for a variety of industries including aerospace, accident reconstruction, and architectural design. Mr. Price holds a Bachelor of Science degree in Physics from Georgetown University, Washington DC.

Stephan Capps (BPA)- will present on BPA activities as they relate to hydro facilities and transmission infrastructure (10 minutes).

Mr. Capps is currently serving as the Bonneville Power Director of Facilities and Workplace Services, and he has recently completed an extended detail as Bonneville Power's Chief of Security and Continuity. In this capacity, he oversaw both BPA's Continuity Program and corporate incident response systems. Before joining Bonneville Power, Steve served in a 23 year Army career and retired as the Deputy Commander, Portland District, US Army Corps of Engineers. During his military career, he deployed multiple times in support of FEMA response operations to coordinate emergency power support and also as an exercise evaluator for national level continuity exercises.

He has a BS from the United States Military Academy and a Masters in Civil Engineering from Louisiana State University, and is a trained All Hazards Incident Commander.

Chris Dieterle (PGE)- will present PGE activities, as they relate to substation distribution and other infrastructure upgrades

Mr. Dieterle is a Registered Professional Engineer (Oregon), working as an Analyst in the Power Supply Engineering Services Department at Portland General Electric. He graduated with a B.S. degree from the College of Engineering at Oregon State University in 1973. After doing nuclear power plant design and startup engineering for Bechtel Power Corp. in San Francisco, Chris joined PGE in late 1976. He performed mechanical & nuclear systems design engineering, decommissioning, and work on dry spent fuel storage at the Trojan Nuclear Plant until 2000. In addition, he provides technical support to the Integrated Resource Planning team, including emerging technology evaluations, energy storage, and resource cost analysis.

Dan Bihn(an Engineer-Storyteller) - will present on the Japanese experience in the aftermath of a disaster.

Mr. Bihn produces communication material that translates the complexities of energy projects, programs, and products into quickly comprehended and visually engaging multimedia content that is a delight to share with busy non-technical audiences. He spent the first half of his career as an R&D engineer developing things like cardiac pacemakers, underwater robots, and greenhouse control systems. He lived and worked in Japan for 7 years, including 5 years as a systems engineer for Hewlett-Packard. Since 2000, Dan has concentrated his efforts on smart energy — first as an engineer and then as a communicator and educator.

Dan holds an MSEE from UC Davis, has 3 U.S. patents, 2 Japanese patents, and can use chopsticks very well.

Resiliency of Northwest Power System
Panel Discussion

August 16, 2017

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In this meeting

- What does Resiliency mean
- Dependency on Electricity
- What has been the trends in natural and man-made disasters.
- Costs and benefits of planning for unexpected.
- People expectations vs realities
- What utilities are doing to prepare
- What individuals and communities are doing and can do.
- Contribution of investment in efficiency to increasing resiliency.
- Utility Panel Discussion

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Although Four Stages of Denial of a Disaster are expressed as

1. Nothing will happen.
2. If it does happen, it won't happen to me.
3. If it does happen, and it happens to me, it won't be that bad.
4. If it does happen, and it happens to me and it is bad, there is nothing I can do (we all be dead).

Adopted from "the unthinkable" by Amanda Ripley

Resilience

"ability to prepare and plan for, absorb, recover from or more successfully adapt to actual or potential adverse events"

National Academy of Sciences – 2012

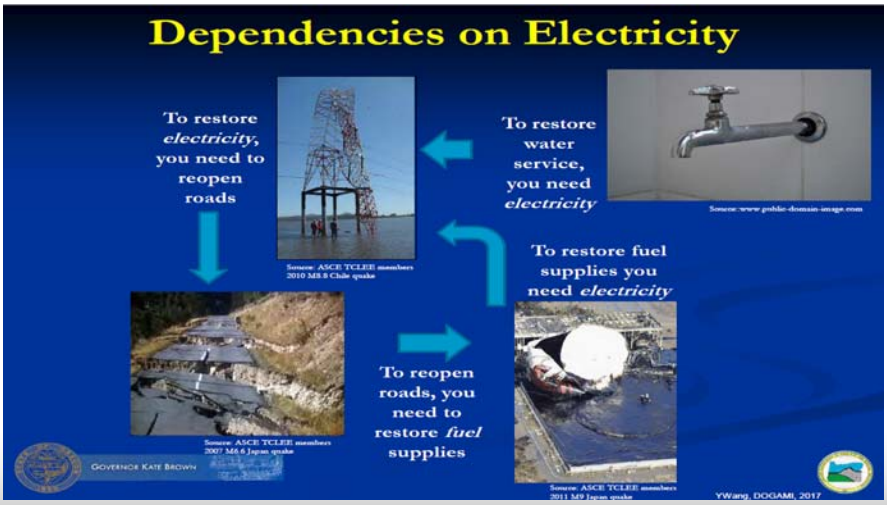
"resilience is a dynamic quality and is usually developed and strengthened over time, it builds upon rather than replaces existing strengths and arrangements"

Queensland Reconstruction Authority – 2012

GOVERNOR KATE BROWN

YWang, DOGAMI, 2017

Integrated Nature of Lifeline services



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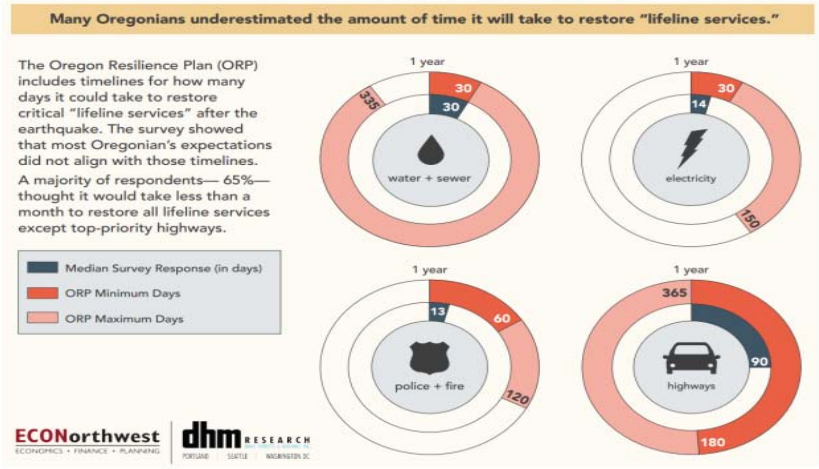
Public perception of recovery is very optimistic



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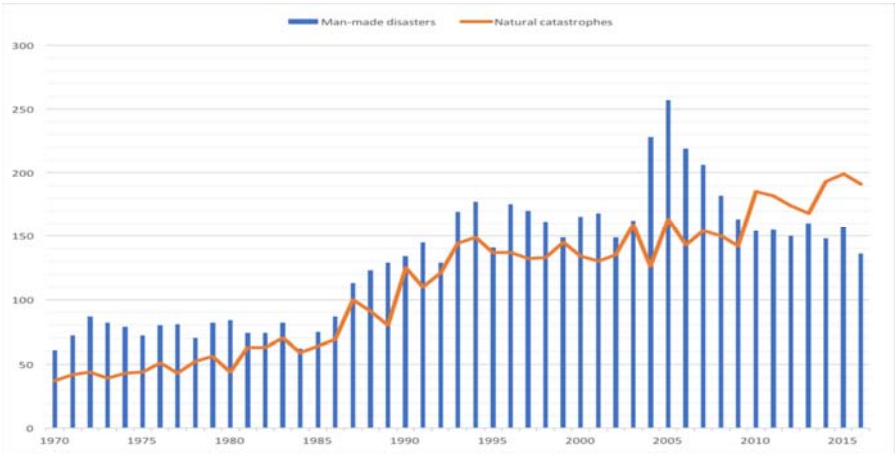
Rise in natural and Man-Made disasters



Credit: Swiss Re/Cat Perils and Swiss Re Institute

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Cost of Natural Disasters and Return on Resiliency

- Japan's 2011 Tōhoku Earthquake/Tsunami –$225 Billion
- Hurricane Katrina: $108 Billion
- Hurricane Sandy : $50 Billion
- Hurricane Ike : $30 Billion
- The Dust Bowl Drought: $1 Billion

- According to FEMA, every dollar on preparation pays back $4 dollars.
- Two examples of New construction with resiliency built in.

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Building with Resiliency in mind

Case of Spaulding Rehabilitation Hospital in Boston

260,000 sqf facility build next to Boston Harbor

Total Project Cost: $225 million
Resilience investments: $1.5 million (half of which was covered by utility rebates)
Resiliency return: $500,000/year in O&M + better rehab center.

Flooding Mitigation Measures

- First floor 30 inches higher than 500-year flood level.
- All mechanicals-boilers, chillers, air-handlers were installed on the roof, penthouse above 8 floor hospital.
- High-voltage electrical service is run to a penthouse transformer and is encased in a concrete case.
- The primary diesel storage in in the basement per fire code, but it is housed in a flood proof vault with 150,000 gallon tank.
- High efficiency mechanical systems including a cogeneration system for heat and power that provides 25% of the total power needed, reduce the building energy requirements to half that of comparable hospitals.
- A secondary combined chiller and HVAC system provides redundancy. An enhanced economizer provides most of winter cooling load.
- Building envelop is super-insulated with foam in the walls and triple-pane glass in patient rooms, eliminating need for baseboard heating.
- Landforms such as swales and earth berms constructed on large granite blocks act as barrier reefs.
- An extensive drainage network allows floodwaters to dissipate quickly.
- A two level 200-car underground parking garage is protected by a berm and a barrier system.

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Resilience-Based Design

181 Fremont Tower
San Francisco

Built to respond and return to re-occupation after a 475 year earthquake

- Distinctive 70 story mixed use tower
- 432,000 rsf of Class A office
- 67 Exclusive Condominium Residences
- Targeted to achieve a LEED Platinum certification, 181 Fremont incorporates innovative design strategies for:
  - sustainability
  - water savings
  - energy efficiency

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Mitigation Strategies

- Be REDi (Resilience-Based Design)
  - New structures (exceed code)
- Existing structures (seismic retrofit)
- Have an integrated plan that brings together resiliency plans for
  - Transportation
  - Communication
  - Water deliver
  - Electric utilities
  - Community

Panel members to discuss regional utilities resiliency activities

- Ms. Diane Broad & Adam Schultz - Oregon Department of Energy
- Mr. Stephan Capps - Bonneville Power Administration
- Mr. Will Price – EWEB
- Mr. Chris Dieterle –PGE
- Mr. Dan Bihn – Engineer story-teller – Japanese experience

New IRP

There is a lot that can be done to increase response to and recovery from disasters big and small.

- A well-practiced Integrated Resiliency Planning for lifeline services with Community as an integral part of the plan.
- Using new sensing technologies (Iot and AI)
- Using distributed generation technologies (solar, batteries, micro-grids and distributed generation) as a backbone for community resiliency.