

Electrical Resiliency for Portland's Mitigation Action Plan

By Sam Churchill (schurchill@gmail.com)
<http://www.hayden-island.net/utility-disruptions/>

Executive summary:

The goal of this proposal is to provide Portland residents with immediate electrical power, even if (as predicted) electrical distribution towers may fall into the Willamette and Columbia rivers due to a large subduction zone earthquake. The goal is power resiliency in a demonstration project.

This paper was prepared as feedback for Portland's Mitigation Action Plan. The author is a Neighborhood Emergency Team member but is not an electrical engineer. This paper is solely the opinion of the author and describes an approach to emergency power that seems to have some merit. This paper is NOT in any way a valid engineering study. It is simply a pitch for electrical resiliency.

Local electrical power could be provided to users in this proposal even if high voltage distribution towers fall into the Willamette and Columbia Rivers from a 9.0 quake. An existing large solar array would be supplemented by on-site battery storage in this proposal. A **microgrid** would automatically switch over to battery power and utilize existing distribution lines for local delivery. Micro-grids, provide power for local users even when traditional power sources are not available.



The existing 200 KW solar array on Hayden Island (from the Manheim auto auction facility), is one possible site for this proposal. The concept of charging electric cars from solar arrays for mobile power is also discussed. Other locations, such as the Terminal 4 substation at Rivergate, may also be modified with the addition of local solar power generation and battery storage.

Introduction:

BPA provides about one-third of the electricity consumed in the Northwest – across 15,000 miles of high-voltage transmission lines. The [Dittmer Control Center](#) at Vancouver's Ross Complex is a national asset that affects electrical delivery throughout the West Coast. If Dittmer is down, Spokane's Munro Control Center takes over. **But substations aren't much help if they can't get power.**

As an investor-owned utility that serves about 830,000 customers in 52 Oregon cities, PGE is testing several smart-grid technologies. Besides a large battery storage system, PGE is working to integrate renewable power sources to the power grid and is also implementing a demand-response program with residential and commercial customers to help meet peak demand. All these resources are optimized with the automated transactive control signal.



Portland and its utilities would benefit from a project demonstrating power resiliency:

- PGE received \$23 million in DOE funding for the Salem Smart Power Project, the largest regional smart grid demonstration project in the nation. The 5 MW plant features a massive lithium-ion battery at the heart of its energy storage system. Salem-based Kettle Brand connected its 114-kilowatt solar array into the project.
- The Oregon Department of Energy awarded \$295,000 in state and federal funds to the Eugene Water & Electric Board for a pilot project that demonstrates energy storage and “microgrid” technology and how it can improve community resiliency and response in emergency situations. The two-year demonstration project will incorporate 500 kW of electric energy storage in combination with [solar PV](#).

This paper proposes an electrical storage facility and micro-grid distribution system for Hayden Island. It would utilize the existing 200 KW Manheim solar array and the existing substation on West Hayden Island, both near the railroad tracks. New investments in solar would not be required. Hayden Island, supporting the I-5 bridge, is critical infrastructure. Power is likely to be cut by collapsing towers.

The author of this paper is not qualified to judge the validity of this concept. However, if it IS feasible, and mutually beneficial to all parties, then perhaps the concept should be explored in some form.

The goal is to provide a reliable source of electricity when existing infrastructure is down.

Microgrids and Electrical Resiliency:

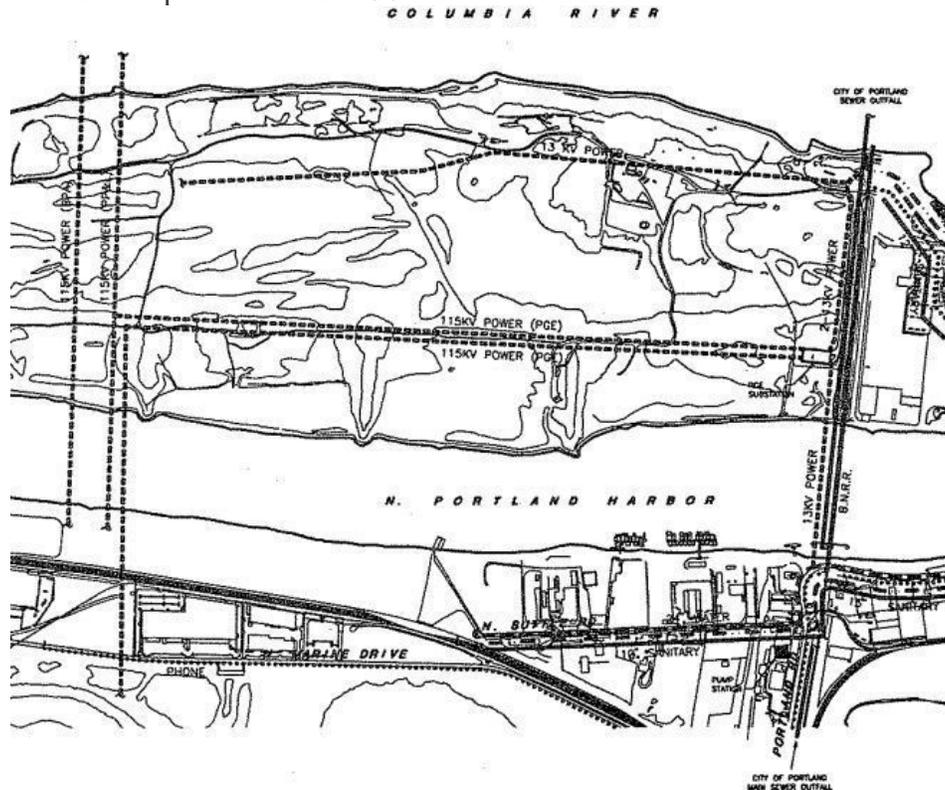
The potential for microgrids to be used as a grid resiliency tool that can enhance a community's ability to recover and restore power after a major physical disaster.

The US Department of Energy defines microgrids as "a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid." A microgrid can connect and disconnect from the macrogrid (the utility scale electric distribution system) so it can operate in as a part of the overall grid or independently ("island mode"). Microgrids have a number of key attributes. They:

- Group interconnected loads and distributed energy resources.
- Can operate in "island mode" or be connected to the larger grid.
- Can connect and disconnected from the larger grid as needed.
- Can act as a single controllable entity to the grid.

[A BPA study](#) indicated the large power lines crossing West Hayden Island and the Willamette River near the Critical Energy Infrastructure is a concern (due to liquefaction). They may topple.

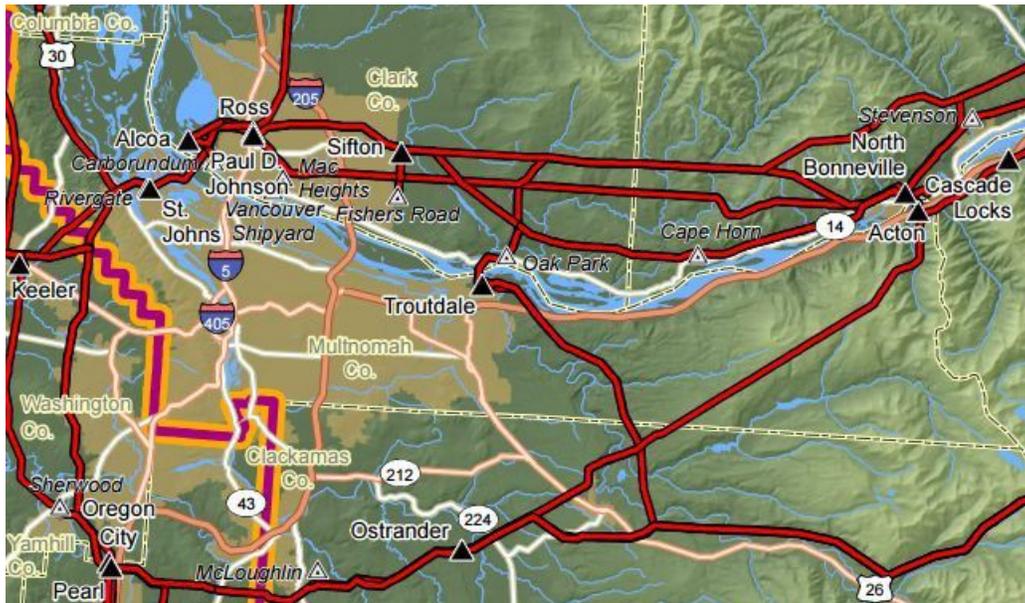
Bonneville Power Administration (BPA) maintains a 115 kilovolt, three phase overhead transmission line which crosses West Hayden Island running north to south, midway between the west end of the island and the railroad tracks. Pacific Power and Light also owns an overhead 115 kilovolt, three phase line that crosses the island parallel to and 450 feet east of BPA's line.



The East Hayden Island substation supplies two overhead, 13 kilovolt, 3 phase lines parallel the railroad. One of these lines heads west and serves the north shore of West Hayden Island while the other serves the Jantzen Beach area. An overhead 13 kilovolt, 3 phase line (Mainland Line) heads south from the substation parallel to the railroad. The other serves the Jantzen Beach area.

Would the Manheim auto auction facility be open to such a demonstration project? Unknown. What about PGE, PPL, BPA, DOE, Battelle? What about other stakeholders? With the financial benefit to all parties significant enough, the concept might be explored. Public safety is a side-benefit.

Recent unpublished BPA Cascadia earthquake scenario studies of the existing transmission line system indicate that their main grid would require between 7 to 51 days to make emergency repairs to the transmission line feeding Oregon and Washington from a magnitude 9 quake.



Perhaps Hayden Island could be a candidate for a Micro-grid demonstration project:

- Major electrical transmission lines cross the Columbia River.
- The island has a major solar array (owned by Manheim Auto Auction)
- Manheim might provide an innovative, cost/effective alternative to a dedicated battery building by using electric cars to power the local micro-grid.
- The electrical substation is a manageable size, not too big or small
- The I-5 bridge on the island is critical infrastructure

Other locations around the metro area may also be candidates for a resilient Micro-grid demonstration project, like the Rivergate substation near Terminal 2 or the Keeler substation in Washington County.

Summary:

Living without electrical power for weeks for months is almost too frightening to seriously consider. But here we are.

One solution that Portland should consider is a resilient electrical grid. With 100-200 KW of (local) solar and wind generation, feeding a substation with battery storage, local power can be delivered whether or not the main power grid is up using micro-grids. Providing both public safety and benefit to all the stakeholders is the goal. Solutions appear to be available.