



## Pacific Northwest Smart Grid Demonstration Project SUCCESS STORIES

SEPTEMBER 12, 2014



# PENINSULA LIGHT CO.



### Smart grid provides power bridge to Fox Island

Nearly half of Fox Island's 1,200 residents moved here to retire by the water. They sail. They hike. They kayak in scenic Puget Sound. But the highly educated maritime residents also expect the same reliable electricity they once enjoyed in the city. That was a challenge for the utility that relied on aging cables to deliver the island's electricity. Yet it was also an opportunity to test new technologies to improve service, and the reason Peninsula Light Co. applied to participate in the Pacific Northwest Smart Grid Demonstration Project.

The goal of the demonstration project is to test how new technologies can integrate renewable energy and improve reliability for grid operators while lowering the costs of energy for consumers. Led by Battelle Northwest, the Department of Energy Recovery Act project involved 11 utilities, five technology partners and two universities across five states in the nation's largest test to modernize the grid. DOE matched the funds of participants, including the Bonneville Power Administration's \$10 million contribution. PenLight invested \$1.2 million in the \$178 million cost-share project. Just in time, too.

### A critical need

PenLight serves all of Fox Island, which, given its watery surroundings, has no gas service. That means many residents and businesses are dependent on electric power for everyday needs. Two cables deliver electricity to the island: one submarine cable and the other attached to a bridge.

"During the summer of 2010, the submarine cable that was installed in 1970 started to fail," said Jonathan White, PenLight director of Marketing and Member Services. "An analysis determined that if the temperature fell below 20 degrees Fahrenheit, the

## Peninsula Light Co. *The power to be...*

### PENINSULA LIGHT CO. Gig Harbor, Washington

- Member owned since 1925
- Second largest membership of any co-op in Northwest
- 997 circuit miles of line
- 112 square-miles of service territory
- 31,000 metered customers

### INVESTMENT IN PNWSGDP:

- \$1.2 million

### HIGHLIGHTS:

- Power Sharing
- Power line-carrier system
- Self-healing network
- Integrated volt-VAR control

### FOR MORE INFORMATION:

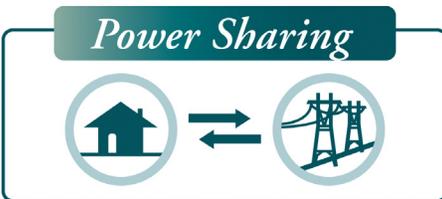
Mike Simpson 253-857-1580  
[www.PenLight.org](http://www.PenLight.org)



ability to maintain load on the island's remaining circuit would be difficult."

To cope with potential outages, a comprehensive strategic plan was developed. The plan included rolling blackouts, backup diesel distributed generation and a smart grid program.

"Fox Island became a smart grid test bed," said Mike Simpson, PenLight's manager of Engineering. "Knowing there was an aging issue with one cable, we thought: let's look at demand response to reduce the load."



## Failing cable leads to fast launch

By September 2010, with winter quickly approaching, a demand response marketing program for electric water heaters called Power Sharing was launched. The program would reduce electric demand when needed by controlling residential water heater operations during peak load time periods.

Community meetings were held as construction started on a new cable 40 feet below Puget Sound. The participation goal was to get 400 of the 1,700 metered customers on the island to participate in the program. Volunteers were offered a \$5 credit on their monthly power bills.

"You don't have to tell the light company about this, but I would do it without a discount," said Dick Olszewski, a PenLight customer. "Electricity is something you must have to survive. Being on an island makes it more difficult, but it's worth it."

A few months later, the old cable partially failed. That's when the program fast-tracked its way to load reduction during the coming winter months. By the end

of December 2010, approximately 25 percent of the targeted customers were on board with the project. A month later, an additional 10 percent had joined. By February 2011, the goal was met.

During several low-temperature days, a phone message was sent alerting island residents of the low-temp risk and that the utility would begin cycling off water heaters.

"We were sending communications out to the members that this was a crisis situation and that we needed their assistance," said White. "Rolling blackouts were imminent if the demand response program and voluntary curtailment failed to meet the need."

The emergency plan worked to get the island through the winter.

## One bit every 20 minutes

Communication sent to the water heater controllers, turning them on or off, worked well. But getting data from the controllers back to the utility over its power line-carrier data collection system was another story.

The technology sent the data along with electricity through the power line. While these systems are generally known for being low-cost, they have significant bandwidth limitations. A smart phone or streaming TV connection delivers 10 megabits per second — PenLight's system could only deliver one bit every 20 minutes. Hourly meter reads created challenges for the required project reporting.

With 500 homes on the island participating in the program and with the low speed of data transmittal, it was hard to tell if the program was working.



"We realized we had to get higher speed communications or it would be difficult to determine how effective it would be to use the system throughout the rest of our service area," Simpson said.

## A cellular solution

Cellular-based transformer monitors provided a perfect work-around.

The devices — part of PenLight's system-wide monitoring program — were installed to measure, in 15-minute intervals, transformer loads and conditions. This monitoring was critical to the ongoing reporting requirements of the demonstration, allowing the utility to know if a hot water tank was turned off and if so, precisely when.

In addition, gathering data at the transformer meant that a demand response event could be validated at one point for multiple participating homes. That means the utility now knows, on a cost-per-unit basis, whether it's practical to deploy the system elsewhere.

## Shorter and shorter and shorter outages

Imagine a grid that fixes itself when a car hits a power pole or a storm trips a wire.

That's exactly what a self-healing grid does. The system detects the fault and then isolates the problem quickly — within minutes — by automatically deciding which switches on the transmission system to open and close. The result: fewer members affected. In addition, work crews know the precise location to investigate. Eliminating the need to patrol the entire circuit saves time and also reduces the length of the outage.

For some, adopting such technology without hands-on experience is tough to embrace. That's why PenLight is taking time to learn about the operation of the system and how to get the most value from the demonstration project for its customers.

"It's difficult to embrace what the system can do," said Simpson. "You're allowing it to exert control automatically. It's one thing to accept the technology; it's another thing to trust it."

The system — installed in strategic locations on the island — will ultimately be allowed to minimize the impact of an outage on its own. But until that trust is established, a person still needs to hit the button to execute the fault isolation. Still, it didn't take long for the system to flex its muscle.

When a large tree fell on a major feeder and disrupted power to 1,300 customers, the system quickly identified the location of the problem. Then a foreman opened up a switch to isolate the damaged section. The crew then restored the rest of the circuit, which brought about 1,000 customers back on line within 30 minutes. It took four hours to bring the remaining 100 customers on line. That reduced the number of customers who were affected by the longer outage by 80 percent.

Eventually, the utility may give the system actual control, but that will take time and a clear understanding of how well the system works. "It's about having complete confidence in the system," said Simpson.

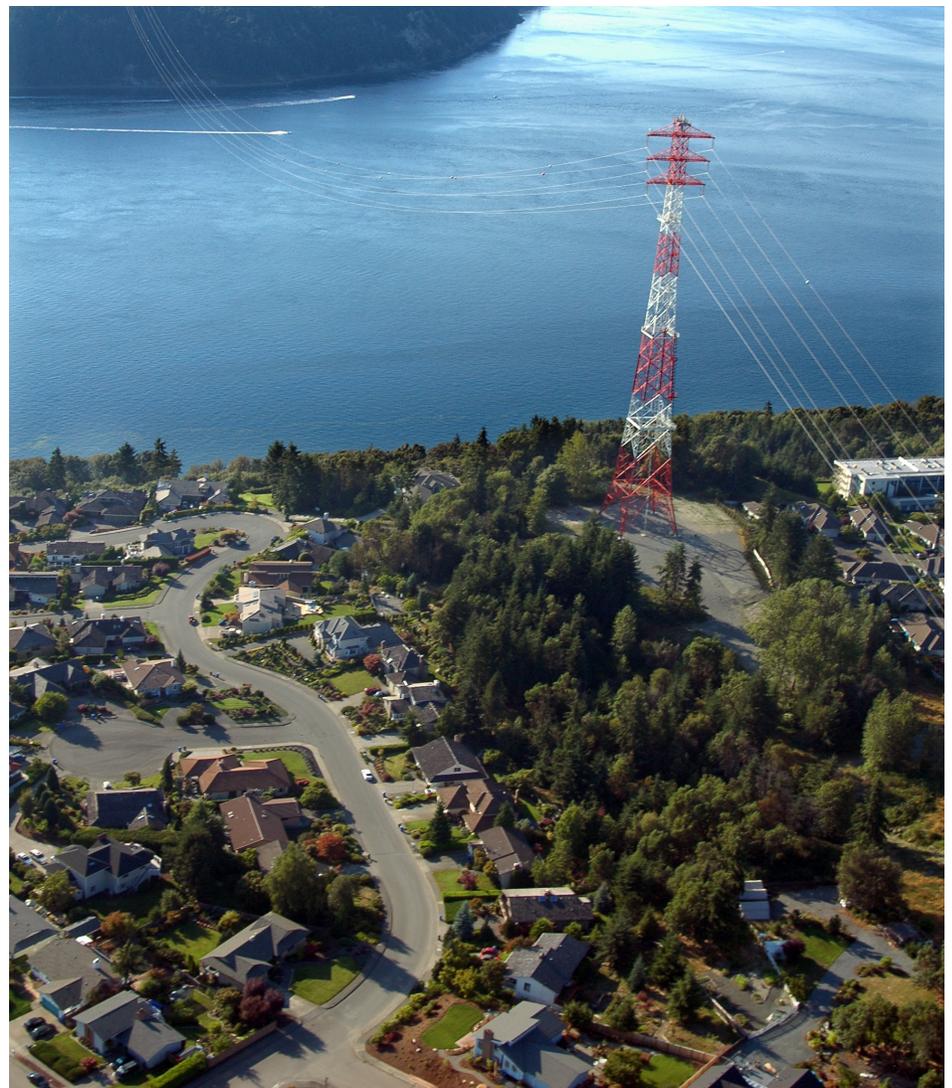
## Volts-VAR

Every home typically gets its electricity from what's called a feeder — the wire outside a home connected to a substation. The voltage is higher at a substation than it is at the other end of the line. Utilities work to flatten these voltages so they are more consistent using devices called regulators and capacitors. When the voltages are about the same, the utility has more flexibility to raise or lower voltage, a tool that can increase or decrease energy consumption during a demand response event, without the voltage getting too low for homes further down the line. This is

called Integrated Volt-VAR (volt-ampere reactive) Control, or IVVC.

PenLight initiated a Volt-VAR control project but couldn't automate it as planned, due to the impact to capacitor switches on the power-line-carrier system, as well as software and monitoring concerns. In addition, the technology requires very accurate voltage measurements, which the utility's current technology isn't able to provide.

The smart grid IVVC solution was built to address a global marketplace which requires data measurement at five-minute intervals. PenLight has a small distribution



network with very short feeders, so there is not a lot of variation across the feeder, particularly over five-minute intervals.

“You see a little voltage fluctuation at the beginning of the day and a little at the end,” said Simpson. “Five-minute timeframes were a little off-putting because you need measurement devices in the field and data transport mechanisms, which is costly.”

As a compromise, PenLight used the transformer monitors to get very accurate voltage measurements, capture them over 15-minute intervals along with the load data, and then used a man-in-the-middle approach to adjust the voltage.

## More lessons to share

Some lessons learned in demonstration projects are qualitative, like in managing change.

“It’s important to ensure that everyone participates in the decisions about operational change so the entire company supports it,” said Simpson. “If new processes and procedure are thrust upon employees who have been doing business the same way for a very long time and trust that process, it’s difficult to make determinations about the new solution. Because you’re really dealing more with perceptions and how comfortable people are with something rather than the value you’ve built into it.”

Other lessons to note from the team include:

- Have operational personnel involved in equipment selection. The overhead switches are awkward and difficult to manually operate for some line crews.
- Ensure that the geospatial database is very accurate if purchasing a system model out of the box.
- Use more than one vendor when integrating software. With just one vendor, it’s really difficult to identify the root cause when there’s a problem. When integrating tools from different vendors there is an integration point and a boundary that assists in problem-solving.

## WHAT’S NEXT

### for Peninsula Light Co.?

The member-owned utility intends to ensure that resilience is built into the system. One way to do that is by being very proactive. They will take a step forward by taking a look back. Technology platforms installed over 10

years ago may need to be upgraded. And if so, PenLight will determine how those technologies will be integrated into other platforms.

After all, many customers are already on board.

“This type of technology is not a bother,” said Olszewski. “It only operates when there’s a peak that’s taking place.”

In today’s world, there’s really not a single right path from one utility to another. Every utility has its own unique challenges. PenLight’s included being surrounded by water.

- Be as clear as possible about team responsibilities — be strategic in assignments according to the functionality of a device and the role of a team member.

“Often, sharing the lessons learned is the most valuable part of a project like this,” Simpson said.

