EXHIBIT NO. ___(GJZ-8)
DOCKET NO. UE-07___/UG-07___
2007 PSE GENERAL RATE CASE
WITNESS: GREG ZELLER

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY, INC.,** **Respondent.**	**Docket No. UE-07____** **Docket No. UG-07____**

SEVENTH EXHIBIT (NONCONFIDENTIAL) TO THE
PREFILED DIRECT TESTIMONY OF
GREG ZELLER
ON BEHALF OF PUGET SOUND ENERGY, INC.

DECEMBER 3, 2007

Windstorm of December 14-15, 2006

Puget Sound Energy
Storm Restoration and Readiness Review
July 2, 2007

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EXECUTIVE SUMMARY

In November and December 2006 the Puget Sound Energy service territory experienced unprecedented severe weather that inflicted the most extensive damage the electric transmission and distribution infrastructure had ever sustained. Severe December winds, preceded by record setting November rains, caused widespread damage to trees resulting in power outages throughout the territory. Over 700,000 PSE electric customers, representing nearly 70% of total electric customers, lost power during the “Hanukkah Eve Windstorm of 2006.”

This storm ranks as the fourth most severe Seattle area windstorm behind other landmark storms of December 1951, October 1962 (“Columbus Day Storm”), and January 1993 (“Inauguration Day Storm”). While December winds were not as severe as these other storms, electric infrastructure damage was the most extensive in PSE history. This can be attributed in part to the impacts of rapid growth and development in the service territory which has resulted in higher customer density and more transmission and distribution infrastructure exposure, plus the fact that the storm was slow moving and remained in the area for an extended time.

In response to the December 14-15, 2006 windstorm, PSE employed approximately 500 electric line crews, tree crews, and electric service crews, in addition to numerous corporate personnel, to conduct the electric service restoration. The rapid response by PSE management to secure additional resources from contractor companies and other utilities was a significant factor in the company’s ability to fully restore the system in approximately 12 days.

The support logistics involved in an effort of this magnitude is invisible to the average citizen but it is the equivalent of bringing the population of a small town into the area and providing all necessary logistical services; food service, lodging, parking, vehicle support, and personal needs to accommodate the population, in addition to the operational logistics for field work such as materials, equipment and supervision. This was a massive effort by any standard. In overall review of the effort put forth by PSE and its service providers, KEMA concluded that:

> ***PSE, its employees, and service providers performed well restoring power after this record-breaking storm. Employees at all levels overcame many obstacles caused by the sheer magnitude of the storm damage and the overwhelming volume of restoration activities. However, PSE functions were not able to respond with the same level of effectiveness previously demonstrated in more typical outage restorations. The emergency restoration plan and information processes are limited today by their ability to scale up to a storm of this size.***

It is also the opinion of KEMA that PSE did not manage the process of providing customer information on restoration times as effectively as needed to meet the needs of its customers. The magnitude of this storm overwhelmed the information systems capability of the company resulting in a lack of actionable and valuable information for customers. This shortcoming is a specific example of the conclusion that the company is limited by current processes and systems to scale to an event of this magnitude.

Based on findings in this project, coupled with knowledge of leading industry practices in the area of outage management, KEMA has identified opportunities for PSE to improve overall storm restoration processes so that the occurrence of another storm of the magnitude of December 14-15 can be handled even more effectively. These areas are:

- Systems to support outage information collection and management;
- Damage assessment processes to identify crew requirements and estimated outage duration;
- Vegetation management processes and access to rights-of-way for restoration; and
- Communication to customers of estimated restoration times.

It should be noted, however, that there were specific areas that were executed extremely well by PSE in this event. They were:

- Crew and materials acquisition to support restoration;
- Employee and contractor safety;
- Logistics support for the off-system crews brought to the area; and
- Performance of PSE employees in rising to the extreme challenge presented in this storm.

In the execution of the restoration effort PSE implemented their Corporate Emergency Response Plan (CERP). This well-defined plan details the processes and procedures by which the company approaches large scale emergency events. Through implementation of the CERP, PSE and their service provider (Potelco) personnel knew the roles, responsibilities and necessary actions to be undertaken to accomplish an effective restoration effort. PSE performed very well in the execution of the CERP. Also, during the course of this unprecedented event, the company recognized the need to deviate from the plan and institute new processes to address previously unforeseen situations. This effort in itself was a major undertaking and one that demonstrated the intent of the company to respond in whatever manner necessary to restore service.

Consistent with the CERP, the company completed a series of post-event debriefings. From these debriefings, a number of actions and recommendations were developed both internally and in conjunction with outside agencies to enhance the company ability to respond to future events of a similar nature and impact. Many of the resulting action items have been completed while others are in progress.

This report is an evaluation of the PSE response to the Hanukkah Eve storm and it details a number of conclusions reached by KEMA in our investigation. These conclusions have been shared with PSE personnel and recommendations developed to address the identified opportunities. The detailed conclusions and recommendations constitute the body of this report. A summary list of recommendations and conclusions is also found in Appendix C.

1. INTRODUCTION

1.1 Company Background

Puget Sound Energy (PSE) is a natural gas and electric utility operating in 11 Washington counties through five operating regions, providing energy services in a territory of 6,000 square miles. PSE is a subsidiary of Puget Energy, which is owned by stockholders and traded on the New York Stock Exchange and regulated by the Federal Energy Regulatory Commission and the State of Washington Utilities and Transportation Commission. PSE serves more than 1.1 million electric customers and approximately 700,000 natural gas customers. Third-party service providers provide maintenance and construction services electric transmission & distribution PSE electric transmission and distribution (T&D) system and the natural gas system. The electric service provider is Potelco Inc. Natural gas services are provided by Pilchuck Contractors Inc. and Potelco.

1.2 Situation

The PSE service territory is, and has been for many years, experiencing dynamic growth and development. PSE's average annual growth in electric customers is approximately 2%. This rapid growth requires ongoing expansion of electric infrastructure to provide service and, in turn, increases the physical infrastructure exposure during severe weather. The annual storms of the Pacific Northwest represent a continuous threat to the native vegetation and, consequently, the utility infrastructure of the area. Heavy rains and winds impact the stability of both trees and utility structures during the severe weather events resulting in the potential for extended service interruptions.

The windstorm of December 14-15, 2006 disabled 85 PSE transmission lines and 159 distribution substations, which is approximately half of the total transmission lines and distribution substations on the system. The PSE service territory includes an abundance of varieties of trees that often tower above the utility's T&D facilities (wires, poles and other line equipment). Because the storm damaged many of these trees, tree crews had to cut trees and remove debris to enable access to T&D facilities, which in many places, had to be repaired before power could be restored to specific neighborhoods. PSE concentrated on restoring the major transmission lines that were out of service before tackling the damage to the distribution system in the hardest hit areas.

PSE, through Potelco, maintains a normal complement of 35-38 four-man line crews performing system construction, maintenance and outage response work on a daily basis. Because PSE had responded to storms earlier in the week there were 145 foreign crews in the service territory. In all, more than 500 line, service and tree crews and more than 2,000 personnel – some from as far away as Alaska, Montana, Missouri and Southern California – worked on emergency restoration. Storm repairs included installation of approximately 770 new poles, 778 transformers, and 170 miles of new power lines.

KEMA believes that despite the issues encountered with the core issues of scalability and lack of a robust information process, PSE performed very well by quickly identifying many of the CERP's shortcomings and instituting new processes to complete the restoration of electric service to all customers. Specifically, KEMA found that PSE and its service providers performed very well in the following areas:

- Developing, in advance, a comprehensive formal restoration plan;
- Establishing, in advance, a clearly defined organization to manage restoration;
- Making a financially risky decision to hold over 145 crews;
- Working safely with a limited number (4) of minor injuries and demonstrating dedication from both PSE and its service providers to safety under extremely hazardous conditions;
- Integrating local government resources to support restoration;
- Releasing the limited information PSE had on the storm's impact very early before damage assessment was fully underway;
- Making early, aggressive outreach effort for additional/foreign crews;
- Creating local area coordination centers;
- Forming an escalated call handling process which required a process, identification of resources and training for resources;
- Adopting a more robust materials resupply process that moved extraordinary quantities of materials to crews in an extremely timely fashion;
- Developing and implementing an expanded logistics process to house 500 line and tree crews;
- Setting up multiple foreign crew receiving/staging areas;
- Redeploying resources quickly as areas were restored;
- Forming a separate transmission restoration prioritization team at the Emergency Operations Center (EOC) to focus exclusively on the repair to the severely crippled transmission system;
- Doubling the number of call-takers by identifying and training more than 200 non-call center personnel;
- Dividing crews to support the additional foreign line crews brought in to repair the heavily damaged transmission and distribution (T&D) system;
- Supporting the community through the charitable volunteer efforts of PSE's employees; and
- Demonstrating the overall resilience of all PSE and service provider personnel to adjust to continually changing needs by performing additional roles that they had not previously performed or even envisioned.

1.3 Approach

The body of this report will detail information gathered by KEMA in the course of an eight week investigation into the PSE performance in response to the storm. KEMA has evaluated both the readiness of PSE to respond to a storm event and the response to the specific event of December 14-15. In this project KEMA conducted more than 85 face-to-face and telephone interviews with company personnel, service provider personnel, local government officials, and PSE customers. The personnel interviews included a broad range of responsibilities in the organization including field service personnel of both PSE and Potelco and executives of both companies. Additionally, KEMA performed the following activities:

- Reviewed and analyzed many PSE documents generated during and after the storm;
- Conducted three major field visits to understand PSE T&D systems and uniqueness of the region; and
- Reviewed PSE information systems and technology that support field operations, customer service, and outage management.

This report presents specific findings and conclusions as they relate to individual areas of a typical storm restoration process. The KEMA approach is to compare PSE capabilities and practices to those that are considered leading practices in the utility industry. The following Section 2 presents a leading practice model while Sections 3 through 11 address specific operational areas that are part of a comprehensive restoration planning and execution process. Each individual section presents a summary of current PSE practice and specific conclusions and recommendations resulting from the analysis.

2. LEADING PRACTICES IN EMERGENCY RESTORATION PLANNING AND PROCESSES

The KEMA focus in this report is to provide an assessment of the parts of the PSE CERP that have proven to be effective as currently structured and an assessment of those areas that can be improved to prepare PSE for future events of this type as well as for more effective response to storms of lesser consequence.

2.1 Industry Practices

To provide a baseline for reviewing PSE processes and capabilities, it is appropriate to provide a summary level description of typical storm restoration activity. For this purpose KEMA has prepared a model of storm restoration process that incorporates leading practices from the utility industry. This model is intended to provide the reader with a basic understanding of how storm restoration is typically managed in a utility company and highlights the basic flow of information, the sequence of events in the field in assessing damage and the logistics of the restoration process. As one would expect, there are many support activities that facilitate the primary processes of system restoration and repair and management of information for both internal decision-making and public dissemination. Both the primary processes and support activities as they currently exist at PSE are discussed throughout this report to provide an understanding of what works well and what could be improved. Exhibit 2-1 shows our definition of the outage management process. Throughout this report Exhibit 2-1 will be referenced to demonstrate the specific area of the process being reviewed.

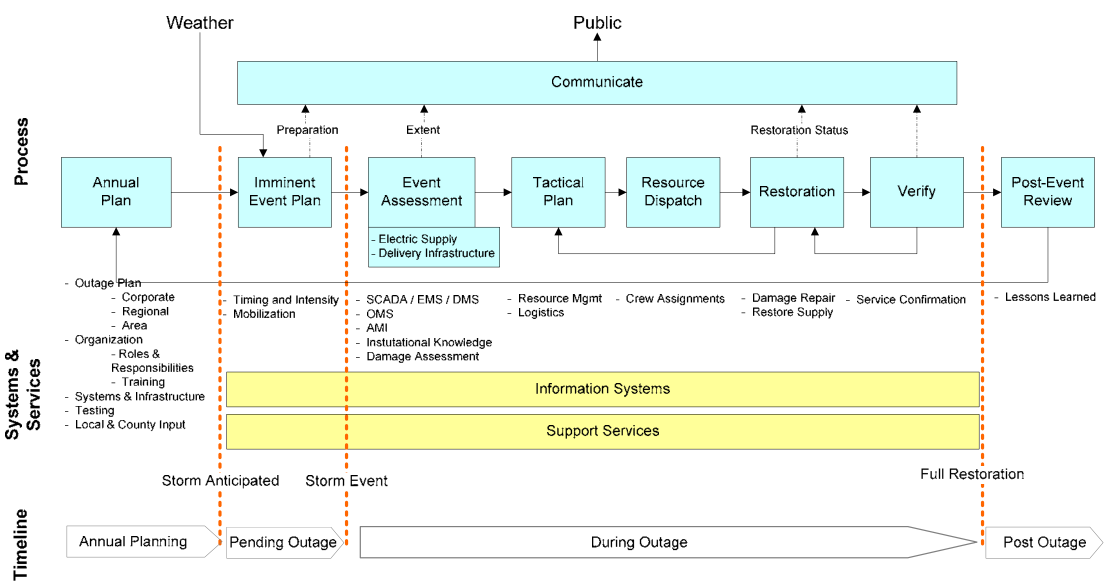


Exhibit 2-1: The Outage Management Process

2.1.1 The Annual Plan

The plan outlines a utility's strategy and approach to managing all the activities associated with a coordinated restoration effort after a significant storm, earthquake or other natural disaster. Specifically, the plan defines:

- The high level strategy to prepare for and execute restoration activities;
- The personnel resources required to effectively prosecute the restoration;
- The processes used to direct and manage the restoration efforts;
- The information tools required to process all the storm and restoration data into usable management information;
- The definition of storm strength and potential damage;
- The communications plan for informing the public and government agencies of the extent of the damage and more importantly the expected restoration time; and
- The tools required for managing logistics and sourcing additional repair resources to match the level of damage.

2.1.2 Organization (Roles and Responsibilities)

Essential to the timely restoration of service is a well-defined emergency restoration organization that defines:

- Critical management positions with their attendant qualifications, responsibilities and authorities;
- Policies to govern the restoration effort;
- Processes for managing, directing and implementing restoration activities;
- Clearly defined functions which support the processes;
- Prioritization of restoration activities down to the service level categories;
- Required skills for critical positions and training;
- Resource call out lists; and
- Critical check lists used as reminders for each position identified.

2.1.3 Plan Execution (including event plan, assessment, tactical plan, dispatch, restoration, verification, communications and support services).

Defines how the utility will conduct the restoration efforts, including:

- Weather forecasting and the determination of the level of storm for early and continuing customer communications;
- Emergency Operations Center (EOC) mobilization;
- Service center mobilization;
- Crew & material staging area mobilization;
- Logistics mobilization;

- Damage assessment;
- Work prioritization;
- Area tactical plan;
- Resource dispatching;
- Management of the physical T&D facilities restoration;
- Progress reporting;
- Customer communications;
- Coordination with governmental agencies at the local, state and federal levels;
- Post storm review; and
- Coordination with public agencies.

2.1.4 Systems and Services

Underpinning the entire effort from event initiation through post event review is the integration of critical support systems including:

- The customer information system used to capture and communicate specific outage data at the customer level;
- Customer contact applications and enablers: Integrated Voice Response Unit (IVRU) and web;
- Outage management system (OMS) designed to map individual customer outages to a physical representation of the distribution system and provide critical information on the size and nature of the event;
- Supervisory control & data acquisition (SCADA) system, provides information on the state of the transmission and distribution (T&D) systems and in some cases allows physical control of critical T&D components;
- Workforce management system (WFM) facilitates the movement and tracking of materials and personnel;
- Mobile workforce management system (MWF) provides mobile, automated dispatch and work ticket capability for field forces;
- Advanced metering infrastructure (AMI) facilitates meter reading and the determination of whether a customer receiving power;
- Energy management system (EMS) used for load flows and management of switching orders and clearances; and
- Outage dashboard used to update all parties including executive management on the restoration progress.

3. PSE Storm Event of December 14-15, 2006

The windstorm of December 14-15, 2006 was the strongest storm to hit western Washington since 1993. PSE's service territory took a direct and sustained hit, which put a significant strain on many utility resources. Several factors led to this windstorm becoming the Pacific Northwest's most damaging storm in 15 years – one that caused the most damage ever sustained by electric infrastructure of PSE.

3.1 The windstorm was the fourth most severe storm on record in the Seattle area.

The December storm followed only the storms of December 1951 (no name), October 1962 ("Columbus Day"), and January 1993 ("Inauguration Day") in highest recorded wind gusts. As shown in Exhibit 3-1:, the December 2006 storm had wind gusts recorded at 69 miles per hour at SeaTac early the morning of December 15. It is believed that the highest gusts for this storm were not recorded due to reporting outages at some stations.

Exhibit 3-1: Puget Lowland Peak Gusts, 14-15 December 2006 (in mph)[1]

Location	Direction	Speed	Time
Olympia	190	53	23:44
Shelton	210	55	15:54
Tacoma	210	68	23:33
SeaTac	220	69	00:44
Renton	180	51	00:40
Boeing Field	190	56	01:24
Everett	180	66	22:46
Arlington	190	45	22:55
Navy Whidbey	250	69	02:17
Friday Harbor	220	60	02:24
Bellingham	160	55	23:49

[1] Website of Wolf Read, Oregon State University, "The Storm King", http://oregonstate.edu/~readw/December2006.html

3.2 Record rainfall in November and early December created soil conditions that compounded the effect of high wind on vegetation.

November in the Seattle area was the wettest month on record with rainfall totaling 15.63 inches. The wet conditions continued into the month of December with a total of 3.52 inches of rainfall between December 1 and the onset of the storm on December 14.[2] The storm also had heavy moisture content and delivered nearly an inch of rain in one hour during the afternoon of December 14.

The wet conditions resulted in soil saturation that significantly reduced the soil adhesion to tree roots and considerably weakened the ability of large trees to withstand high winds for sustained periods. The storm therefore was able to uproot many large trees, which damaged many T&D structures and facilities, including power lines and their support structures. In addition, the storm resulted in 30 natural gas line breaks caused by uprooted trees.

3.3 The storm's slow pace exposed vegetation to strong winds for a long period, resulting in heavy damage and delays in the initial damage assessment and initiation of restoration efforts.

As shown in Exhibit 3-2, the Puget Sound area was exposed to storm force winds for more than 24 hours. Unlike many Pacific Northwest windstorms, which pass relatively quickly, this system moved slowly through the area and lost little or no intensity as passed through the PSE service territory. The event's extended duration increased both the rainfall and amount of time vegetation was exposed to strong winds.

[2] National Weather Service Forecast Office, Seattle, WA; http://www.weather.gov/climate/

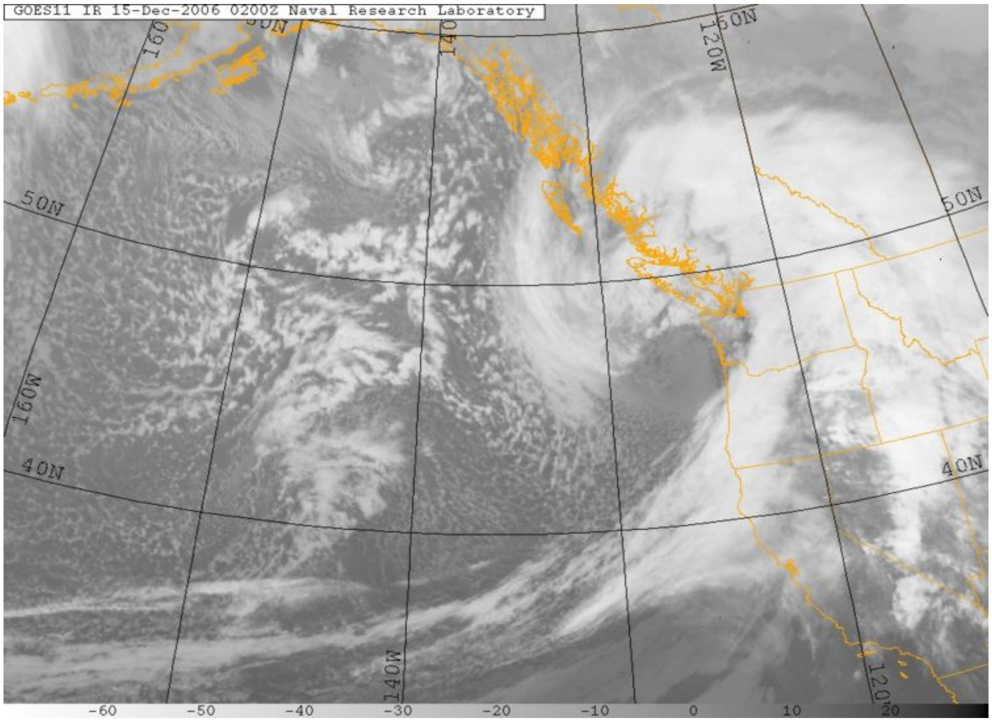
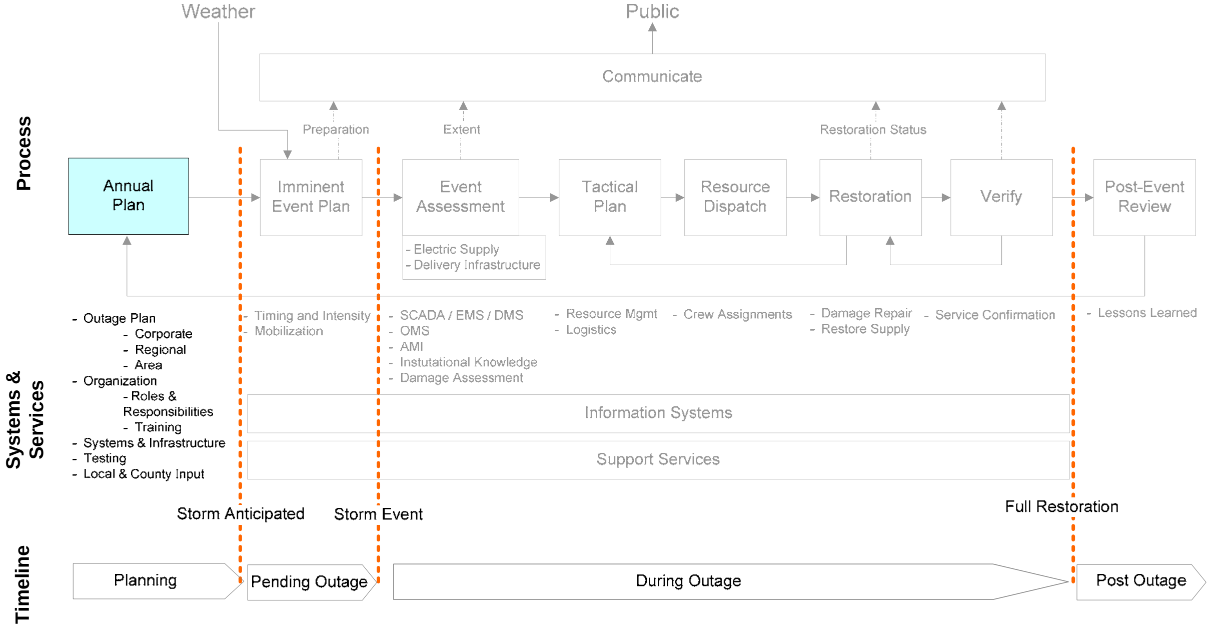


Exhibit 3-2: December 15, 2006 Storm System[3]

[3] National Oceanic Atmospheric Administration (NOAA)

4. Emergency Restoration – Annual Planning

A comprehensive ability to respond to any type of emergency begins with capability planning. In the electric utility industry, a common emergency situation is system damage due to a weather event. The ability to respond efficiently and effectively to widespread system outages is a direct result of comprehensive planning and training for such an event.



4.1 Industry Practices

Throughout the utility industry, companies routinely review and update emergency response plans on at least an annual basis. Depending upon the type of emergency situations to be handled, annual planning may involve detailed personnel training and drills with emergency simulations. Annual planning includes the review and incorporation of improvements resulting from previous event experience as well as from the experience of other companies as learned through various industry committees and working groups.

4.2 PSE Practices

Consistent with industry practice, PSE modifies and updates the CERP on at least an annual cycle. Lessons learned from events during the previous cycle, as well as potential improvements from other drivers, are incorporated as improvements in the CERP.

The Corporate Emergency Response Plan (CERP) works well for small and mid-sized storms, but was overwhelmed by the major storm of December 14-15. The following four conclusions where reached with respect to the overall plan:

- The PSE CERP is intended to provide a uniform approach for responding to any emergency;
- The application and execution of the CERP is not fully institutionalized within PSE and Potelco;
- The stewardship of the CERP is well managed and executed, though some parts of the organization perceive the effort as merely corporate bureaucracy; and
- Operations Base execution is very much a function of the local individual Potelco and PSE leaders. This extends to both the overall operation of the storm board activity and effectiveness of coordination between Potelco and PSE resources in the field.

4.3 Conclusions

4.3.1 The PSE CERP is intended to provide a uniform approach for responding to any emergency.

The intent of the plan is to define consistent emergency procedures for the company which should translate to an appearance of consistency and uniformity to the public. As written, the Plan clearly defines the roles and responsibilities of personnel and leaves specific actions to the individuals. The plan outlines the following specific guiding principles for the Company actions:

- Treat all customers, PSE and contract personnel with consideration and respect;
- Assess damage and relay information promptly;
- Ensure employee and public safety; and
- Maintain environmental stewardship.

The primary role of EOC is (and should be) to support and coordinate overall restoration activity in the field. Those interviewed for this report generally felt these functions were performed well in the December event with some process alteration as time passed.

4.3.2 The stewardship of the emergency response plan is well-managed and executed; however, some parts of the organization perceive the effort as corporate bureaucracy.

As outlined above, the CERP is managed by a central organization capable and knowledgeable of emergency planning. Other corporate organizations as well as field operations appear to understand the plan and its outlined roles and responsibilities. At the same time, some departments appear to view the emergency plan as a corporate exercise that is to be acknowledged by all involved, but that the responsibility and ownership for the plan and all it entails belongs to the administering organization.

After the utility has defined the emergency response roles required, the employees and service providers designated must receive appropriate training. Because emergency response roles may be different from normal assignments, training is important.

4.3.3 The application and execution of the CERP is not fully institutionalized within PSE and Potelco.

It is the responsibility of the PSE operations continuity organization to provide the overall corporate framework and plan for emergency response. This activity is consistent with utility leading practices throughout the industry. Utility companies generally have a central coordination and administration unit for emergency planning.

The ultimate execution of restoration activity under the CERP is, however, the responsibility of the line organizations in the field. The corporate organization responsibility is the coordination of the emergency restoration plan. For restoration planning activity to be accepted and adopted by the field organization, there must be accountability and the expectation that certain local planning elements will be addressed by local operations personnel. The PSE emergency plan appears to be well understood by the personnel with defined EOC roles and responsibilities. The further operations are removed from the EOC organization the more the operations become a function of local management style, experience, practices and preferences.[4]

4.3.4 Emergency response roles are defined but the process needs to be refined.

Assigning employees to a specific emergency response role based on their knowledge and expertise ensures those employees can be trained, equipped and counted on to be available to perform that role when requested. During this restoration, many PSE employees appear to have assigned themselves to emergency response roles based on their own perceptions of resource needs.[5,6] Matching skills to position requirements is becoming more difficult due to retirements and other attrition; skill-matching in this emergency was sub-optimal.[7] While Community Relations Managers (CRM) have defined emergency response restoration roles, many of their direct reports, who have specific skills and experience, are unaware of their roles.[8] PSE/ employees consistently refer to people by name, rather than their emergency response roles, when explaining processes and results.

4.3.5 PSE's CERP organization is consistent with leading practices found in the electric utility industry.

The leading practice in the electric utility industry is to have a formal emergency restoration organization defined with the key positions fully identified and their respective roles, responsibilities and authorities defined. This organization is designed to go into effect as soon as certain threshold conditions are met. At that point, key positions are staffed within a short period of time and the call out for the critical skills begins.

[4] KEMA Interviews RG03; WS/HS08; WLS05
[5] KEMA Interview JEC08, KEMA Interview HS13
[6] KEMA Interview RG13
[7] KEMA Interview RG12
[8] KEMA Interview JEC01

Generally these organizations are led by the Emergency Operations Center (EOC). Some utilities have begun to adopt the Incident Command Structure (ICS), created by the federal government. The ICS differs from the EOC in that for any size event there is an Incident Commander, whereas the EOC is generally reserved for the larger or complex events. Either approach works well.

A well-designed emergency organization will have the following elements clearly defined:

- Command structure;
- Critical positions;
- Master personnel roster with backups identified;
- A formal process communicating critical restoration information;
- Mobilization and demobilization triggers;
- A group to develop the restoration strategy;
- A group(s) to manage and direct the physical restoration efforts;
- Personnel assigned to managing:
    - Staging resources;
    - Accommodations to rest crews;
    - Feeding crews;
    - Guiding foreign crews;
- Checklists for each position identified in the plan delineating their responsibilities;
- Personnel and support systems dedicated to providing timely information to the various stakeholders; and
- Liaisons identified to work with government agencies and other first responder organizations.

PSE has a well-developed restoration organization. There are primarily two levels, the EOC and the Storm Base. The EOC is the strategic and leadership group for the restoration effort and is co-located with the Electric System Operations and the Load Center. Strategy execution occurs at the nine Operations Bases, which are staffed by PSE and Potelco operations personnel.

The PSE EOC is the nerve center of the operation where the restoration strategy is set and additional resources are identified and contacted. The EOC is responsible through its media staff to craft the messages given to all the stakeholders. The EOC personnel are responsible for interpreting the CERP to adapt to changing conditions during the event. Exhibit 4-1 shows the PSE CERP organization. The boxes to the right show the key department managers that have a significant role in storm restoration.

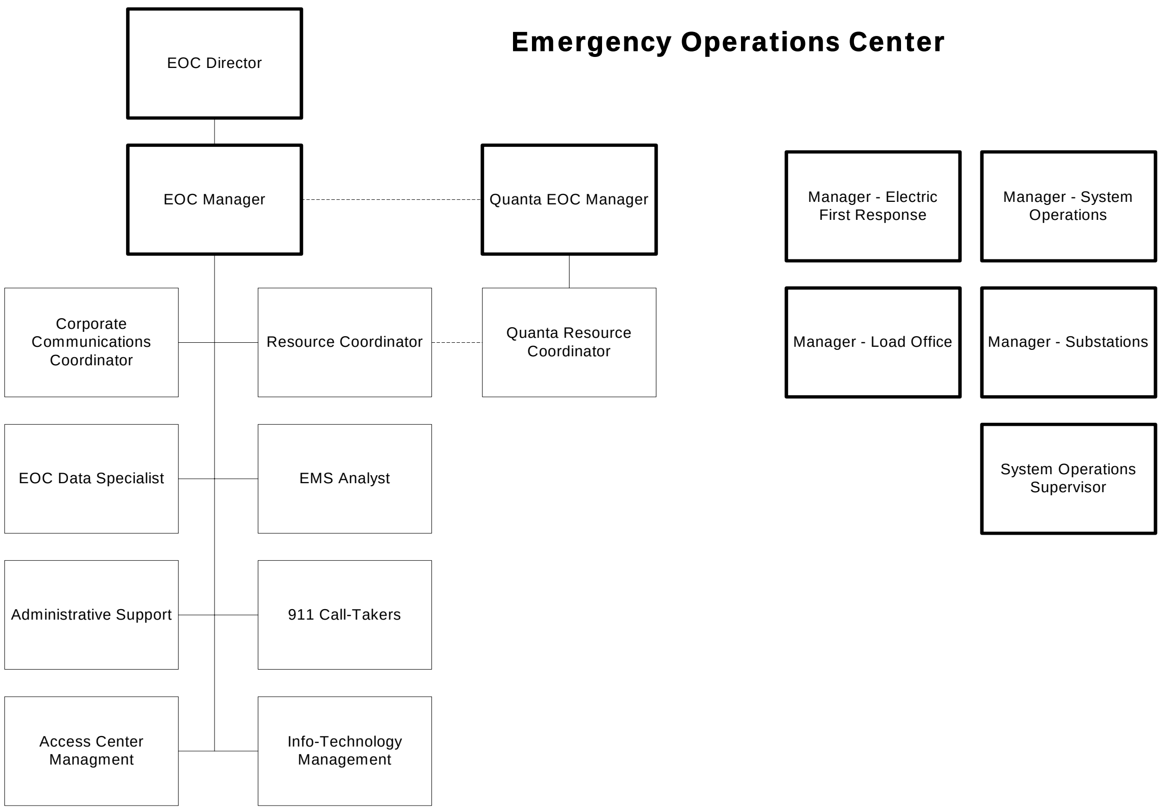


Exhibit 4-1: CERP Emergency Organization

Exhibit 4-2 shows the key positions for a typical Operations Base.

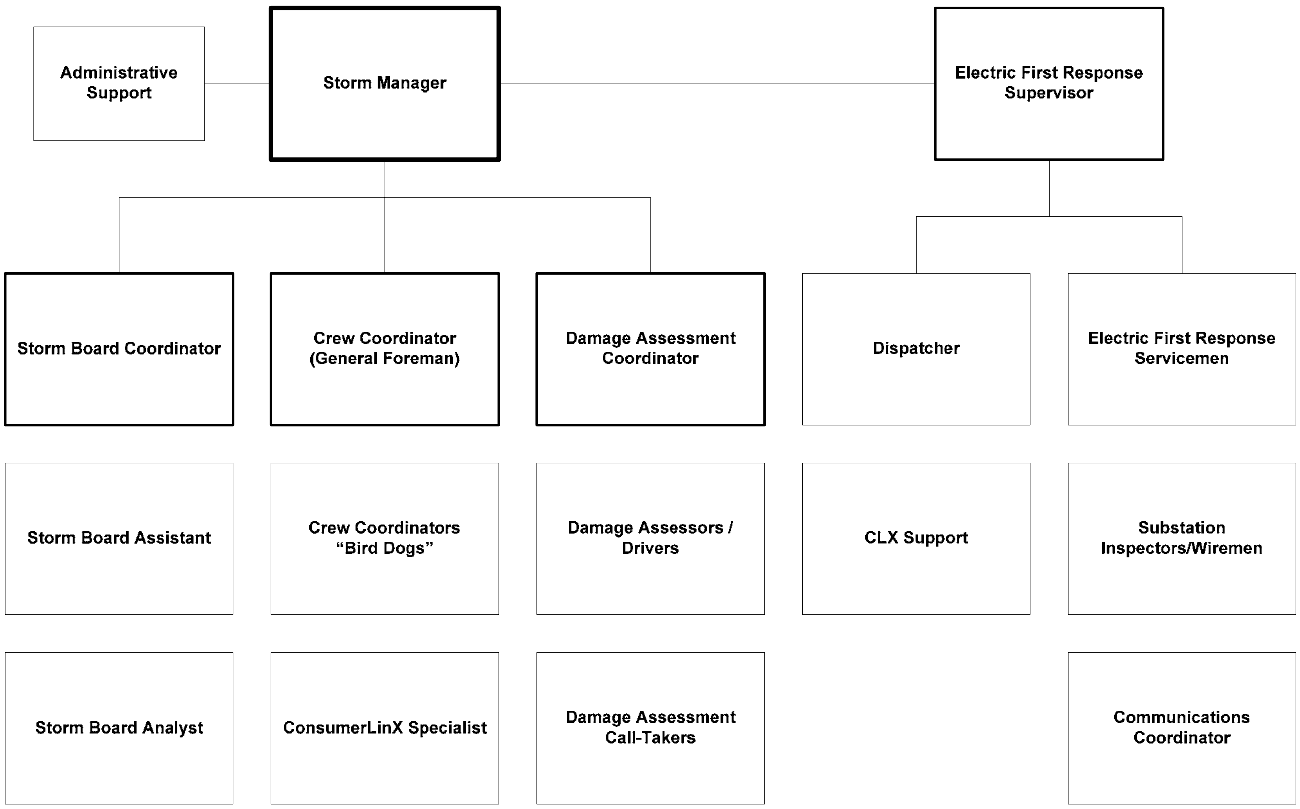


Exhibit 4-2: Operating Base Organization

Position descriptions and training requirements for the positions shown in Exhibit 4-1 and Exhibit 4-2 are found in Appendix B. A clear set of qualifications has not been identified for each position in the storm restoration organization.

4.3.6 During the storm, effectiveness of Operations Base management was impacted by the magnitude of the damage in their area of responsibility, but PSE quickly adjusted its plan.

In today's electric utilities, KEMA is seeing that there are fewer Operations Bases staffed by fewer people, covering a greater territory. During normal operations this is a cost effective structure; however, during storms of this magnitude, it will stretch the best of the operating organizations as the damage is highly dispersed.

Some utilities will further divide their operating centers into smaller units to provide more local control over smaller areas. This approach ensures that smaller communities are not forgotten during a restoration effort and permits the required focused attention.

KEMA did see evidence that the bases generally functioned well in their storm roles, but that the geographic areas covered was excessive in several cases. For the small and mid-sized storms impacting localized areas, the current operation base configuration works well. However, with the wide spread damage received in the December storm, PSE took the initiative to create smaller more workable area coordination centers for several key areas that were hard hit by the storm. This concept is very appropriate for PSE, which serves several semi-isolated islands. In addition, they created a transmission restoration priority coordination group to manage the entire transmission line restoration effort. In essence one person or a small group of personnel were assigned a specific geographic area of responsibility. Crews were then assigned to this area coordination and took on the full restoration within the area.

4.3.7 PSE adapted to the unique challenges very well.

Critical to any utility's successful restoration effort is the ability of the personnel and management team to adapt to the situation presented to them.

PSE did an excellent job of identifying CERP's shortcomings and overcoming each with a modification to the plan or process. Several examples include:

- The creation of the area coordination centers discussed in the previous section;
- The escalated call handling situation, which required developing a process, identification of resources and the training of those resources;
- Adopting a more robust materials resupply process which got extraordinary quantities of materials to the crews in a very timely fashion;
- The increased logistical effort to house 500 crews when many of the hotels were already booked by locals;
- As areas were being completed, the resources were quickly moved to support other areas in need;
- The formation of a separate transmission group at the EOC to focus exclusively on the repair of the severely crippled transmission system;
- The division of normal crews to support the foreign line crews brought in to fix the heavily damaged distribution system; and

- The overall resilience of all the PSE and Potelco personnel to adjust to continually changing needs by performing additional roles that they hadn't previously performed.

It is this ability to change combined with the spirit and dedication of the PSE and Potelco people that allowed the restoration to be completed as quickly as it was under serious physical conditions and information constraints.

4.3.8 Training is a critical component of an emergency restoration plan.

The majority of utilities provide training to assigned emergency response personnel. This training can take many different forms, including but not limited to classroom, tabletop and field exercises. A significant number of utilities capture these costs in their annual budgeting and accounting processes. KEMA concurs with this leading practice to training, but would also recommend that training evaluation be added. To have a solid training program, there should be some form of evaluation attached. To ensure that training is effective, participation is measured and analyzed and the skills to be acquired and/or maintained are tested during and after the emergency response role training.

Because emergency response roles may be different from normal assignments, training is important. Because emergency response roles are assumed on short notice and with limited time for preparation, checklists, supporting technology, and other tools and aids should be available for employees.

4.3.9 PSE has a formal damage assessor training program, but it did not provide the number of qualified assessors required for an event of this magnitude.

Well-qualified damage assessors are critical to any storm plan and restoration efforts. The practice of using trained damage assessors is considered a leading practice in the utility industry. Training programs are generally designed to provide the damage assessor with the tools required to adequately describe the damage so appropriate crews and materials can be assigned for repairs. At leading utilities, damage assessors are pre-selected based on their knowledge of the system and geography. Many utilities budget for the training, which is often mandatory.

PSE's service provider arrangement provides that Potelco is responsible for coordinating damage assessment through the allocation of its damage assessment teams and requesting assistance from PSE for circuit patrol and other damage assessment as required. For normal storms experienced by PSE, this process works very well. However, the magnitude of the December 14-15 storm was so great that it completely exhausted available damage assessors at both Potelco and PSE. This situation required PSE to reach deeper into its ranks for damage assessors who had less T&D and geographical system experience. The lack of trained damage assessors further slowed the damage assessment.

PSE has developed a four-hour annual training program to prepare damage assessors. Generally, the training was developed for individuals with a reasonable understanding of the system.

The training program covers the following topics:[9]

- Establishing the scope of a storm (short-lived or multi-day event) during the first six to 12 hours;
- Setting an initial target of 24 hours for a complete assessment;
- Defining the overall Electric Emergency Event Organization;
- Setting work and environmental expectations for the assessors;
- Defining proper damage assessment practices and procedures;
- Explaining the use of the damage assessment form;
- Reviewing use and terminology of overhead circuit maps;
- Using the storm damage tag;
- Reviewing the potential safety issues and how to deal with them in the field;
- Handling customer inquiries; and
- Reviewing general types of T&D equipment and structures.

There is no formal or informal means for evaluating how well the attendees learned the skills put forth in the class. Further, basic skill requirements for the damage assessor do not appear to be formally defined in any document.

4.3.10 PSE conducted damage assessment training just prior to the beginning of the storm season but attendance was low.

Utilities typically provide damage assessment training to ensure each assessor is fully prepared. The training stresses safety so that "hot" downed wires are properly partitioned off and the company is immediately notified of the public safety hazard.

PSE smartly arranges its training just prior to the storm season, during August and early September. For the 2006 season, seven training sessions were identified around the system. Approximately 124 PSE and Potelco personnel were identified for this training exercise, but only 49 or 40% of the identified personnel, attended.[10] The actual range of attendees actually participating in the training sessions ranged from 30% to 73%. For normal storm years, this would generally not be a problem. However, this performance may have impacted the number of qualified assessors available for the major storm on December 14-15.

4.3.11 PSE does not measure the effort devoted to emergency response planning and training.

You get what you measure. Unless training time and its costs are budgeted, other "measured" priorities will take precedence. Without proper training, restoration efficiency may be adversely impacted and incur higher costs.

[9] Source: D30
[10] Source: D30 KEMA & Analysis D30

Training is unbudgeted at PSE and Potelco and instead charged to overhead accounts, which can diminish training. [11,12] Specific examples and comments include:

- Electric first response dispatcher's emergency response role is learned on the job;[13]
- Better training needed for almost every position (System Operations);[14]
- No ability to familiarize damage assessor with area;[15]
- Damage assessor training sparsely attended;[16]
- Not clear on damage assessor training quality;[17] and
- Trained in a class specifically for 911 call takers by an instructor who walked everyone through the CLX recording process.[18]

4.3.12 New employees do not receive emergency response training at employee orientation.

Emergency response role training must be completed before the storm season for employees to be effective. Additionally, emergency response may be required outside of the normal storm season. Without training, a new employee has limited effectiveness during restoration. A specific example included: "I didn't have training beforehand as I'd just started two months before."[19]

4.3.13 PSE's CERP does not include checklists for before, during or after the emergency.

Checklists - whether manual or technology-based – are essential to confirming an emergency response role has been properly executed. Leading practices indicate that emergency restoration plans should include checklists for all jobs to serve as reminders of each position's responsibilities.

Emergency response role employees are asked to perform unusual tasks on short notice during periods of potential stress. A role-specific checklist ensures the employee completes all expected tasks, obtains all information needed or provides proper feedback to customers and other stakeholders.[20] A specific example includes: The back shift replacement for a Dispatcher was not trained in the reporting required, nor was the replacement aware of the specified emergency response role description. [21]

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[11] KEMA Interview HS06
[12] KEMA Interview RG03
[13] KEMA Interviews HS18 and HS19
[14] KEMA Interview HS08
[15] KEMA Interview HS12
[16] KEMA Interview HS13
[17] KEMA Interview HS16
[18] KEMA Interview JEC11
[19] KEMA Interview JEC15
[20] Review of CERP
[21] KEMA interview HS18

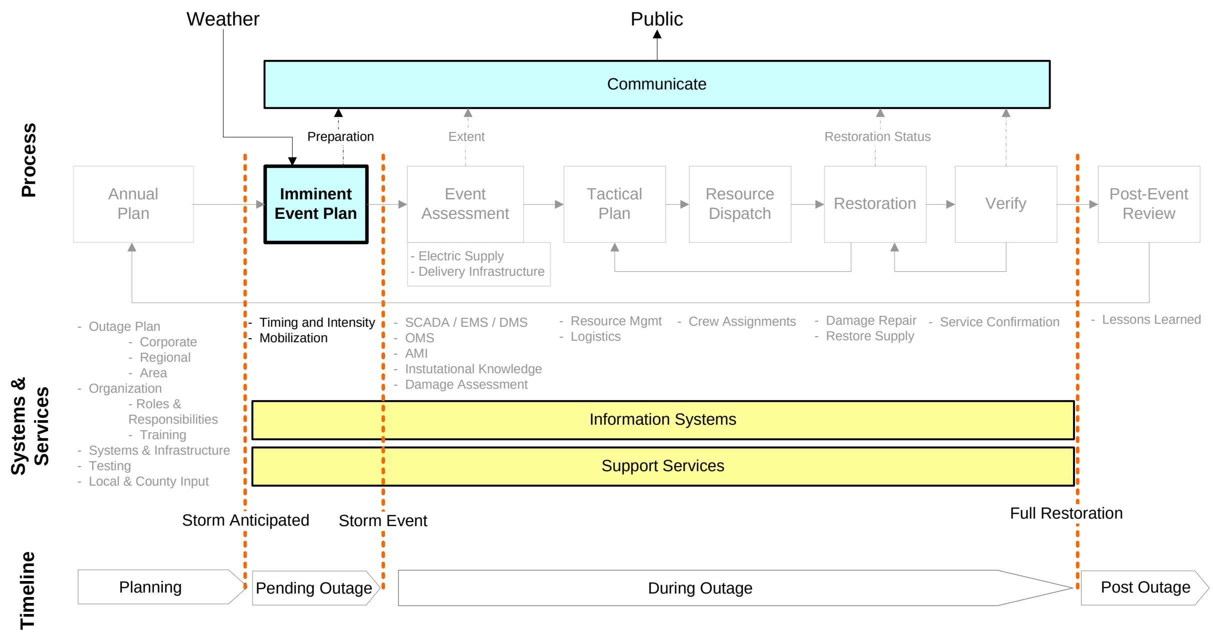
4.4 Recommendations

4.4.1 Expand the company emergency response capability through enhanced personnel utilization.

KEMA recommends the following actions:

- Enhance skill and process training for experienced and new employees;
- Provide detailed definition of ownership of responsibilities across positions ;
- Institute broader and more consistent participation of PSE representatives in local government emergency operations; and
- Develop succession plan for key positions.

5. Emergency Restoration – Imminent Event Plan



5.1 Industry Practices

Throughout the electric utility industry, companies have plans in place that detail when and to what extent that company's emergency response plan goes into effect. The first stage of the plan often is the advance planning and mobilization that occurs in anticipation of a specific event. The best example of this action is found in those companies that are exposed to tropical cyclones (tropical storms and hurricanes). Obviously there is much advance warning for storms of this nature that allows for mobilization on an escalating scale. As part of any emergency response plan, however, there must be detailed information on the various stages of planning and mobilization and the "triggers" for those stages. This early planning and mobilization is tailored to the company and the specific exposure it experiences. Whether the company is an area of exposure for hurricanes, tornadoes, earthquakes, sub-tropical storms, ice or wind will determine what the specific plans and triggers should be.

5.2 PSE Practices

Like other utilities, PSE practice in this area is driven by the amount of advance notice the company has of impending severe weather. PSE currently does not open the EOC until there is an event is progress, so the amount of specific event planning is minimal. However, within the CERP there are provisions for ongoing readiness for emergency response.

5.3 Conclusions

5.3.1 PSE estimated the impact of the storm and wisely held 145 crews that had been used in the prior storm.

PSE made a hard choice and assumed the cost and risk that the additional crews would be needed for restoration after the storm. The availability of the additional crews paid dividends by shortening the time necessary for the crews to arrive, ensuring that PSE would have the additional and rested crews at the beginning of the restoration.

5.3.2 PSE did not use its inherent knowledge and experience to convey to its customers an initial estimate of the restoration duration.

Some experienced PSE employees realized very early after the storm abated that system damage was extensive and the restoration would be protracted. As with many employees in the utility industry, there is a hesitancy to make an early restoration estimate for fear of being wrong. However it was clear to those experienced professionals that the restoration period would be five to seven or more days and this information was not communicated within PSE or communicated to PSE's customers.

5.3.3 PSE does not have a storm classification methodology to estimate storm impacts and resource requirements before and shortly after a major storm strikes.

PSE has a strong relationship with the National Weather Service and a deep institutional knowledge base that can serve as a basis for estimating the need for resources before a storm strikes when the weather service can forecast a storm in advance. A storm classification methodology also could provide PSE with initial information for its customers before damage assessment is completed. After the storm strikes the methodology may draw on PSE's SCADA, EMS and AMI systems to provide additional data to refine the early restoration estimate.

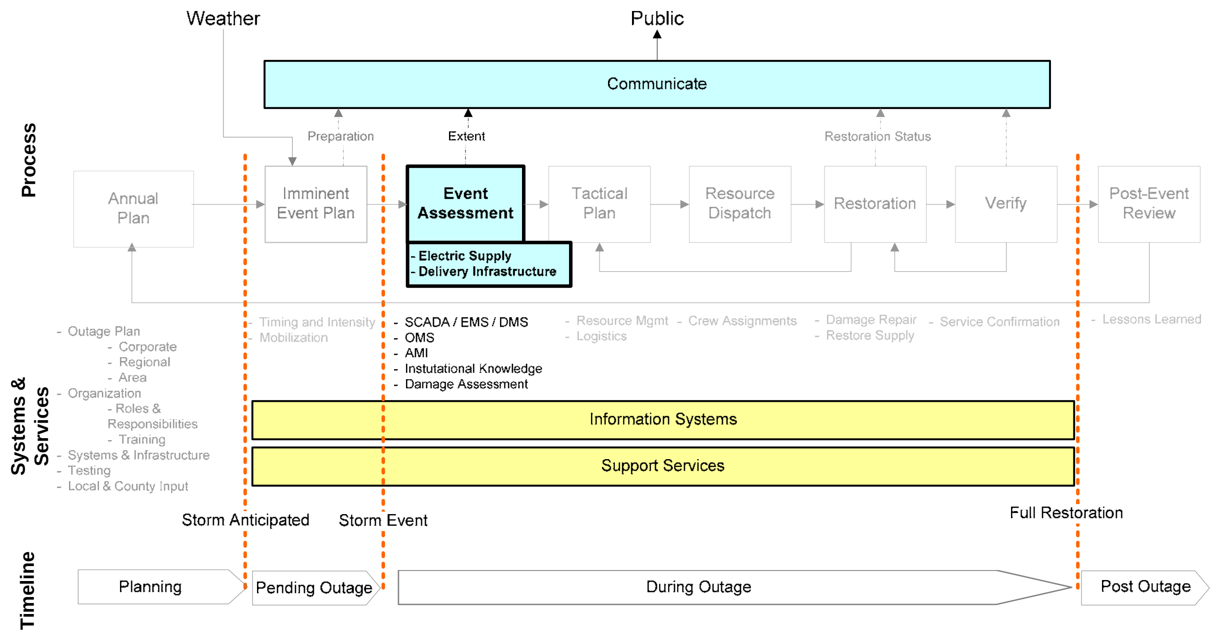
5.4 Recommendations

5.4.1 Develop a storm categorization methodology and tailor aspects of the CERP to the various levels of storms.

KEMA recommends:

- Build a database of historical storm data;
- Review and document historical damage by areas; and
- Document process for early storm restoration estimates based on immediately available information, historical data and personnel experience.

6. Emergency Restoration – Event Assessment



6.1 Industry Practices

The ability to quickly and accurately assess damage from a major event varies widely throughout the industry. Those companies on the leading edge of this process are equipped with technology that enables earlier decision making on what areas need the most attention, in terms of on-site assessment and overall extent of damage. In all companies, any technology used to facilitate this process is a tool to assist the early focus of the physical assessment process. Technology can also be used from the field assessors to build a database of number of sites requiring repair, materials and manpower estimates, and restoration estimates. Throughout the industry, however, this is largely a labor intensive process that requires smooth processes and focused response in order to provide early information for effective decisions on resource allocation.

6.2 PSE Practices

PSE's CERP defines responsibilities of several roles in the damage assessment process. As roles are staffed at Operations Bases, local management directs the damage assessors and the process to gather as much information as possible about the extent of storm damage. As outlined in the sections below, the assessment process can be better supported with technology and as discussed earlier in the report by increasing the number of adequately trained damage assessors.

6.3 Conclusions

6.3.1 Crew requirements estimation can be more effective by employing a consistent methodology used by all Operations Bases and the EOC.

There is no quantitative or documented method or guideline for estimating crew requirements. Estimates are based on experience and "feel" for the situation. Estimation of crew resources implicitly suggests an estimate of restoration time but no documentation or confirmation of that restoration estimate is made until crews are on site.[22]

Our interviews revealed that there is no formal basis for estimating restoration times or crew requirements. PSE's dependence upon field personnel's "experience and feel" is not uncommon in the industry. Without the aid of a restoration estimate, it is difficult for management to accurately quantify resource requirements other than adopting a default position of "get it done as quickly as possible with the resources available."

Even more challenging was the acquisition of additional personnel and resources, such as flagging crews, staging areas, shuttle transportation, and hotels. Consensus among operations personnel at both PSE and Potelco is that while additional line or tree crews could have helped to restore power more quickly, no resources were available to supply, house and manage additional crews.[23]

The storm's size and associated widespread damage strained the availability of PSE resources to support restoration. Because the storm covered virtually its entire territory, all local PSE and Potelco resources were needed in their base areas and therefore not available to be moved to other areas as would normally occur in smaller events. While off-system line and tree crews were acquired to supplement local resources, the option to bring other support services from outside the PSE territory was significantly limited by the availability of those resources and the related diminishing value gained through importing their services.

6.3.2 There is a formal damage assessment process, but it did not scale sufficiently to provide adequate and timely information to management during the December 14-15 storm.

Damage assessment is critical to any storm restoration program. The purpose of damage assessment is to provide management with a clear picture of the damage level to T&D assets. From this picture, management can determine the necessary materials and number and types of crews, as well as restoration times.

Contrary to popular belief, the damage assessment does not determine the initial restoration time; a full damage assessment usually takes several days to complete, depending on access to damaged areas, number of damage assessor teams and damage extent.

[22] KEMA Interviews RG02-RG05
23 KEMA Interviews RG02RG01

Generally, the storm magnitude and personnel experience is relied on to determine the initial estimate of restoration for a major storm affecting at least half of customers.

PSE has a damage assessment process and tool. Management selects individuals to be damage assessors and provides each assessor four hours of training.[24] At the Operations Base, assessors are paired with a driver. The driver frees the assessor to concentrate on damage evaluation and reporting.

Each assessor regularly reports damage to damage assessment coordinators at the Storm Board and completes damage assessment forms for each instance. Results are recorded on the Storm Board and in ConsumerLinX (CLX), the PSE customer information system.

The Storm Board graphically depicts circuits and roads. The Storm Board Coordinator records the damage on the appropriate circuit and assigns an event number. As crews are assigned, their names are tied to the event number. This part of the process provides the Operations Base management personnel with a dynamic picture of the level of damage accruing and the crews assigned. This information tends to remain at the Operations Base, though the reason for this is unclear. Compounding this situation is the fact that the foremen and crew coordinators do not consistently report progress to the Operations Base. This creates an incomplete picture of the restoration progress.

This damage assessment process works well for the small 30-hour or less events that PSE experiences several times a year. It does not scale well for extremely large events because of the following issues related to the process:

- There are not enough qualified damage assessors to complete the required assessments in the target time of 24 hours. In fact, for North King County, the assessment took more than a week to complete.[25]
- Damage assessors followed the process of calling in each event in a timely fashion and the damage assessment assistants entered the data directly into CLX; however, no one could possibly evaluate all the damage to develop a meaningful restoration time for that circuit's customers, nor could the EOC obtain a clear picture of the damage extent in any area based on the data contained in CLX.

6.3.3 Crew foremen provide direct feedback on the extent of repairs required and an estimated completion time; however, this completion time may not be the same as restoration time.

The Operations Base Managers KEMA interviewed indicated they prefer to obtain potential repair times from the crews assigned to making the specific repairs.[26] The Operations Base Managers said crew leaders/foremen are best positioned to determine the level of effort required to complete repairs. KEMA agrees with this opinion.

[24] Review and analysis D25, RG02, 03, 04, 05, 06, 07
[25] KEMA Interview RG06
[26] KEMA Interviews: BS08,RG03,08

When an assigned crew reaches the work site, they perform a quick analysis of what must be repaired and the time needed to complete the repairs. This information is radioed back to the Storm Board so the CLX specialist can enter it into the CLX. This information is critical to the Operations Base management because it indicates the necessary materials and an estimate of when the crew can accept more work. However, this information may not be as useful in determining the restoration of service time as there may be other problems both up and down stream that could prevent restoration to customers.

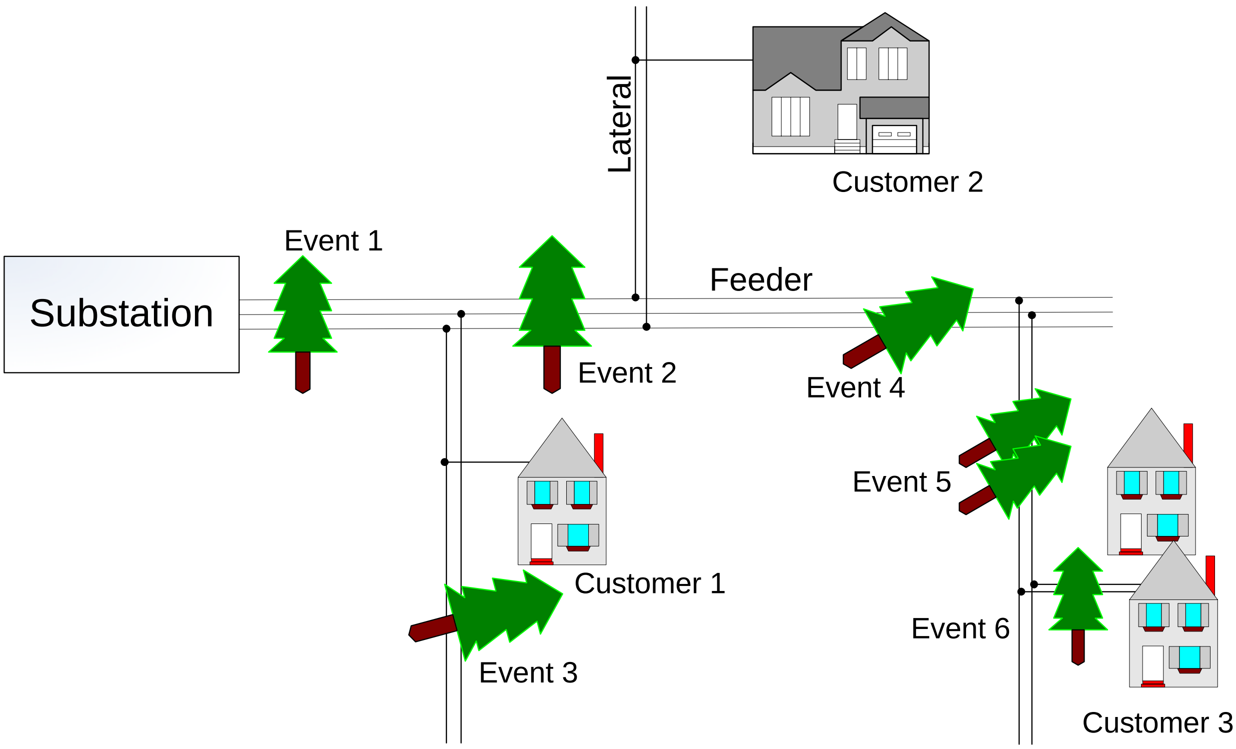


Exhibit 6-1: Outage Event Example

Exhibit 6-1 shows KEMA's reasoning for not equating restoration time with repair time. In this diagram, six emergency events (indicated by tree symbols) are identified on the feeder and its laterals and services.[27] Customer 1 may be associated with Event 1 in CLX. When Event 1 is repaired, Customer 1 is returned to service. In this case, restoration time equates to repair given by the crew. Customer 2 may also be associated with Event 1, but because of a second feeder event, the restoration time would be the sum of repairs for Events 1 and 2. Customer 3's restoration time will be the sum of Event repair times 1, 2, 4, 5 and 6. Compounding Customer 3's time is that its repairs cross from the feeder to the lateral and then the service; this means the actual repair time will be far greater than the simple sum previously stated. Repairs are done to Feeder (Event 1, 2 and 4), then the laterals (Event 5) and finally, the secondaries (Event 6).

[27] KEMA Review and analysis

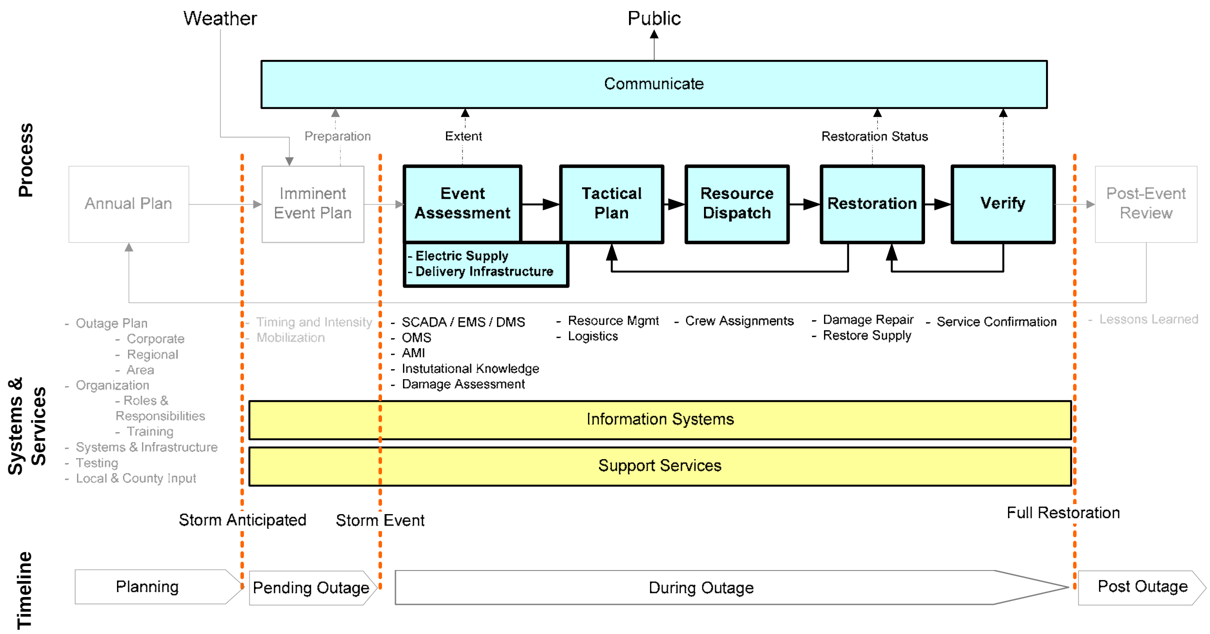
6.4 Recommendations

6.4.1 Enhance the damage assessment capability and process to provide better and faster estimates of restoration time and resource requirements.

KEMA recommends the following actions:

- Enhance Damage Assessor training through more detailed technical content, extended training time, and qualifications screening for participants;
- Revise the DA process to include specific methods for estimating restoration times and manpower requirements; and
- Formalize the information requirements and process for Damage Assessors in the field.

7. Emergency Restoration – Execution



7.1 Industry Practices

Reliable utility services (electric, gas and water) are essential to maintain our standard of living and provide the infrastructure for our advanced economy. Utility employees recognize their "public service" role and generally exhibit a strong sense of duty, timeliness, compassion and teamwork, which supports reliability. These attributes form the "utility culture." Consistently, the utility industry has seen increased levels of performance from its employees during the most adverse times and situations, such as outage events.

7.2 PSE Practices

PSE employees also exhibit a strong public service attitude in the execution of storm restoration duties. Unlike most other utility companies PSE depends upon a service provider arrangement with a contract company to execute much of the field operation associated with storm restoration. The service provider is an integral part of the PSE emergency restoration plan and process and the intent is for the separation of companies to be seamless to customers.

7.3 Conclusions

7.3.1 The event's scale and magnitude strained PSE's emergency response process.

PSE has a well-defined and documented emergency response plan that anticipates various types of events and disasters, and details specific response processes and responsibilities. The successful application of this plan to the first nine storms of 2006 proves its value. This storm, however, was the first extreme event to truly test the emergency plan, and the breakdown of some critical processes was evident. While the efforts of personnel often overcame process issues, the need for extra effort indicates that parts of the plan should be reviewed for potential improvement.[28]

7.3.2 As restoration time and external pressures increased, EOC processes and functions appeared to become more ad hoc.

Some management directives at EOC were initiated without knowledge of affected Operations Bases and personnel in those bases. The directives were apparently initiated as a response to pressure from external influences that created a sense of urgency among EOC management to take action.[29]

Adaptability and flexibility of EOC process and personnel was required due to the many new situations encountered in this storm event. Individual employees and small work groups pulled together to meet challenges. KEMA believes management rose to these challenges.

Initiation of the Transmission Restoration Team to coordinate transmission and substation outages was extremely effective and should be considered as an option whenever transmissions lines sustain significant damage.

The EOC formed similar local area coordination groups at the field level and those involved in this effort considered them successful. However, some operations base staff considered this interference by EOC that created additional work for the operations base. The overall concept of area coordination has support among many operations and management personnel, but this operational activity should be part of formal storm response planning instead of considered an "add-on."[30]

The EOC's expectations of the volume and detail of information from the field increased as each day passed. Company personnel felt an obligation to deliver more detail as restoration time increased.[31]

In any storm event, the public reasonably expects that the utility will have and relay better information about restoration time as each day passes. In this restoration effort, however, the quality of information did not appear to improve as time passed. The lack of information

[28] KEMA Interviews D25, 44-48, 51, 52
[29] KEMA Interview RG03, WLS08
[30] KEMA Interview WLS08, WLS02
[31] KEMA Interview RG03, WLS04, WLS05

systems that provide updated outage and restoration information create a need for manual information handling and in a multi-day event, the volume of information creates many opportunities for inefficient processing.

7.3.3 The number of crews and total restoration time was reasonable given the extent of damage and available tools to manage such an event.

PSE put forth an exceptional effort in repairing and restoring facilities during this event, which was greater than most current employees or area residents had ever experienced. By any standard, the overall level of effort and dedication was commendable.

Identification of the need for and acquisition of additional line crews from as well as other third parties was effective and appeared well-coordinated between PSE and Potelco personnel. At its peak, the restoration effort included more than 500 crews of various types.

PSE and Potelco at the EOC worked well together to identify additional crews and acquire these resources for the recovery. These efforts, however, are dependent upon estimates about overall damage and crew requirements from the Transmission Dispatchers, System Operations and field operations personnel. The lack of qualified damage assessors and information systems to support the outage management process hindered crew estimation. (These specific issues are discussed in detail in other areas of this report.)

7.3.4 In spite of the magnitude of the storm event, PSE employees overcame numerous obstacles to get the system working again.

The examples of many employees working well above expectations during the restoration are too numerous to catalog within this report. During the KEMA interview and review process, there was never any hint that PSE or Potelco employees lacked dedication to the restoration effort.

Many employees without formal assignments were pressed into service or volunteered their services. Training was expediently provided to give them the basics of their assigned tasks. A good example is the internal auditors assigned to the call center who began handling escalated calls with only two hours of training on the customer service system, referred to as CLX.

7.3.5 The dedication shown by employees and service providers was truly outstanding.

After completing their assigned tasks, many employees also quickly moved to support other tasks. Specific examples include:

- One employee worked 22 consecutive hours on the first day of the storm when, after completing her normal business function during the day, she volunteered to answer outage calls for an additional 12-hour shift;[32]

[32] KEMA Interview HS17

- One first responder was on vacation in Hawaii, but immediately returned to help;
- Employees were relieved of regular job assignments to volunteer for emergency response duty;[33]
- Other employees worked regular job assignments and volunteered for emergency response roles during the weekend;[34]
- Crews worked 18 hours per day;
- Excess food was donated to food banks;[35]
- Food and personal hygiene kits were delivered to crews and call center reps;
- Employees volunteered at Red Cross shelters; and
- Employees and PSE made charitable contributions to local shelters, non-profit organizations, and food banks.

7.3.6 Coordination of Operations Base activities and the EOC are sometimes strained and counterproductive.

In this event, EOC operational decisions were imposed upon Operations Base management. This is recognized as a sometimes necessary action; however, coordination with the local operations base should be an integral part of any such action. The Transmission Restoration Team exemplified effective coordination, while some local area coordination groups demonstrated less coordination.

As outlined in the following section, local leadership is critical for effective coordination. Official recognition of the roles and responsibilities of EOC and Operations Bases requires ongoing vigilance by all involved.

7.3.7 Operations Base effectiveness is generally determined by local Potelco and PSE leaders, which extends to overall operation of the storm board and effective coordination of resources in the field.

As with most companies, leadership skills and styles vary from organization to organization and from individual to individual. The ultimate measure of effectiveness is the manner in which goals are achieved within established corporate guidelines such as budget, customer satisfaction, employee satisfaction and schedules. In storm restoration the same principles apply but with a sense of increased urgency that requires strong leadership and consistent understanding throughout the organization of roles and responsibilities.

At PSE, some personnel have proven more effective in leading storm restoration operations than others. Often this effectiveness is a result of the individual's operational knowledge and their experience in these events. Both PSE and service provider personnel are capable of leading effective storm restoration. PSE is at risk of becoming more dependent on a service provider as much of the operational knowledge within PSE has been or will be lost due to

[33] KEMA Interview HS11
[34] KEMA Interview HS11
[35] KEMA Interview RG10

attrition and reduction of operational responsibilities. As operations have migrated to the service provider, so has PSE's knowledge and capabilities.

The service provider model has been successful for PSE and should continue to be so. A risk that arises from the model, however, is that it is unclear who owns the customer restoration effort in the field. In day-to-day business activities, issues are handled through mutual efforts of PSE and Potelco. In a storm restoration, however, resources are spread thin and the urgency of the situation requires immediate and decisive leadership. This requires that all Operations Base and EOC managers are well-versed in both storm restoration procedures and the chain of command that is ultimately accountable for all operational decisions. There cannot be ambiguity between PSE and Potelco management as to who is in charge and responsible for restoration at any location.[36]

7.3.8 The abundance and backlog of requests for clearances delayed crews in the initiation of repairs.

As during the normal course of business, crews are legally required to get clearances to work on circuits. These clearances help to ensure the safety of the crew working on a given line. In addition, clearances provide an effective means to exercise control of the system, which affects the configuration of the system at any given time. Clearances for the distribution system are issued by the operators in Electric System Operations. During storm emergencies, this practice is followed except in cases where the power on a lateral can only feed from one direction, in which case the crew can issue a self- clearance.

The clearance process is reasonably straight-forward. The crew leader or foremen requests a line or line segment clearance over the radio, which is the preferred means of communication as it allows other crews working in the area to hear the request. The Electric System Operator (ESO) for that region takes the call, repeats the information back to the leader or foremen to ensure accuracy of the request, and logs the information into the system and checks the circuit maps for clearance boundaries (switches or breakers) and issues the clearance. The ESO then enters the information into the written log. The foreman then physically locks out the breaker or switches and tags them appropriately. Upon completion, the same process is followed to release the clearance.

It was noted in several interviews that crews routinely waited upwards of two hours to obtain clearances before starting work.[37] This meant that four to eight people could not perform meaningful repairs until the clearance was obtained, thereby further delaying restoration. Further, PSE customers observing crews may believe the crews were simply not working.

7.3.9 Potelco crew members were wisely assigned to foreign crews to take clearances.

To ensure each crew had knowledge of switching and clearance processes, Potelco crew members were assigned to foreign crews as crew coordinators. This practice essentially

[36] KEMA Interviews: WS/HS08, WLS10
[37] KEMA Interviews: RG02, 03, 04, 06, 07, 08, 16, 19

reduced the number of Potelco crews available to do repairs. However, without this action, foreign crews would have been much less productive.

Without compromising safety, this enhanced the foreign crews' ability to work effectively on the PSE system with a higher level of efficiency than would otherwise be available.

7.4 Recommendations

7.4.1 Institute consistent accountability for executing the storm plan.

KEMA recommends the following actions:

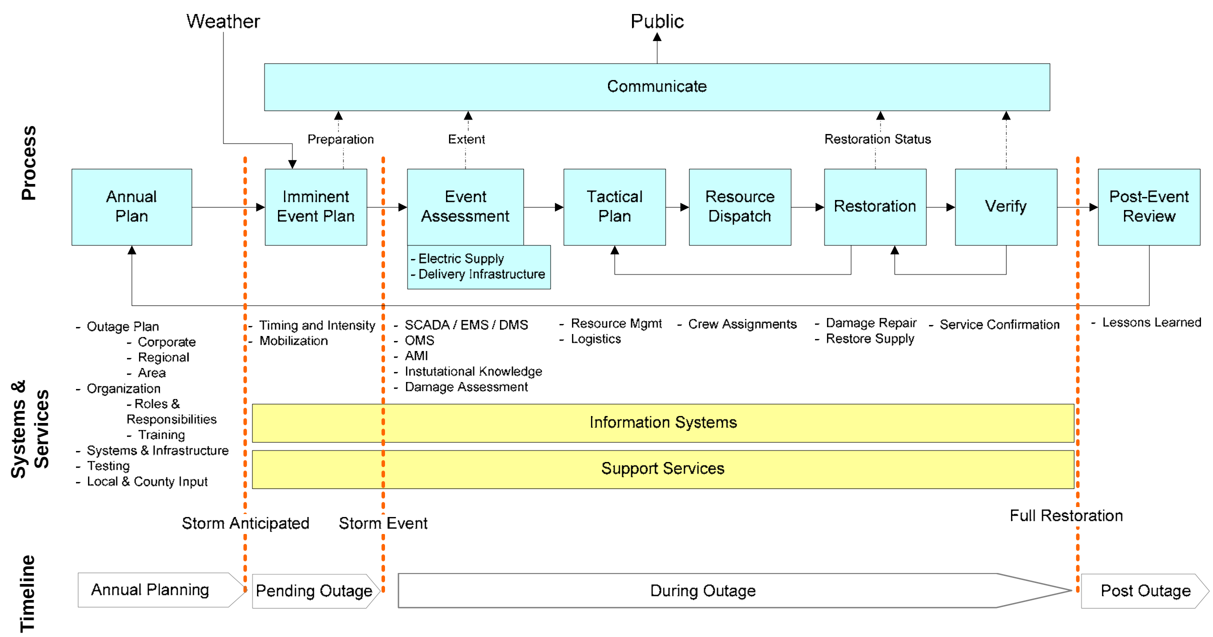
- Review documentation of operating base management process;
- Establish performance metrics; and
- Clarify roles of PSE and the service provider.

7.4.2 Formalize local area coordination and transmission restoration priority activities.

KEMA recommends PSE:

- Develop a local area coordination plan that:
  - Documents the necessary logistics issues and plans;
  - Establishes trigger points that launch the strategy; and
  - Develops appropriate clearance request and execution procedures.

8. Emergency Restoration – External Communications



8.1 Industry Practices

A typical utility's external communications function provides information to customers before, during and after outage events. External communications must also address the business community's needs to predict when service, and therefore, business, will be resumed. Government bodies such as local, county, state and regional authorities need restoration information to support public functions such as shelters, traffic control, food transportation and other essential public safety services such as healthcare and law enforcement. While it has similar functions as the call center, external communications is subject to customers' ability to receive TV, radio, print and internet media during outage events. Additionally, the media may act as a filter or interpreter, or even report news that dilutes the utility's intended message. Some utilities have messages pre-placed with radio stations to be played during storms to ensure the purity and clarity of its message gets to its customers.

8.2 PSE Practices

PSE has a well-designed communications plan and strategy for external communications during storm events. Coordination with operations management is regularly and timely in order to provide Corporate Communications with the necessary information for media and public messaging. PSE also has a Community Relations organization and a Major Accounts organization that are positioned to deliver messages and local information to affected major customers, communities and other governmental organizations during emergency events.

8.3 Conclusions

8.3.1 PSE provided consistent customer messages, but customers needed more localized information. The Community Relations Managers (CRM) took the initiative to find more specific information.

As detailed above, PSE did not move to regional/local restoration estimates until December 18. PSE employees, specifically the CRMs, filled the gap between corporate and local information needs by working directly with Operations Bases to develop specific restoration information for governmental customers.[38] This CRM role is detailed in the CERP. Some CRMs reported that PSE's Corporate Communications staff wanted to use a single company report for consistent messaging, but the CRMs knew the corporate message did not meet local needs.[39] Corporate Communications did not have the manpower to staff local Operations Bases therefore CRMs supported the corporate effort by engaging the local media when they visited Operations Bases to gather information.[40]

8.3.2 Instead of waiting for a definitive damage estimate, PSE should have communicated the severity of the outage to its customers sooner.

Lacking specific information to communicate the severity of the outage in terms such as the expected length of the restoration (number of days),[41] PSE added additional stress to its customers during the restoration.[42] Early in the process, experienced PSE personnel estimated complete restoration would take five to seven days or more. [43]

It is reasonable to expect that PSE's customers be told the potential extent of the storm event outage, even if a customer or area specific estimate cannot be provided early in the restoration process. This information would have allowed PSE customers to make better decisions about how to best cope with the outage. Their options included staying in place, moving to relatives or friends with utility service, moving to a motel or hotel, or leaving the area. The public is encouraged by PSE and government agencies to plan for self - sufficiency for up to 72 hours before governmental assistance is mobilized.[44] [45]

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[38] KEMA Interview JEC13, CERP page 60
[39] KEMA Interview JEC10
[40] KEMA Interview JEC14, CERP page 60
[41] KEMA Interview RG11
[42] KEMA Interview HS08
[43] KEMA Interview HS09
[44] The Washington Military Department's Emergency Management Division (EMD) discussed the importance of sound disaster recovery plans. The Division advised that citizens be prepared to be on their own for 72 hours, have a disaster kit, a disaster plan, and exercise the plan. - page 7 - Summary of the Public Workshop on Utility Preparation, Response, and Recovery from the December 2006 Wind Storm Docket No. U-070067

8.3.3 PSE's initial communications to customers lacked specificity and provided limited actionable information during the first three days of the restoration.

Providing actionable information is critical if the area government or utility expects customers to develop their own coping mechanisms for dealing with major outages. While PSE did provide frequent updates during the initial three days of the restoration process, its communications during that period did not use clear language nor provide a specific estimate of the number of days it may take to restore power. Instead terms such as "extended," "numerous," "several," "number of," "perhaps longer," and "likely longer" were used frequently in PSE messages to customers. A sample of these messages follows:

- On December 15, the sequential messages included:
  - "People should prepare themselves for the possibility of being without power for an extended period."
  - "We can't yet provide any reliable estimates on how long it will take to restore our customers' power. We do know, however, that it will take numerous days, perhaps a week or longer, to get all customers' service restored."
  - Later in the day communications highlighted the expected restoration in Bellevue, Olympia and Whidbey Island. "We encourage those still without power to spend the weekend with family or friends that do have service."
  - Even later the IVRU messaging changed to, "We expect that it will take several more days to restore power to all of our customers, especially those in rural areas."[46]
- On December 16, the sequential messages included:
  - "It's going to be a number of days yet before the lights are back on for all PSE customers affected by the massive storm."[47]
  - "…it's going to take several more days to get everyone's service restored."[48]
  - Later that same day "…it's going to take several more days – perhaps even longer in the very hard-hit areas - to get everyone's service restored."[49]
  - "…tomorrow and likely longer…"[50]
- On December 18, the sequential messages included:
  - "It's going to take several more days – perhaps even longer in the very hard-hit areas - to get everyone's service restored."
  - "…tomorrow and likely longer…"[51]

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[45] King County Emergency Management "three days, three ways" campaign – page 7 - Summary of the Public Workshop on Utility Preparation, Response, and Recovery from the December 2006 Wind Storm Docket No. U-070067
[46] Internal PSE E-mail message 9:03 PM 12/15/06
[47] PSE Windstorm Update/Key Message 5 AM 12/16/07
[48] PSE Windstorm Update/Key Message 9:30 AM 12/16/07
[49] PSE Windstorm Update/Key Message 4:30 PM 12/16/07
[50] PSE Windstorm Update/Key Message 9:00 PM 12/16/07
[51] PSE Windstorm Update/Key Message 5:00 PM 12/17/07

- On December 18, the IVRU began to provide region-specific restoration estimates referring to specific days of the week.[52] [53]

8.3.4 Early in the restoration, PSE had no plans to communicate with customers at company facilities, but it adjusted its communication protocol once the magnitude of the situation was understood.

To obtain restoration information, customers visited PSE's corporate office and Operations Bases, which were not initially staffed to handle "walk-in" communications. When customers resort to traveling to a utility location, it can be a signal that they have been frustrated by long communications delays, have no access to communications, or feel they cannot obtain needed information. Once PSE recognized that customers were traveling to Operations Bases and the corporate office, it placed laptop-equipped employees in position to take customer outage reports and provide restoration estimates, when available, to customers. PSE's response, which recognized that many customers lacked the expected telecommunications capability, was appropriate and necessary.

8.3.5 Responsibility for communication with critical customers, such as key customers, the media and municipalities, is assigned in the CERP to the communications coordinator, but that process was not consistently executed.

Municipalities need restoration information to plan and operate shelters, coordinate road clearing, and provide protection for persons and property. Other utilities (water and telecommunications) require restoration information to distribute or maintain emergency generation facilities, including fueling and restoring their systems. In its CERP, PSE defined the emergency response role of the Community Relations Managers as the Communications Coordinator working at the Operating Base.[54] The tasks assigned to the Communications Coordinator cover a wide range of assignments. Some CRMs chose to remain at the Operating Base to maximize their ability to obtain timely information,[55] while others chose to serve customers on-site or by telephone. The magnitude of the storm magnified the communications and PSE's messaging was not viewed as responsive or useful by some governmental stakeholders. Some examples:

- Public messaging not coordinated with Pierce County;[56]
- EOC official messaging not good enough for cities; and[57]
- Because of the extent of damage in King County, PSE management personnel manned the county's EOC during the event. This action was well-received by the County.[58]

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[52] PSE IVRU Programming 8:00 AM 12/18/06
[53] KEMA Interview HS10
[54] CERP pages 60 and 111
[55] KEMA Interview HS06
[56] KEMA Interview RG18
[57] KEMA Interview JEC01
[58] KEMA Interview: RG19

8.3.6 PSE did not use prepared or prepaid messages to convey information directly to customers and thus was subject to the media's discretion and editing of PSE's intended message.

Some utilities purchase radio airtime to ensure their exact messages are delivered at specified times. This can be accomplished by placing pre-recorded generic messages at radio stations and then updating those messages with specific information.

By relying on the media's discretion to transmit PSE's restoration messaging to customers, PSE created the possibility that it would lose control of its intended message. PSE did not use or consider this method of communicating with customers.[59]

8.3.7 Faced with limited information flow automation, PSE continued its practice of scheduled conference calls initiated by the EOC. However, more localized information was obtained by employees directly contacting the Operations Base.

PSE has limited systems capability to communicate the status of the emergency restoration process internally to its employees and Potelco. Therefore, PSE continued its practice of regularly scheduled conference calls initiated by the EOC.[60] These calls were designed to allow the interchange of information to a wide range of internal functions. The calls helped provide emergency restoration information, on a consistent basis, within PSE.[61]

The conference calls provided a wide range of information throughout the process. CRMs were able to obtain high level restoration status to assist their roles as Communications Coordinators and supplemented it with calls to Operations Bases.[62] The call center stationed an employee at the EOC to monitor the conference call and then follow up for further detailed information.[63] Major Accounts also utilized the EOC conference call to assemble information to respond to their customers, but needed to supplement the EOC conference call with calls directly to field personnel.[64]

8.4 Recommendations

8.4.1 Create an integrated corporate and local communication strategy that is scalable to storm severity.

PSE should have a communications strategy that scales to various levels of storm response. This strategy should also recognize the need for different messages and delivery across the service territory to address specific local situations.

[59] KEMA Interview HS10
[60] RG at 17 EOC Director Duties and Responsibilities
[61] KEMA Interview JEC16
[62] KEMA Interview JEC01 and JEC14
[63] KEMA Interview JEC04
[64] KEMA Interview JEC09

KEMA recommends that PSE:

- Create a communications plan that scales to the severity of a storm and:
  - Facilitates consistent messages;
  - Utilizes appropriate communications channels; and
  - Achieves customer accessibility.

9. Emergency Restoration – Customer Service

9.1 Industry Practices

The leading practice in electric utility customer service functions is to provide the first two-way communication with the customer before, during and after outage events. During an outage event, the call center's role shifts from its initial role of receiving outage information from its customers to providing restoration estimates designed to help customers cope with or react to the outage event. Near the expected end of the restoration period, the call center's call volume may shift to receiving outage information from individual customers still without power.

The customer service function includes the call center and its supporting technology. Generally, the supporting technology includes an automatic call director ("ACD"), an interactive voice response unit ("IVRU"), and the utility's network telecommunications provider's network ("cloud") and related contracted-for capabilities. Utilities typically use various customer service and/or outage reporting systems to manage interaction with customers.
The volume of calls received is dependent on the:

- Severity of the outage;
- Customers' emergency preparations;
- Quality of the utility's external communications;
- Visibility and progression of the restoration;
- Availability and accuracy of restoration estimates; and
- Customers' communications capability during the outage event.

The call center should have access to information requested by customers. During outages, customers want specific actionable information on which to make decisions. Each customer call that does not provide requested information will increase future call volume, as well as the frustration levels of customers and customer service representatives (CSR). At the same time, the utility may not have yet completed damage assessment or developed a specific restoration estimate for each area or outage.

9.2 PSE Practices

PSE's 200 seat call center is consistent with industry leading designs. The call center is fully equipped with an ACD and IVRU to support and augment the CSRs. The IVRU can handle an additional 300 calls simultaneously. The call center can provide two-way communication with the customer before, during and after outage events.

9.3 Conclusions

9.3.1 PSE call center technology is marginal for high-volume of calls during restoration effort.

Management of customer calls is critical to any utility's operations because customers generally call the utility to report outages and learn about restoration efforts. In most states, the Commission sets call center performance guidelines, and Washington is no exception. Various technologies can limit call center capabilities including:

- Number of work stations and incoming trunk lines;
- ACD and IVRU capacity; and
- Facility constraints such as lack of emergency generation.
-

During the storm, about 500 telephone trunk lines fed PSE's 200-seat call center. In theory, this means that the first 200 calls would go to the CSRs and the next 300 would initially go to the IVRU. Additional calls beyond the first 500 would be sent to the local carrier network cloud to be processed in a fashion similar to the IVRU. Other types of emergency calls would go to the next available agent. Exhibit 9-1 shows this flow. While this call routing capability gave the customer an answered call, it provided very limited customer information.

9.3.2 PSE augmented its call center staffing to handle inbound calls.

When faced with a significant increase in call volume, PSE's call center management developed a recruiting and training program to train and support over 200 additional call takers. This program included one to two hours of training for CLX data input and customer interaction.[65] The program was implemented at three different call center training sessions throughout the day to accommodate volunteer employees.[66] However, due to a lack of planning, too many people tried to organize or recruit non-call center staff and were doing so in an unorganized manner.[67]

[65] KEMA Interview RG14
[66] KEMA Interview JEC06
[67] KEMA Interview JEC06

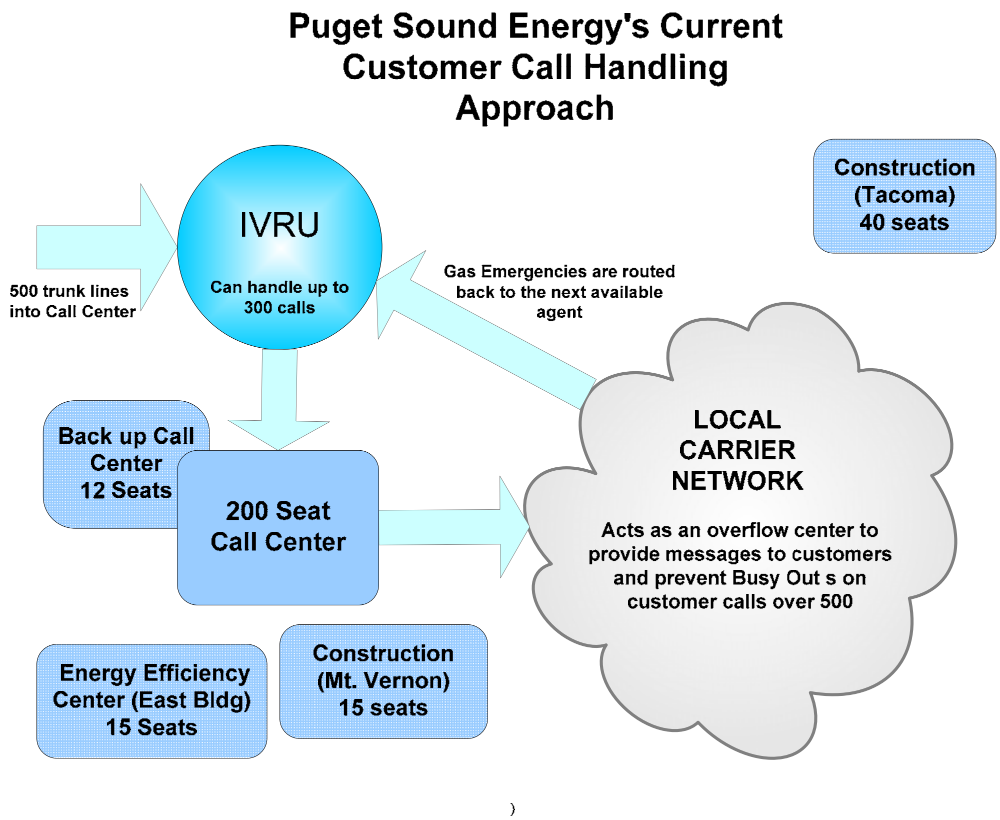

Exhibit 9-1: PSE Call Processing Approach

9.3.3 PSE provides customers with an easily memorized toll-free number.

The PSE telephone number (1-888-CALL-PSE) is simple and easy for customers to remember. However, the single number is available only in Washington State. For extended outages that require customers to relocate (such as a major earthquake), this will need to be adjusted.[68]

9.3.4 PSE maintained a way for customers to report natural gas leaks during the high electric outage call volume.

The utility must maintain a means of receiving all emergency calls, such as natural gas leaks, during periods of high call volume. PSE maintained a back door within its IVRU for customers to report gas leaks during periods of high call volume.[69] PSE's call center also used the local carrier network for customers to report gas leaks during periods of high call volume.[70]

68 KEMA Test 4/26/07
69 KEMA Interview HS14
70 KEMA Interview HS14

9.3.5 PSE's inbound network communications system does not differentiate by the geographic origination of a call; however, PSE's call center staff did develop regional restoration information and used the IVRU effectively to provide available restoration information to inbound-calling customers.

Network-based solutions can geographically prioritize calls by focusing on their automatic number identifier (ANI), which is transmitted in advance of the actual call by the telephone network, as a means to estimate geographic location, and then priority route to the utility's call center only calls from areas unaffected by the outage.[71] While this may seem counterintuitive, it offers advantages including routing gas leak and downed wire calls from lightly damaged areas, and recognizing individual outage calls that would be lost without geographic routing.

PSE's network does not differentiate calls based on their ANI. To mitigate this limitation, beginning on December 18, PSE's call center implemented IVRU messaging that allowed customers to select a location and receive an update.[72] Had geographical routing been available, PSE customers could have accessed the available (and potentially more accurate) restoration information for their area more rapidly.

9.3.6 PSE's inbound call system does not automatically generate individual restoration estimates.

Typically, utilities with fully effective outage management systems (OMS) can automatically determine if a customer's meter matches a specific outage report and then provide specific tailored outage status to each customer. This function can be operative within the utility's IVRU (as limited by trunk-line capacity) or implemented within the network for maximum volume.[73]

While CLX is designed to provide outage restoration estimates, the lack of restoration estimates, plus the many limitations of CLX and how it is utilized by PSE, preclude or negate the effective use of this capability. Additionally, as presently configured CLX is limited by trunk line capacity.

9.3.7 To respond to calls escalated from the call center and other sources, PSE developed an escalated call follow-up process.

As the restoration progressed, many customers requested escalation of their calls to PSE management. Faced with a number of escalated calls PSE developed a process to handle, review and respond to the calls.

[71] KEMA Principals' network experience
[72] KEMA Interview HS14
[73] KEMA Principals' Call Center Experience

The PSE employees assigned to answer escalated calls were recruited and received preliminary training. Their limited training included a focus on calming down customers and assuring them they had not been forgotten within the restoration process.[74]

Beginning on Day 5, PSE assigned 10 special field crews to escalated calls. These field crews performed special repairs such as removing downed wires from driveways to allow customers to safely leave their homes.[75]

9.3.8 Due to incomplete restoration information, CSRs could not provide many customers with timely and accurate restoration estimates.

CLX provides a means to record the outage status for an individual customer. The IVRU allows customers to self-report outages to PSE. A CSR or a customer using the IVRU can access restoration estimates if they have been entered into CLX.

However, it has been the practice at some Operations Bases to not enter a restoration estimate into CLX until a crew actually arrives on-site. This practice leads to two problems. First, the time entered by an on-site crew is not a restoration estimate, but an estimated repair time for that job. A restoration estimate is the sum of the repair time plus the time it will take to assign a crew, crew travel time and any delay time. Second, until the repair time is entered, the CSRs and the customer (through the IVRU) have no estimated restoration time.

The entry of data into CLX is also a source of delay. The required data is supplied by, and entered into CLX at the Operations Bases. Some Operations Bases did not keep the CLX data entry current as their presumed priority was customer restoration. However, this practice ignores PSE's and its customers' need for actionable information. Additionally, there is no direct audit function that tracks the entry and changes in the restoration time field in CLX. CLX has a comment field suitable for this purpose but it is generally not used, sometimes for lack of space.

Due to the magnitude of the damage including extensive transmission system impacts, restoration times were generally not provided in CLX for the first three to five days after the storm.

There are reports of initial restoration estimates in CLX being removed. While these removals may have be the result of a clear understanding that the initial estimates were not reasonable, a customer calling to confirm a previous estimate is effectively left with no actionable information and a distrust of all future estimates.

When the repairs are completed the original event in CLX is closed. If a customer also has a secondary source for the outage (example-service down) CLX could report the customer's outage as resolved even though the service is still down. (See Exhibit 6-1)

[74] KEMA Interview RG14
[75] KEMA Interview RG11 and RG15

9.4 Recommendations

9.4.1 Formalize a customer escalated call process.

KEMA recommends that PSE:

- Document escalated call processes established in December 2006 storm;
- Design logistics to support this process; and
- Design information flows to inform management of calls/responses.

9.4.2 Use local carrier phone network in front of CLX/IVRU to enhance call-taking capacity and capabilities.

Moving the local area communications network from the back-end of the call-taking process to the front-end allows PSE to handle a greater volume of calls. The increased call volume can then, through Automated Number Identification (ANI), have a unique restoration message while allowing non-electric and emergency gas calls to proceed to the call center. An added benefit to this configuration, as shown in Exhibit 9-2, is a potential reduction in the number of trunk lines coming into the call center.

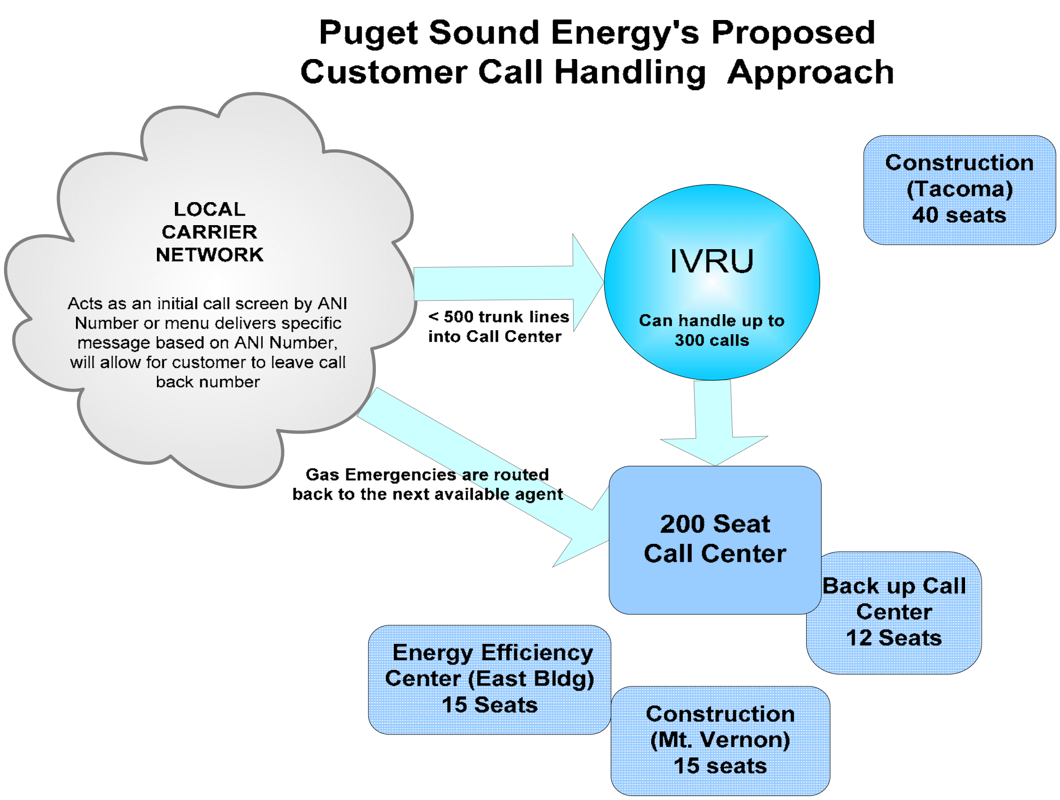

Exhibit 9-2: Using Local Carrier Network to augment call center capability

10. Emergency Restoration – Information Systems and Processes

10.1 Industry Practices

The diagram below illustrates a leading set of integrated information systems for supporting outage management processes.

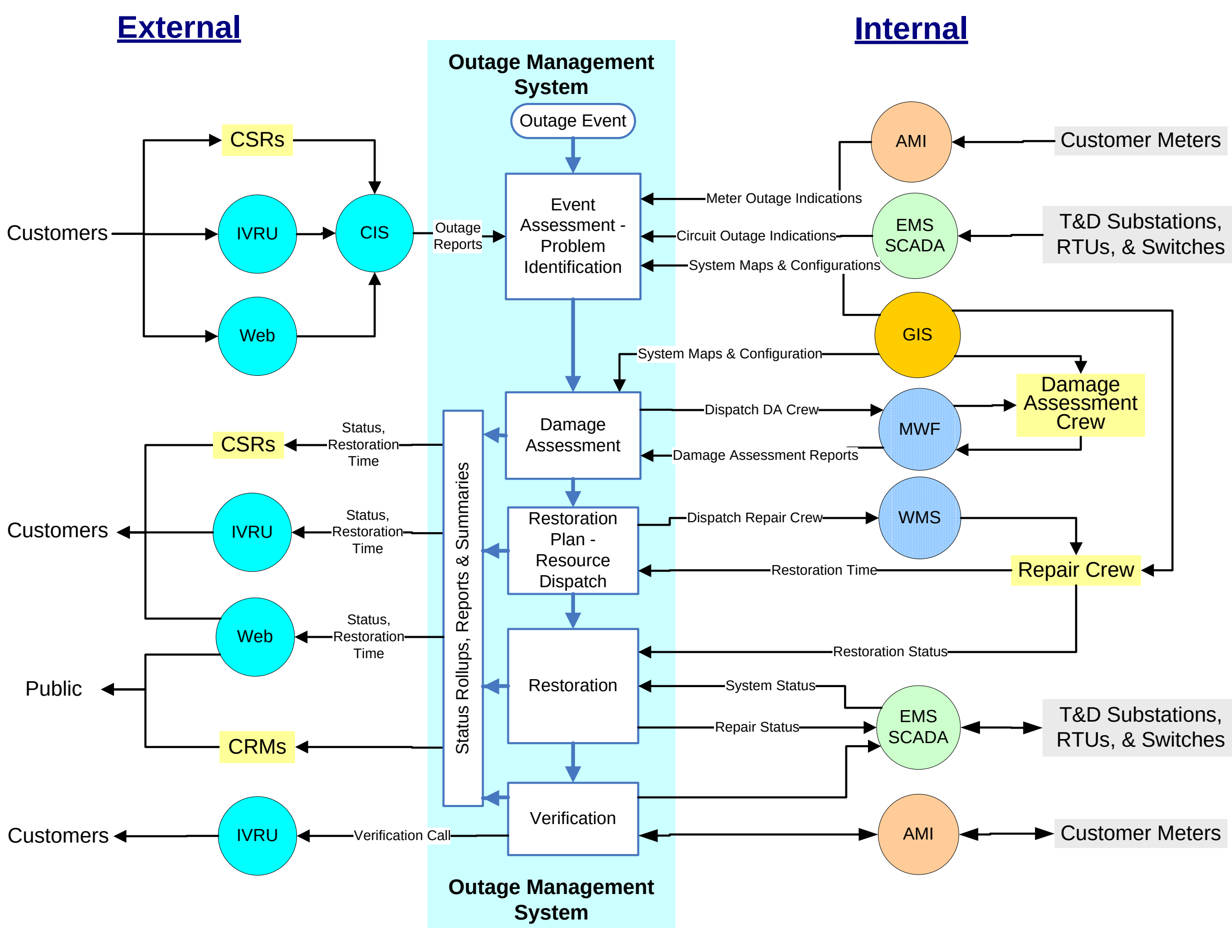

Exhibit 10-1: Leading Practice Integrated Information Systems for Outage Management Process

The key components of this solution include:

- **Customer Information System (CIS):** Managing information about customers, customer services, metering and billing, with supporting Interactive Voice Recognition unit (IVRU), web posting and other customer and public communications.

- **Outage Management System (OMS):** Managing trouble tickets, outage analysis and assessment, crew dispatch and restoration process.
- **Advanced Metering Infrastructure (AMI):** Automated meter reading, meter data management, meter "last gasp" outage reporting and processing, and automated remote interrogation (pinging) of meter for power restoration verification.
- **Systems Operations Supervisory Control & Data Acquisition (SCADA)**, Energy Management System (EMS) and Distribution Management System (DMS): Real-time monitoring of the electric transmission & distribution network, energy supply, equipment operating status, and remote switching and control.
- **Geographic Information System (GIS):** Detailed geographic mapping of utility transmission and distribution facilities and equipment, network connectivity, equipment information and field configuration.
- **Work Management System (WMS):** Work order processing and management, resource assignment, job status and completion tracking
- **Mobile Workforce Management (MWF):** Automates field crew operations with mobile workforce dispatch, scheduling and routing, remote electronic connectivity, and automatic vehicle location.
- **Interactive Voice Response Unit (IVRU):** In the context of outage management, the IVRU routes calls to CSRs and enables allows customers to self-report and receive outage information.

A leading OMS maintains an up-to-date distribution system connectivity model that reflects the current configuration of the electric system. Reported outages are analyzed against the system model compared to the current operating status of key equipment, e.g., substations, transformers, and switches.

A leading OMS has business rules that allow the efficient management of large scale outages and restoration efforts. Proper integration of key systems, including CIS, IVRU, EMS, and MWF significantly reduces the need for manual and redundant data entry, and allows efficient transfer of data to those who need it.

The SCADA/EMS systems supply valuable real-time information about operating conditions and system configuration. When combined with the OMS connectivity model, circuit outages can be quickly identified and outage reports mapped and analyzed.

A leading OMS provides a library of planned switching scenarios the switching coordinator uses to manage outages. Restoration procedures and processes can also be defined in the OMS to help with large-scale distribution outage restorations. The procedure defines the correct sequence of events to safely and effectively restore circuits. The sequencing is coordinated with the real-time system status from the EMS.

Integration between the OMS and a mobile workforce management (MWF) system allows dispatching of OMS analysis results to field personnel. Field information, such as outage validation, cause, and estimated time to restore are sent back electronically to the OMS, passing seamlessly to the CIS for call center notification and IVR message updates.

Integrating GIS to the OMS allows electric connectivity data to regularly pass to the OMS for developing the model that reflects the as-operated configuration of the electric system in the field.

A leading AMI system when integrated with OMS provides for automated reporting of customer outages using the "last gasp" capability of the meters. OMS can automatically determine if a customer's meter matches a specific outage report and then provide a specific outage status. This function can be operative within the utility's IVRU or implemented within the local carrier network for maximum volume.[76]

The AMI system is an effective tool for outage restoration verification where meters are "pinged" (interrogated) to determine their energized state. When well integrated, this provides an automated capability for systematically verifying power restoration at each customer site.

10.2 PSE Practices

Exhibit 10-2 is a high level illustration of the key PSE information systems in place during the December 14-15, 2006 storm restoration.

[76] KEMA Principals' call center experience

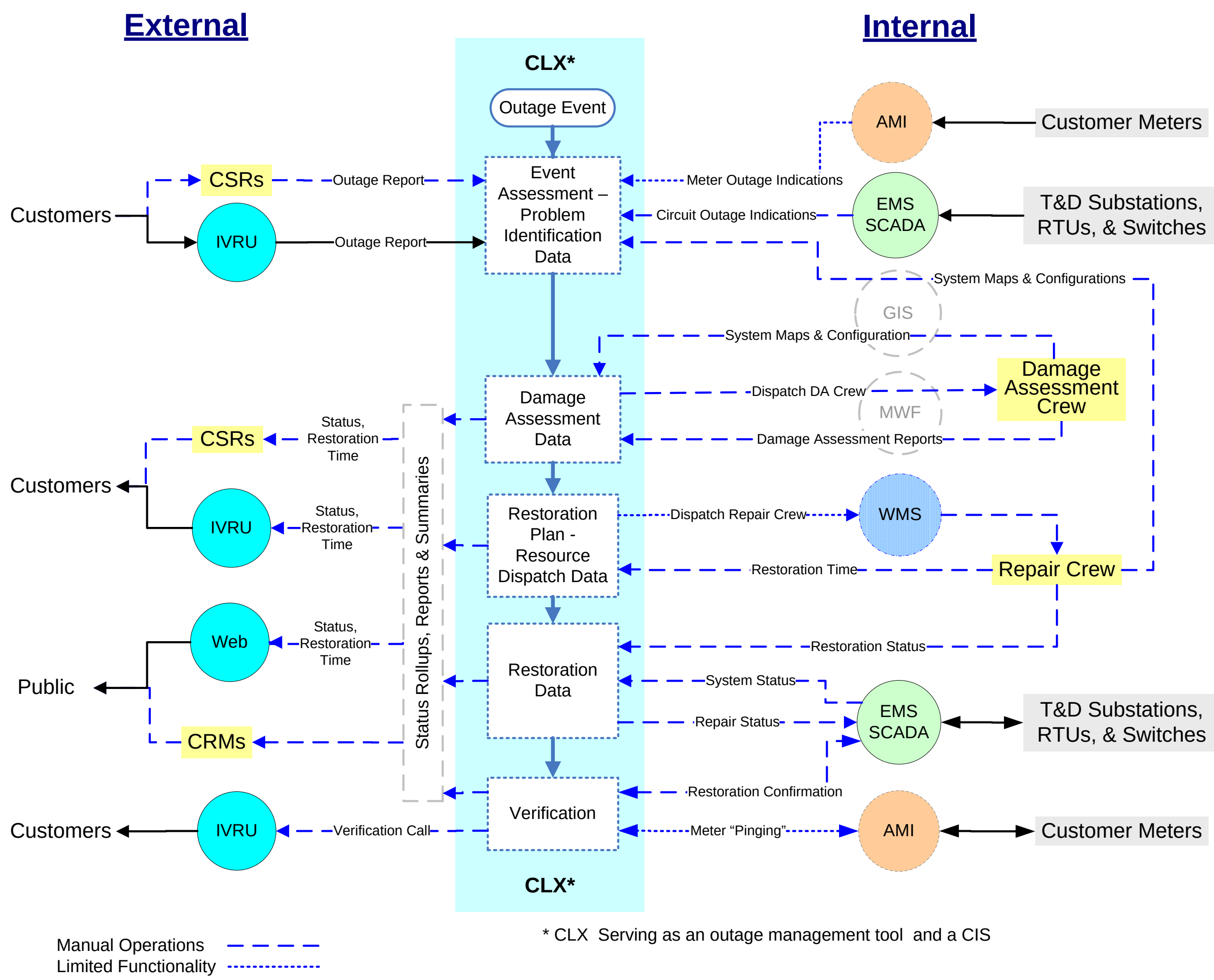

Exhibit 10-2: Overview of PSE IT systems in support of the December 14-15 storm restoration

The key components of existing system capability at PSE include:

ConsumerLinX (CLX), a high-transaction volume customer information system designed around PSE business needs. In addition to customer service and billing functionality, CLX also includes some capabilities to support outage management and restoration processes. CLX generates outage orders for every customer-reported outage, and is the main information system supporting PSE's outage restoration process.

CLX is integrated with an IVRU for customers to receive general outage messaging and specific outage status. The system can also make automated callbacks to confirm service restoration. This capability was fully utilized during the December outage, with some congestion and processing delays due to volume of incoming calls. CLX is also integrated with an application called Distribution Data Display (DDD) for graphical display of outage information on a circuit basis. This allows outage events to be segmented during the course of a circuit outage for assigning repair crews and providing more specific restoration time estimates.

EMS/SCADA – Use at the System Operations control center, EMS/SCADA also played an important role in the outage management process. The storm resulted in damage to the transmission lines and left entire substations off-line with many full-circuit distribution outages. By monitoring the status of the transmission system using EMS/SCADA, control centers dispatchers detected and reported such outages in a very timely manner. Dispatchers also continued to use EMS/SCADA to monitor the status of the system during the restoration process and provide oversight and direction for the energization of transmission lines once field repairs were completed.

Advanced Metering Infrastructure (CellNet) - the AMI system provides some functionality to support the outage detection and restoration process. The AMI meters and pole-tops report a signal when they lose and regain power. The AMI system is supported by a meter data warehouse and includes a limited web-based outage map and outage summary dashboard. The AMI system also includes an application for interrogating individual or groups of meters to verify power operation. The massive volumes of outage data generated during the early stages of the December 14-15 outage overloaded the AMI system compromising its effectiveness for outage detection and reporting. Also, storm damage affected the AMI's ability to effectively communicate meter status.

10.3 Conclusions

10.3.1 Field data volume overwhelmed several PSE Systems, and therefore data was not consistently collected or transformed into usable information.[77,78]

PSE information systems provide adequate functionality and performance in support of a typical storm, where there are manageable numbers of trouble calls and outages. System limitations are overcome by manual operations. The sheer volumes of data produced during the December 14-15 storm overwhelmed these systems and the manual data entry could not adequately support the process in a timely fashion. Furthermore, certain data integration links and communication points were not designed to handle the large volumes of data transactions in the short time frame.

Due to unavailability of data, CLX could not provide adequate support to CSRs, CRMs and other personnel in response to customer inquiries and for dispatching resources.

The IVRU system was sporadically overloaded due to the volume of incoming trouble calls. The AMI system was crippled with both a large number of simultaneous outage reports and loss of power supply and thus was not able to successfully report meter outage information.

[77] Source: AI01, 02, 03
[78] KEMA Principals' Distribution Application Experience

10.3.2 CLX is a customer information system that has limited outage management functionality.[79,80]

CLX connects a customer account to an electric circuit identifier. CLX also provides basic functionality needed to capture trouble calls, identify outage circuits, capture restoration time and track status of the restoration process. During an outage event, CLX is the key system for capturing outage related data, and for providing information needed by Customer Service Representatives (CSRs) when responding to customer trouble calls. CLX cannot, however, provide summary level circuit outage information or reports.

Due to limited integration with other systems, CLX requires extensive manual data entry when supporting the type of outages experienced during the December 14-15 storm. PSE ability to communicate with customers is severely limited when CLX data is not consistently entered and updated due to a limited numbers of personnel qualified to enter data into CLX during an event

CLX is labor intensive due to:

- Cumbersome nature of CLX data entry efficiency;
- Field processes and CLX system processes that are not fully integrated and synchronized;
- Lack of CLX integration with EMS;
- Limitations in transmitting meter outage reports from the AMI system; and
- Lack of a system connectivity model in CLX amplifies the need for manual data entry.

10.3.3 PSE has no automated technology to “roll-up” outage and restoration information from the field to the EOC.

It is essential that PSE management has clear and timely summary information about the restoration effort. This information flow begins at the field crew level and works its way back to the Operations Base and then to the EOC. Once the EOC has the necessary information, it can be communicated and used to evaluate progress and fully inform customers.

10.3.4 The damage assessment reports can not be summarized into meaningful management information.

Damage assessment information is phoned into the Operations Base, where it is recorded on a form, the Storm Board and CLX. The completed forms are manually filed and kept near the Storm Board. As results are recorded on the Storm Board, completed forms are returned to the file and inserted in a different alignment to enable Storm Board personnel to track what has been recorded.[81]

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[79] Source: AI01, 02, 03
[80] KEMA Principals’ Distribution Application Experience
[81] Source: RG03, 08, BS08

A CLX specialist will enter the form information into CLX by circuit and customer. This creates a permanent record inside of CLX. However, there is no way of summarizing the information in CLX to provide management with a clear picture of individual circuit damage. Anyone outside of the Operations Base needing information has to search for each record tied to that specific circuit in CLX. Alternatively, management would have to call the Operations Base directly to obtain the information. While the latter is possible, it distracts Storm Board personnel from restoration efforts.

10.3.5 The lack of an outage management system severely hampered the efficiency of the restoration process.

CLX and the supporting PSE information systems have certain functional limitations when compared with leading practices outage management systems. These CLX limitations are particularly evident when dealing with major storm scenarios involving a large number of outages. They include the lack of:

- An electric distribution predictability model that associates customer outages with physical location on the distribution system;
- Business rules that allow for the effective management of large scale outages and restoration efforts;
- Integration and SCADA/EMS system for real-time system status updates within CLX; and
- Automated outage analysis to assist in crew dispatch.

10.4 Recommendations

10.4.1 Establish enterprise-level technology, data and integration architecture for outage management related processes.

This recommendation is based on the premise that increased automation will improve the outage management process. KEMA recommends the PSE undertake the following activities:

- Develop a data architecture that shows how data will be organized, exchanged and shared;
- Develop an integration architecture that shows how various systems and applications interoperate; and
- Develop a technology architecture that shows how the underlying computing and communications platforms support the business applications.

10.4.2 Develop end-to-end information and business process flows for outage management and emergency restoration processes.

KEMA recommends PSE perform the following activities:

- Document business processes related to outage management;

- Produce end-to-end process map that defines;
- Process activities, roles and responsibilities;
- Flow of information and communications; and
- Data requirements.

10.4.3 Enhance existing technology and systems to close functionality gaps and with the strategy of migrating them toward the final architecture.

KEMA recommends PSE perform the following activities:

- Accelerate expansion of SCADA coverage of distribution circuits and distribution automation capabilities. This would include the following activities:
  - Expand real-time monitoring of key distribution substations and field devices e.g., switches and reclosers;
  - Expand distribution automation capabilities on key circuits in support of automated switching and restoration process;
  - Establish the approach for integration of SCADA data and key alarm conditions with other systems such as OMS. Make interfaces available for such integration.
- Bridge functionality and reliability gaps of the Cellnet AMI system from outage reporting and verification standpoint;
- Utilize and integrate proven consumer technology in support of restoration management and emergency response functions;
  - Evaluate and implement low-cost consumer technology, e.g., digital cameras, and GPS devices; and
- Use local carrier phone network in front of CLX/IVRU to enhance call-taking capacity, and capabilities.

10.4.4 Deploy new systems to close the functionality gaps and build out the outage management architecture.

New systems and applications are needed to bridge gaps that exist in support of emergency restoration processes. KEMA recommends PSE perform the following activities:

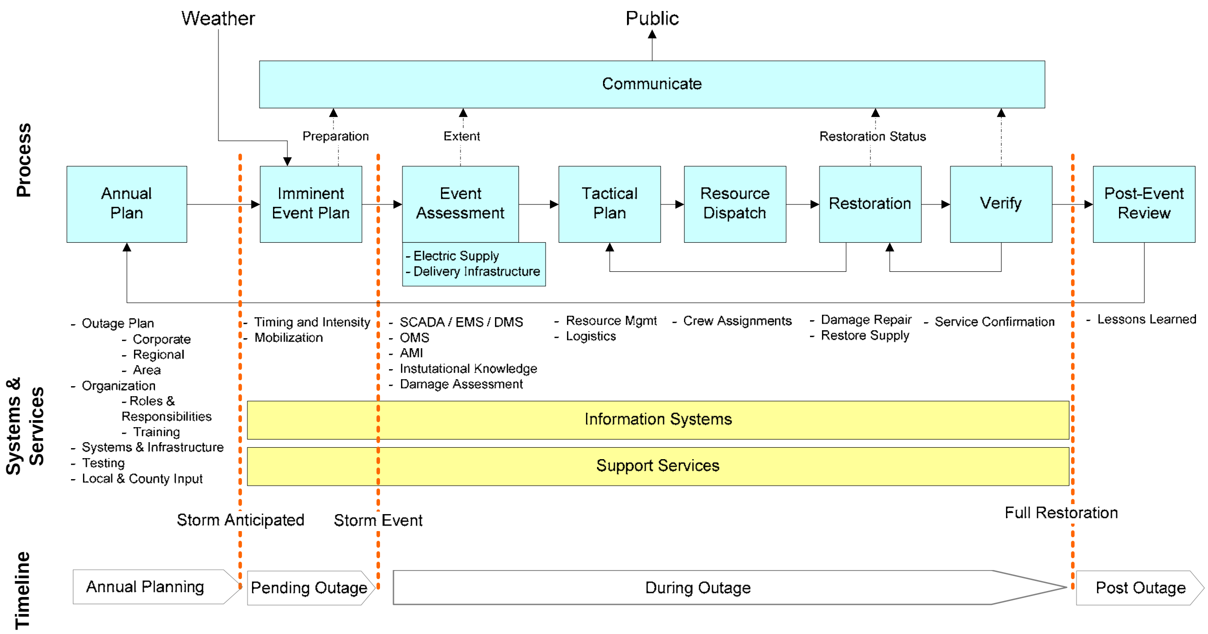
- Select and implement an OMS:
  - Migrate existing outage management functionality from CLX to the new OMS; and
  - Integrate the new OMS functionalities with PSE systems and processes.
- Select and implement a GIS system that includes:
  - Migrating existing raster-maps to the new GIS System;
  - Augmenting existing capabilities with geo maps; and
  - Implementing electric system connectivity models.
- Implement an electronic storm board with information overlay from SCADA, OMS and AMI; and
- Select and implement automated switching and restoration workflow tools.

10.4.5 Develop a phased implementation plan for outage management related information system and processes.

Establishing enterprise data and integration architecture, developing end-to-end business process maps, enhancing existing systems, and deploying new technologies will require several years. A phased implementation will take several years and a roadmap should be established to guide this effort. The following considerations should be incorporated in development of this plan:

- Identify immediate and high-value items that can be implemented in a short time period;
- Implement key foundational elements of the architecture to support the interoperability and integration goals;
- Consider the interdependencies of various projects;
- Migrate existing systems and processes to the new capabilities without business disruption;
- Integrate data; and
- Identify resource constraints and budget requirements.

11. Support Services



Support services are essential to an emergency restoration process. The CERP details the roles of the service provider and materials management and purchasing functions in a restoration effort.

11.1 Industry Practices

The utility industry routinely uses contract companies to provide assistance to company forces for storm restorations. Utilities also employ contract line and service companies under multi-year agreements to augment company forces for day-to-day construction and maintenance operations.

11.2 PSE Practices

In 2002, PSE contracted with Potelco to provide construction and maintenance services. Potelco assumed many responsibilities formerly owned by PSE. Under the contract Potelco is responsible for all field construction, maintenance, repair and emergency restoration. PSE retained the serviceman function for first response diagnosis and light repairs, but Potelco absorbed PSE line crews, heavy vehicles and leased some PSE operating centers. Potelco provides all management functions for its areas of responsibility, including hiring, performance evaluation, dismissal, training and safety.

The service provider contract was first signed in April 2002 and renewed in January 2007. The structure and responsibilities of the two contracts are very similar. PSE's response to the December 2006 Storm occurred under the first Service Provider contract. The contractual definition of roles and responsibilities follow:[82]

Joint PSE and Potelco responsibilities:

- Review all potential emergency/outage events;
- Mobilize additional resources needed to supplement Potelco, subject to PSE approval;
- Review status to determine when an Emergency/Storm Event can be closed; and
- Develop operational metrics.

PSE responsibilities:

- Determine whether an Emergency/Storm Event has occurred based on criteria such as the following: number of emergency crew jobs outstanding, length of restoration remaining, weather conditions, overflow at system dispatch and/or size of the event;
- Provide damage assessment assistance upon request of;
- Operate an Emergency Operations Center (EOC) to handle high priority calls, if necessary, and dispatch PSE resources, media relations, load office operations, and switching; and
- Determine when an Emergency/Storm Event is closed.

Potelco responsibilities:

- Upon determination of an Emergency/Storm Event, assume responsibility for dispatching crews and opening service bases;
- Coordinate damage assessment and allocate service provider damage assessment teams;
- Request damage assessment assistance from PSE;
- Coordinate damage assessment to avoid duplication of circuit patrol;
- Restore service in accordance with PSE's prioritized list of circuits for power restoration as delineated in the PSE Corporate Emergency Response Plan keeping in mind the primary objective of expeditious restoration of electrical service to PSE customers;
- Mobilize service provider resources necessary to provide Emergency/Storm Event Response Services;
- Direct and control outside resources in accordance with PSE priority designations;
- Prepare a Force Report detailing all available resources, which will be reviewed and updated monthly prior to storm season, and bi-weekly during storm season (October 1 through April 1);
- Make temporary or permanent repairs to maximize restoration of service;
- Operate Storm Boards at pre-designated locations to depict the storm's impact;
- Provide Emergency/Storm Event Response Services without limitation including engineering and design; permitting and construction; resource coordination; construction inspections; and job closeout;

[82] KEMA review and analysis HS02 and H005

- Supply data to various PSE systems including CLX, SAP, work management, FERC accounting, and update maps and records;
- Provide updates to assess restoration and crew resources based upon a schedule determined by the EOC; and
- Manage all materials acquired from PSE.

11.3 Conclusions

11.3.1 Purchasing was not been notified that PSE agreed provide accommodations for the service providers and foreign crews.[83]

The impact of this decision significantly increased PSE accommodations requirements, although it negated competition for scarce resources between PSE and Potelco. Previously, the service provider's EOC Duty Manager was tasked with coordinating accommodations.[84] The CERP indicates that Materials Management/Purchasing is not tasked with coordinating accommodations.[85]

11.3.2 The PSE service provider contract does not hinder or enhance the restoration process.

After reviewing the contracts and Potelco performance during the storm, KEMA believes that the operational structure, role definitions and responsibilities detailed within the Emergency/Storm Event Response Services Contract ("ESERSC") do not, on their own, inhibit effective restoration.[86,87] However, the addition of significant items that were either excluded from the contract or not yet implemented would enhance PSE's and Potelco's performance during restoration.

11.3.3 Several outstanding issues with contract implementation potentially may have impacted the restoration effort.

PSE's high level outage restoration priorities are defined within the CERP[88] and the Emergency/Storm Event Response Services Contract ("ESERSC") requires that Potelco "direct and control outside resources in accord with PSE priority designations." However, PSE's detailed "critical loads for restoration" list appears incomplete and remains in DRAFT form.[89] PSE did not provide formally deliver this list to Potelco. It is unclear if Potelco followed the previously established priority designations during the December 2006 storm.

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[83] KEMA Interview HS15
[84] KEMA Notes RG page 18 –CERP page 44
[85] KEMA Notes RG page 40 –CERP page 113
[86] KEMA review and analysis HS02 and KEMA review and analysis HS05
[87] KEMA Principal's Outsourcing Experiences
[88] CERP page 22
[89] KEMA Data request HS05-5 Critical Loads for Restoration DRAFT 11 06.xls

11.3.4 While the respective roles and responsibilities of PSE and Potelco are defined in the ESERSC, not all contract roles are followed during restorations.

- The ESERSC defines the roles of each party during the restoration process. While PSE and Potelco work together as required, their roles are not consistently followed at all Operations Bases. The quality of this arrangement is highly dependent on the individual skills and experience of the PSE/ team at the Operations Base.[90] For example, at one Operations Base, the local PSE management controls the storm restoration process.

11.3.5 PSE and Potelco have not developed operational metrics called for in the ESERSC, and thus the performance of Potelco and PSE can not be objectively measured.

Operational metrics can be used during a storm event to check the progress of restoration against past experience and standardized expectations. They can be used to provide an overall estimate of the restoration time for a storm event.

Under the ESERSC operational metrics were to be developed by July 15, 2002. Had the operational metrics been developed as scheduled, they would have been tested, refined and calibrated multiple times before the December 2006 Storm. PSE indicates it has determined that operational metrics will not be pursued at this time.[91]

Effective operational metrics may have been useful in helping determine estimated restoration times to the public and various governmental bodies, and would have provided other valuable operational information to PSE and Potelco.

11.3.6 The ESERSC does not provide a mechanism for PSE to implement emergency response role training and testing, nor for Potelco to be directly paid for this effort.

The lack of a mechanism for PSE to request and for to be compensated for training, mock drills and other efforts to enhance the restoration process confirms the lack of focus within the service provider contract on preparation and planning for a storm.[92]

11.4 Recommendations

11.4.1 Refine the ESERSC contract to add the planning, training, communication and evaluation roles necessary to plan for and implement major restoration efforts.

KEMA recommends PSE and Potelco negotiate and modify the ESERSC contract to:

[90] KEMA Interview HS06
[91] KEMA Data Request HS05-8
[92] Potelco Emergency Response Services Contract – 2007 1/23/07

- Define communication of restoration priorities to ensure that critical facilities are identified for each Operations Base;
- Clarify and define the communications required between and PSE at both the Operations Base and the EOC to ensure that restoration status, crew resources and other information is provided as needed in a timely manner by each party;
- Evaluate, clarify, refine and define roles within the scope of the CERP;
- Jointly develop operational metrics to forecast and measure the performance of and outside crews during emergency restoration;
- Define PSE needs for initial, preliminary and other outage restoration times and related information;
- Develop a process for PSE to request and to perform required emergency restoration planning, training, drills (mock exercises) and evaluation;
- Confirm specific responsibilities for support logistics and update the CERP as needed; and
- Consider a process to formally exchange information and restoration experiences between different functions.

12. Materials Management and Logistics

At all utilities, an outage event requires the availability of materials needed to repair or replace damaged infrastructure. These materials must be delivered to the appropriate location in a timely fashion. Materials management must receive estimates and specific requests for materials from operating centers and must communicate delivery times and locations to field operations. The effectiveness of materials management directly impacts planning and execution of any storm event.

12.1 Industry Practices

Logistics - The typical utility must be prepared to provide support such as food and lodging for both its own employees while working long outage shifts and outside restoration crews. This requirement is complicated by the typical 16-18 hour shifts used during the early phases of restoration, which leave little time for needed rest and travel to accommodations.

For efficiency, many utilities arrange catering services that deliver hot meals to crews at their work locations. This alleviates the need for crews to travel from the work site two or three times per day. The motel accommodations also require creativity, as the parking lots must be able to accommodate a large line trucks and other vehicles. In some circumstances, local motels cannot be used if they are still without power. In both cases, the utility might be competing with its customers for accommodations.

Materials management - Due to long lead times for certain materials, the materials management function requires planning to respond to an outage event. Pre-stocking of outage reserves within operating center storerooms is needed to ensure rapid response and reduce transportation requirements during outage events.

12.2 PSE Practices

Logistics - PSE not only provided the expected food and lodging but also provided shuttle vans to move crews from their lodging to staging areas, security for Company facilities and vehicles parked overnight, and contracted for staging areas for foreign crews and rental vehicles.

Materials management - PSE has a robust materials management function and application operating in SAP. The system provides the needed functionality to source, request, procure and issue materials.

Emergency stores were rapidly being deleted by previous storms; however, the materials management personnel were able to source, procure, arrange transportation and deliver critical materials to the crews in a timely fashion. In some cases materials were air lifted in to ensure a continuous supply of materials to the crews.

12.3 Conclusions

12.3.1 To address initial problems in meeting the need for a large number of accommodations, Purchasing developed an effective process for assigning motel rooms for outside crews.

To maximize the productivity of crew resources, lodging and food must be provided on a timely and nearby basis. In Volume 2 of the CERP, there are lists of hotels with direct contacts and prearranged rates. Many of the listed hotels and restaurants were either without power or filled to capacity serving displaced local residents leading to scattered problems with accommodations and food.[93]

PSE's Purchasing Department developed the concept of Lodging Coordinators. The department placed two Lodging Coordinators at each Operations Base and then recruited internal auditors to provide additional staffing.[94] Purchasing developed spreadsheets to manage the lodging requirements, which included detailed explanations and instructions for the newly recruited employees.[95] These spreadsheets were designed to provide consistent summary information to each level. An outside travel agency was used to procure accommodations, including the use of the agency's buying leverage for both volume and price.[96]

12.3.2 Materials management function performed well before, during and after the 2006 storm.

PSE material management processes are consistent with industry practices for storm planning. PSE plans include:

- A process for determining and assembling storm outage stock at operating center storerooms before an outage event;
- Expedited materials management during the restoration process designed to keep pace with accelerated construction efforts;
- Plans to restock storerooms in preparation for the next outage; and
- Procedures to account for restoration costs with sufficient accuracy to meet regulatory scrutiny.

PSE's Materials Management function reviews its outage procedures before each storm season.[97] Pre-storm season staff meetings include review of storm procedures with warehouse and office staff.

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[93] KEMA Interview RG17
[94] KEMA Interview HS15
[95] KEMA Data Request HS15 (Storm_Hotel_Bookings__Dec_19_1930.xls)
[96] KEMA interview HS15
[97] KEMA Data Request Materials Management e-mail dated 9/1/06 agenda for 9/5/06 Staff Meeting

As part of its standard practice and recovery from earlier storms, PSE Materials Management and Purchasing departments began to review needs on Monday, December 11, three days before the storm began. Initial materials deliveries began Tuesday, December 12.[98] Materials Management conducted an after-action review to evaluate its performance.[99]

Materials Management continued to evaluate its storm requirements in preparation for the next storm and adjusted delivery methods as appropriate in January 2007.[100]

12.3.3 The material flow started slowly, but the pace increased to meet the extent of the damage.[101]

In restoration efforts of this magnitude, most utilities will at some point use the fastest mode of shipping to ensure materials are available for the crews. Stocking all materials to the level required to support a major restoration effort would be fiscally imprudent.

PSE's Materials Management group used an outside logistics company to support delivery, including chartering a cargo jet to deliver critical supplies. Orders were combined from multiple vendors and delivered by shared trucks and the cargo jet charter.[102] Expedited deliveries were needed to restock crews running low on materials.[103]

12.3.4 Emergency material stockpiles at the Operations Bases were accumulated prior to and replenished during the storm season; however, formal standards do not exist to ensure adequate supplies are in place.

To ensure a rapid start of the restoration process, the typical utility must have an appropriate level of materials available at the beginning of the restoration. The development of the outage stock levels must take place before the outage.

PSE Materials Management reviews outage stock levels prior to storm season.[104] However, because no formal inventory standards exist, local operations centers are left to their experience to determine the necessary level of outage material stockpiles.[105] Centralized reviews of emergency material stockpiles are harder to accomplish without formalized standards.

[98] KEMA Interview HS15
[99] KEMA Data Request Materials Management e-mail dated 1/8/07 Strom (sic) Debriefing
[100] KEMA Data Request Materials Management e-mail dated 1/10/07 Double Whammy Follow-Up 6 PM Edition
[101] KEMA Interview RG02, KEMA Interview RG06
[102] KEMA Interview HS15, KEMA Data Request e-mail dated 12/20/2005 @2:27 PM
[103] KEMA Interview RG02 page 54
[104] KEMA Data Request Materials Management e-mail dated 9/30/57 and attached file Potelco Storm Material 2005
[105] KEMA Data Requests HS02-8 and HS05-8

12.3.5 During outage events, PSE uses the SAP materials management system to manage materials between the field and central stores, and supplements the SAP system (during heavy volume outage events) between Central Stores and Purchasing with pre-developed spreadsheets and additional information.

Most utilities have installed sophisticated materials management systems integrated with their accounting and work management systems. If properly designed, the materials management system allows operations centers to order and track restoration materials and their expected delivery times. Conversely, Materials Management can communicate with Purchasing to order and expedite materials deliveries. The value derived from such systems hinges upon implemented cost and delivered results relative to results derived from "current state" approaches.

As per the CERP, PSE Purchasing and Materials Management departments exchange storm material status using pre-developed macros to extract data from SAP into an Excel spreadsheet. Using a spreadsheet instead of the SAP system reports allowed PSE to add additional information (including priority level, ETA and shipper information), manage and analyze the information in a more nimble spreadsheet and better review information at a summary level.[106] [107]

12.4 Recommendations

12.4.1 Enhance logistics to better support the number of crews supporting the restoration.

Management had to adapt its logistics practices quickly. Therefore, KEMA is recommending the following actions:

- Formally document these processes as implemented;
- Build a formal process map;
- Incorporate processes into the CERP;
- Identify who is responsible for managing the process at the EOC level;
- Identify responsibilities for the Operations Bases; and
- Ensure the process to update logistic vendor lists in the CERP volume two is adequate.

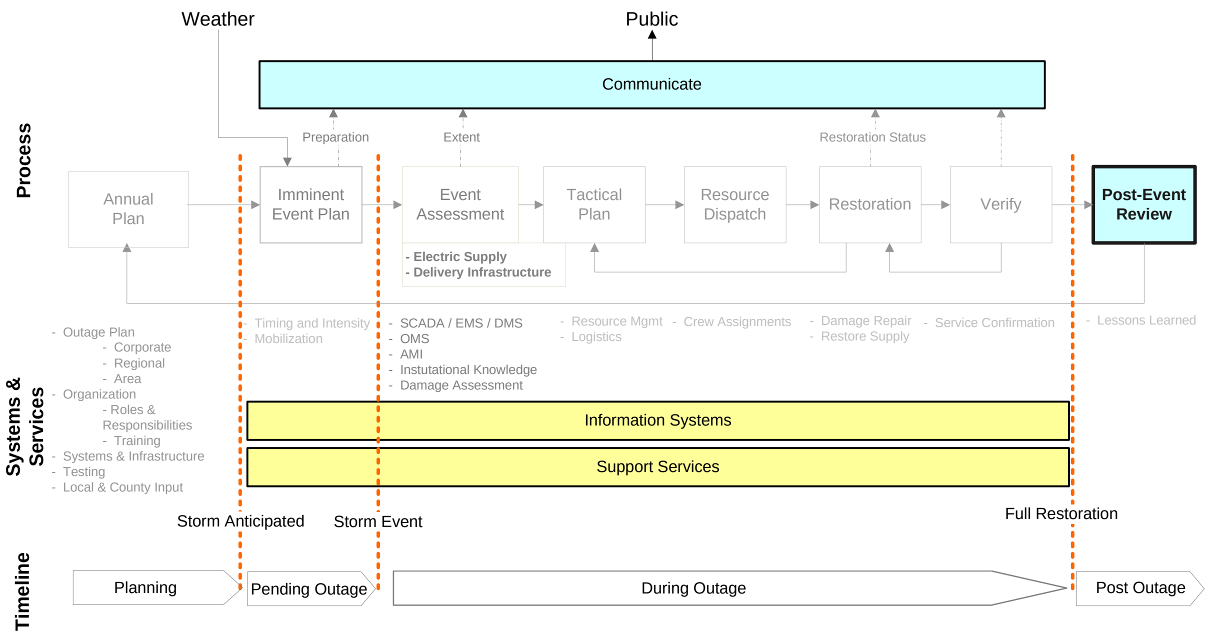
12.4.2 Document material management policies and processes created to support storm levels.

PSE rose to the occasion by ensuring adequate materials and equipment were available to the crews when needed and in the right place. However, PSE needs to find a new balance for its emergency stock. KEMA recommends the following action be taken:

[106] KEMA Interview HS15
[107] KEMA Data Request spreadsheet DoubleWhammyMatlsUpdate 061220@1345 (2).xls, MID's to Expedite

- Document the material requirements procured during the December 14-15th storm restoration effort;
- Document the new processes created to source, procure and ship materials on a short lead-time basis;
- Review the additional stores requirements for the anticipated storm season and balance against the usage rate during the season. PSE should consider increasing stock levels to cover the first eight to ten days of a major restoration effort;
- Arrange for critical materials to be stored on site as vendor stock that can be released on short notice with email confirmation to purchase from PSE; and
- Prearrange for expedited shipping to ensure availability of transport as well as best pricing.

13. Post-Event Review



13.1 Industry Practices

It is common practice within the utility industry to conduct post-event reviews following storms or other significant outage events. These reviews include an assessment of operational response, staffing, logistics, equipment failures, and any number of other topics that were part of the event. In most cases these reviews are internal, however, in major weather or disaster events there are often government initiated reviews that include utility participation. Such broader review activities are usually focused on coordination of response across companies and agencies as opposed to internal operational activities.

13.2 PSE Practices

Consistent with industry practice, the PSE CERP includes provisions for post-event debriefings. The briefings process and participants are outlined as well as the potential topics to be discussed. The initiation of the post-event review is assigned to operations managers, the level of management dependent upon the intensity of the event under review.

13.3 Conclusions

13.3.1 PSE held post-event reviews of the December storm both internally and in conjunction with external governmental teams. Action items were identified and are being addressed.

The after-action reviews of the December event resulted in a number of action items that are in progress at PSE. Additionally, the company participated in the review initiated by the Governor and has action items from that review that are underway in coordination with other agencies.

Since the beginning of the 2007 a number of efforts have been initiated to allow PSE to better understand the restoration process and identify improvement opportunities. These efforts include:

1. Began tree trimming on Whidbey Island, but the major effort associated with the transmission ROW will be occurring during the mid-to-late summer;
2. Redesigned the community outreach programs to include subsequent emergency preparedness considerations rather than just the power outage information;
3. Completed storm temporary repairs to permanent repairs
4. Reviewed Vegetation Management program in response to the tree damage identified after the storm;
5. Performed several customer research surveys, including:
   - Phone survey;
   - Web survey;
   - Email survey and interviews of major accounts customers;
   - Focus groups;
6. Conducted extensive Internal storm debriefing - after action reviews;
7. Participated in the Governor's storm review and after action report:
   - Created a Utility Road Clearing Task Force (1st meeting held with DOT in March; follow-up meeting scheduled in July 2007);
   - Prepared a Memorandum of Agreement with State Emergency Management Division – in progress. To address PSE's participation at State EOC, expediting disaster proclamation, HOV lane exemption, and access to State resources as required; and
   - Established PSE representatives for State and County EOCs, to staff when activated.
8. Led legislative discussions on HOV access and vegetation management issues (ROW clearing);
9. Performed additional system planning work since storm - some jurisdictions are already reviewing capital improvement projects to include potential schedule 74 measures;
10. Conducted an employee visioning process;
11. Updated county restoration prioritization lists – to be shared with Counties, PSE operations bases and State EMD;
12. Created new Emergency Response Roles for lodging coordinators and State/County EOC representatives;

13. Enhanced training for Damage Assessor and Contract Crew Coordinator roles including reference materials;
14. Established additional and new lodging locations for emergency response;
15. Restocked storm bags for all operating bases; and
16. Developed capability for Web access to AMR outage map data and information.

13.4 Recommendations

13.4.1 Ensure the existing post-storm actions and recommendations are consistent with the leading practice model presented in this report.

KEMA recommends that PSE:

- Consolidate all ongoing actions and recommendations with the recommendations made within this report and conduct a prioritization exercise that considers urgency, ease of execution, impact on process and cost of implementation; and
- Develop master work plan with schedules, budget requirements, assignments, etc.

14. Infrastructure Conditions

14.1 Industry Practices

Vegetation management, access road management and system hardening are critical elements for many utilities that face the potential of excessive winds or other tree related problems.

Vegetation management has always been a high priority of electric transmission and distribution utilities. The majority of US electric utilities have very active programs and in some cases are required to report their programs to the regulators. Transmission vegetation management generally consists of three parts. First, is to ensure the rights of way (ROW) are trimmed to keep trees and branches well outside the conductors. This usually entails trimming at the margins of the ROW. Second, is the vegetation control inside the ROW to prevent new trees from growing in the ROW and to preserve vehicular access to the facilities. Third is the management of danger trees. These are trees located outside of the right of way, but are sufficiently tall enough to make contact should they fall and have some structural defect. Utilities have formal programs to remove such trees before they become a problem.

Transmission access road management ensures access to cross-country transmission corridors. The leading practice is to maintain these roads so that crews have ready access to the transmission system.

Electric system hardening is a new leading practice designed to harden those portions of a distribution system subject to extreme winds. The Florida utilities have done a substantial amount of work in this area.

14.2 PSE Practices

PSE has a good vegetation management program, with well defined cycles for both transmission and distribution circuits. Most of the $8 million is spent on maintaining the distribution system tree clearances.

PSE has a well-respected danger tree program called “TreeWatch.” This program has been an aggressive effort to remove danger trees from the rights-of-way and has been very effective.

In addition to TreeWatch, PSE has a number of reliability improvement programs in place that are a type of system hardening. These include, among other actions, installation of tree wire, animal guards, and conversion of some overhead lines to underground. The company has not devoted significant effort to system hardening, however, in terms of evaluating different design and construction methods and materials on the transmission and distribution systems; although, the majority of new distribution construction is underground.

14.3 Conclusions

14.3.1 The narrow rights-of-way with heavily vegetated areas immediately adjacent were significant contributors to the infrastructure damage and the extended restoration times experienced in some cases.

KEMA noted that PSE transmission rights-of-way are very narrow compared to other utilities across the country. The local trees are generally much taller than the physical transmission structures. These two conditions create a potentially significant problem for the transmission system. The potential for out of ROW tree contact is much greater during storms like the one of December 14-15. PSE recognizes the problem but is limited in its ability to overcome the strong public sentiment around the local vegetation and the limited area available wider for rights-of-way due to growth and development.

KEMA performed a number of field observations to better understand PSE's situation. The team concluded that:

- There is good evidence that PSE's distribution tree trimming program is effective. In spite of narrow rights-of-way boundaries that are extremely close to lines, the KEMA team generally found no over hanging branches;
- Trees are significantly taller than both the distribution or transmission lines and structures;
- Many trees lining circuits were in subdivision buffers making them much more susceptible to high wind damage; and
- The combination of extremely tall trees relatively close to T&D facilities and the lack of wind breaks in some areas make trees very vulnerable to wind-caused failures. This was particularly true when KEMA considered the fact that there were abnormally high levels of rain prior to the December 14-15 storm, leaving the earth much softer than usual and impacting the tree stability.

PSE's 2006 reliability results (Exhibit 14-1) indicate that 25% of all non-storm customer outages are tree related.

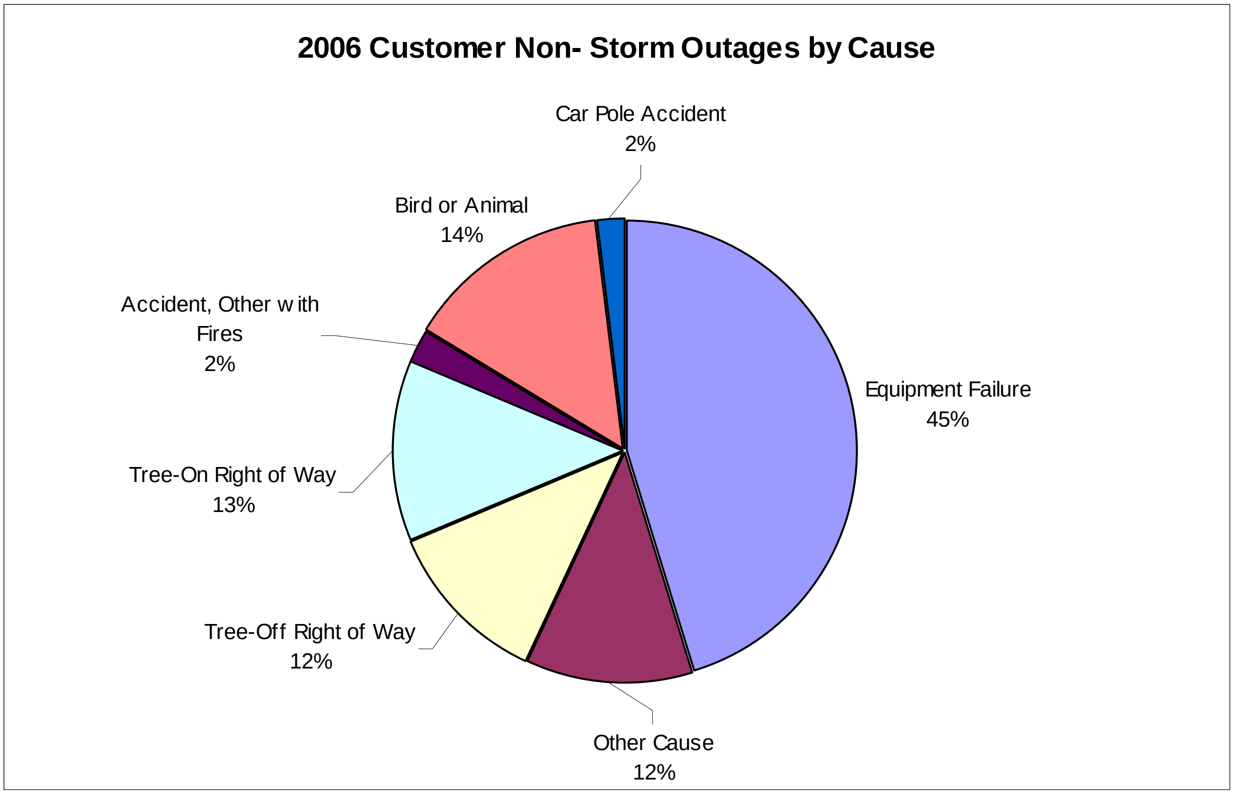


Exhibit 14-1: 2006 Customer Outages by Cause

14.3.2 PSE's TreeWatch program has been effective in mitigating tree risk; however, all vegetation management issues will not be rectified with a business-as-usual approach.

Danger tree programs generally focus on the transmission system and its rights-of-way (ROW). Danger trees have the following typical characteristics: they are tall, are located outside of the ROW, are diseased or otherwise damaged, and if they were to fall into the ROW, could make contact with the transmission line or structure. Most utilities owning transmission systems have a formal program to identify, purchase and remove such trees.

PSE has an extremely active and effective danger tree program known as TreeWatch. When first initiated TreeWatch was funded through capital deferral with regulatory approval and funded at approximately $10 million per year for five years. It is now funded as an O&M program at $2 million per year. This is in addition to the standard vegetation program funding of $8 million per year. Within the TreeWatch Program, PSE in 2006 cleared trees around 600 miles of T&D lines and removed 13,853 danger trees.[108]

[108] Review and analysis of PSE's 2006 Annual Reliability Report

Transmission corridors are established to allow crews access to lines, prevent trees and other vegetation from damaging facilities, and for public safety. PSE's transmission is primarily 115kV with some 230kV. Based on utility industry common practice guidelines the ROW for 115kV should be 100 feet and the 230KV should be between 125 and 200 feet depending on structure type and other conditions. The team noted that the types of trees growing in and around PSE's service territory tend to grow to heights 1.5 to 1.7 times the height of the transmission system.

Our observations of PSE's storm impacted transmission lines show that the ROW width for many lines is inconsistent with the above mentioned guidelines. KEMA identified two direct concerns with this finding:

- The potential for line damage caused by trees falling into lines during severe weather as experienced in the December 14-15 storm is far greater, and contributed to the loss of 85 transmission lines; and
- The potential for tree incursion is significantly increased with narrow ROWs such as found at PSE.

Exhibit 14-2 and Exhibit 14-3 demonstrate our concerns.

Exhibit 14-2: North King County Right-of-Way Vegetation

Exhibit 14-3: North King County Right-of-Way Growth

14.3.3 Increasing PSE's vegetation management program will not address the impacts of narrow rights-of-way.

Vegetation management programs in electric utilities are designed to ensure that trees and their branches are kept a safe distance from T&D lines and structures and thus, prevent accidental contact that can either cause lines to lose service or damage equipment. This is done by cycle trimming of circuit corridors based on the average growth rate of the native tree and brush population. The majority of utilities have formal programs that are annually funded.

PSE follows a distribution cycle trim program with approximately 50% of the system on a four-year cycle and 50% on a six year cycle, with cycle times based on vegetation type. For distribution voltages, desired clearance is based on a four or six year cycle based on average vegetation growth. Management states PSE gets desired clearance 95% of the time. The transmission system is maintained on a three-year cycle.

Vegetation management for transmission ROW is designed by voltage class, as the higher the voltage the taller the structure. PSE's transmission guidelines are as follows:

- For 230 kV, the desired clearance is 40 feet under the conductor, 15 feet for side clearance for conifers, and 20 feet for deciduous varieties.

- For 115 kV, the right of way obtained by the company determines the amount of clearing they can accomplish. The 115-kV circuits in urban areas are on single wood poles along roadways, often with underside-built distribution. In most cases, the 115-kV line is encroached on roadway ROW and the clearing zone is limited by private property at the edge of roadway ROW.

Due to PSE's ROW limitations, caused by regional, cultural, and political considerations, vegetation management is primarily a safety program as opposed to a reliability program. Industry norms are to maintain rights-of-way for both safety and reliability; however, at PSE the narrow rights-of-way and limited rights for private property trimming limit the effect that can be realized on system reliability. It should be noted, however, that PSE reliability indices fall into the first or second quartile of utilities in the country as reported in an IEEE reliability survey.[109]

As noted earlier, the PSE 2005 System Performance Annual Review reports that 40% of non-storm customer outage minutes were tree caused. Because of limitations PSE faces in right-of-way vegetation maintenance, other programs have been adopted to reduce the number of customer outage minutes caused by trees. As part of an Overhead Outage Reduction Program the company also considers actions such as the replacement of aging small wire, installation of covered conductor (tree wire), and animal guard installations to help reduce outages. Placing existing lines underground lines is also an option but is generally cost prohibitive.

Statistics from 1997 indicated that 60% of tree-caused outages were from trees more than 15 feet from the affected line. About 13.5% of tree caused outages were due to tree growth in the line. Of trees falling into lines, 30% were from broken tree trunks compared to 31% from uprooted trees.[110]

Obstacles to effective tree maintenance include local government ordinances that require permitting or other approvals prior to cutting street trees, private property rights, and PSE ROW management practices that have included less than full exercise of company rights.

As stated earlier in this report, the majority of significant damage caused to PSE's T&D facilities was due to trees falling into the lines from outside PSE rights-of-way. KEMA is extremely concerned that the issues noted above may result in similar damage should PSE experience another event the magnitude of the December 14-15 storm.

14.3.4 Current level of funding for transmission right-of-way maintenance is inadequate for reducing risk of damage to the facilities in similar storms.

On transmission corridors, vegetation management is designed to keep clear paths open for vehicles to access transmission facilities and is generally considered an industry leading practice.

[109] IEEE Distribution Subcommittee Working Group on System Design, 2004 Reliability Survey
[110] KEMA Interview WLS01

PSE spends $8 million annually on its program, but only $1.75 million is devoted to transmission. The annual performance indicator of cost of trimming per circuit mile has remained constant since 2000.

PSE has already begun a special 230kV vegetation management program designed to remove ROW trees with a mature height of greater than 15 feet that will cost about $7.5 million and cover approximately 327 miles of right-of-way.[111]

14.3.5 The lack of access road maintenance resulted in delays to transmission system repairs.

PSE does not allocate any money to develop and maintain access roads to transmission lines located off normal roads. Access to transmission corridors is critical for two reasons:

- PSE must be able to access structures for routine inspection; and
- PSE must have unfettered access during emergencies to assess damage and make necessary repairs. Electric utilities have formal programs to manage vegetation inside and along the rights-of-way and attendant access roads.

Based on physical inspection of the access roads and the ROW in some of the hardest hit areas, PSE could do better controlling vegetation for vehicle access. As a result, transmission crews could not easily access many damaged transmission lines, leading to a number of delays that lengthened the overall restoration time of the transmission system. According to several individuals with the responsibility of repairing the transmission system, the delays ranged from several hours to as much as one day as bulldozers were needed to cut paths and pull trucks to damaged facilities. Exhibit 14-4 and Exhibit 14-5 illustrate the extensive growth on the ROW and access roads.

[111] KEMA Interview RG22

Exhibit 14-4: Vegetation Impeding ROW Access

Exhibit 14-5: Vegetation Impeding ROW Access

14.3.6 Putting existing lines underground will not eliminate outages.

It is a common perception that putting distribution systems underground will insulate utilities from the type of wind-tree problems experienced during the December 14-15 storm. However, in order for underground facilities to prevent or minimize damage from wind storms, the entire transmission and distribution system would need to be underground. The transmission system outages experienced in this storm interrupted power to all distribution circuits the transmission lines supplied, including the underground circuits. In order for underground facilities to have made a difference, the transmission system would have to have been underground. A recent study by KEMA for a state regulatory agency documented the cost of undergrounding new transmission lines at $10-$20 million per circuit mile, depending upon line voltage and type of construction used. Additionally, environmental regulations and required permitting for construction of this type often drive costs even higher.

While the concept of undergrounding facilities has merits, a number of mitigating factors have to be considered:

- PSE currently has about 47% of its distribution system underground;
- PSE experienced some underground outages during the storm;
- About 30 gas line breaks during the storm could be directly attributed to up-rooted trees demonstrating the vulnerability of underground utilities to windstorms and tree damage;
- The cost to place the existing distribution system underground would be costly for customers. Industry studies document the cost to convert overhead distribution facilities to underground to be eight to ten times the cost of new overhead construction. Costs for new underground are estimated at five to seven times the cost of new overhead construction.[112]
- Maintenance and operation of underground systems is more expensive. Also outages on underground systems are on average longer than overhead outages.

Placing distribution lines underground during new construction can be cost-effective because the utility and customer share the installation cost. Typically, all new residential and commercial developments are built underground. The developer/owner usually provides the trench and backfill services while the utility provides the cable, equipment and connections. Currently, it is estimated that over 97% of PSE's new distribution construction is underground. It is KEMA's understanding that PSE is willing to consider conversion of existing facilities to underground. Such consideration would include provision that the cost differential can be managed in a way that protects customers from extraordinary rate impact and at the same time protects the financial integrity of PSE.

Throughout the US utility industry there is a concerted effort underway to develop methods to strengthen electric infrastructure against storms. Undergrounding lines is only one of many options to be considered in this effort. Utilities, like PSE, are challenged to find the best mix of engineering standards, construction methods, and materials that will provide a

[112] "Out of Sight, Out of Mind" A Study on the Cost and Benefits of Undergrounding Overhead Power Lines, Edison Electric Institute, July 2006

stronger system for the most reasonable cost. In an effort to maintain a reasonable rate structure, many options should be considered and evaluated both technically and financially. For example, a study in North Carolina showed that undergrounding all existing distribution lines in the state would take approximately 25 years and cost over $40 billion. This increase in the value of the distribution facilities in service would require a rate increase on the order of 125%.[113] For an investment of much less money, significant changes could be made to an overhead distribution system that would yield major improvements in reliability both in daily operations and storm conditions.

Another concern with undergrounding electric lines is that many other utilities use the electric system poles. If electric lines are placed underground, the telephone, CATV, and other communications lines are either forced underground or required to assume ownership of the existing poles. Some estimates place the resulting cost increase in services from these providers as high as 25%. Again, the net effect is an increase in cost to all customers of those systems.

14.4 Recommendations

14.4.1 Enhance PSE's transmission vegetation management policy and standards for ROW width.

KEMA recognizes that PSE as other utilities in the region face a daunting task of trying to get wider ROWs and increased vegetation management programs due to political and social pressures. Balancing these external concerns with the need to continue to provide safe and reliable electric service will require a different and concerted effort on the part of PSE. KEMA recommends that PSE take the following actions:

- Work with other utilities in the region including BPA to foster change in both public perception and regulatory policy to create new regulations to support improved reliability consistent with the new NERC guidelines;
- Map the most frequently and severely storm impacted areas of the transmission system;
- Formalize a plan to broaden ROWs in particularly hard hit areas;
- Expand PSE's Tree Watch Program to cover these difficult areas;
- Develop plans to increase vegetation management activities in these critical weak spots by; and
- Ensure that all cross country ROWs have adequate paths to permit moving equipment inside the ROW.

14.4.2 Aggressively develop and maintain cross country transmission access roads.

Lack of access roads created delays in transmission restoration. KEMA recommends that PSE take the following actions:

[113] "Out of Sight, Out of Mind" A Study on the Cost and Benefits of Undergrounding Overhead Power Lines, Edison Electric Institute, July 2006

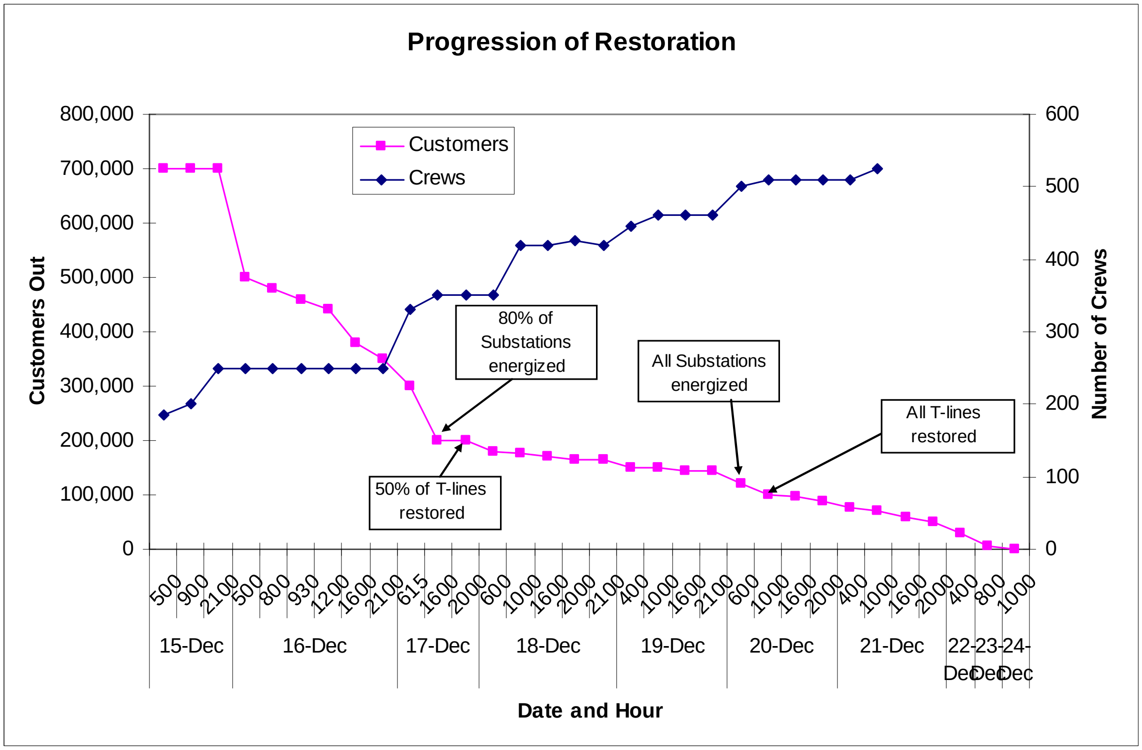
- Continue PSE's efforts to catalog all existing access roads;
- Develop a comprehensive access road program for cross country transmission lines. The program should:
  - Create a rating system for access road conditions;
  - Identify those access roads requiring culvert construction;
  - Develop a program to upgrade those access roads used to get to the hardest hit or frequently hit corridors; and
  - Prepare and fund an access road maintenance program.
- Coordinate the access road program with the vegetation management program so critical sections of transmission corridors are fully accessible.

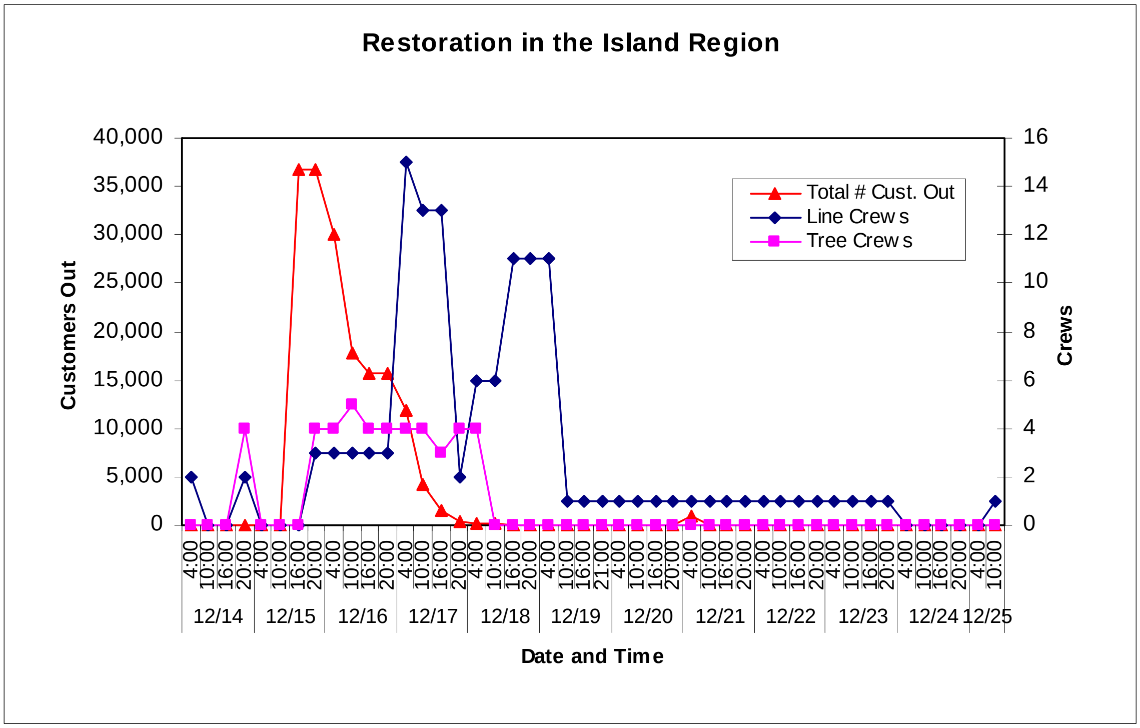
14.4.3 Evaluate hardening opportunities for both transmission and distribution.

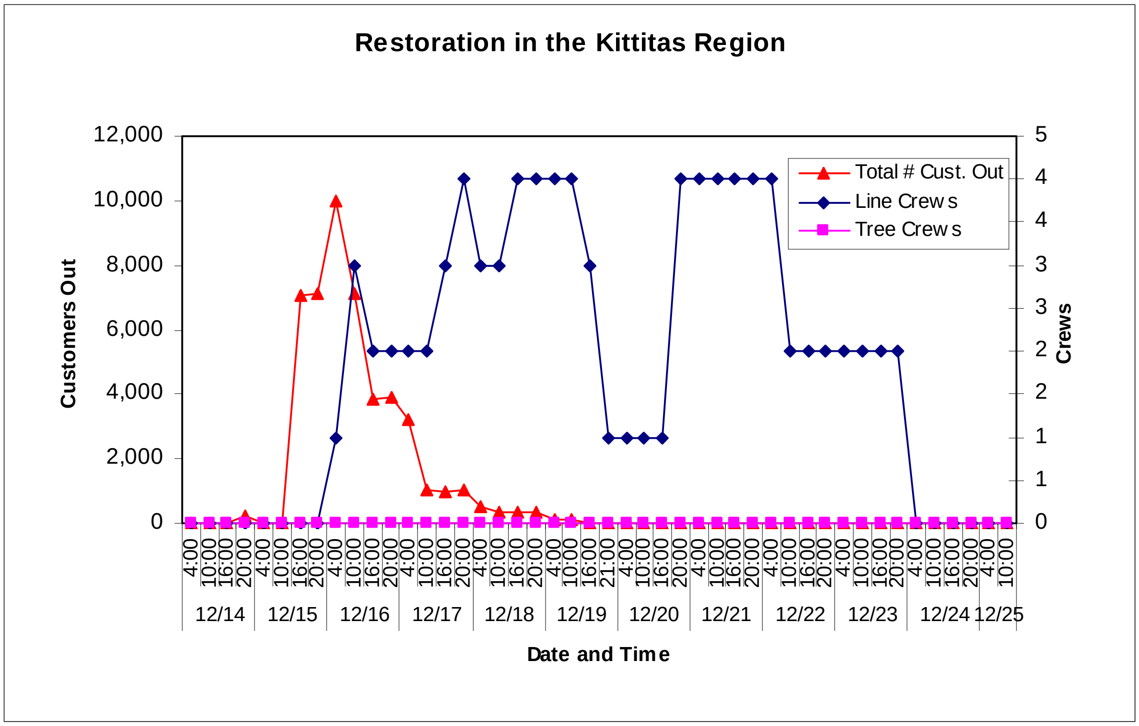
In 2006 PSE spent in excess of $180 million to repair or rebuild portions of its T&D systems. This level of expenditure for repair of storm damage may justify further investment in damage prevention. KEMA recommends that PSE undertake the following actions:

- Conduct a system hardening study to determine:
  - Additional opportunities for under grounding;
  - The use of different towers in particularly hard hit areas; and
  - Match material and design standards to the region's weather conditions

APPENDIX A: Regional Performance Graphics




Restoration in the Island Region
Customers Out
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Crews
16
14
12
10
8
6
4
2
0
Total # Cust. Out
Line Crews
Tree Crews
12/14
12/15
12/16
12/17
12/18
12/19
12/20
12/21
12/22
12/23
12/24
12/25
Date and Time


Restoration in the Kittitas Region
Customers Out
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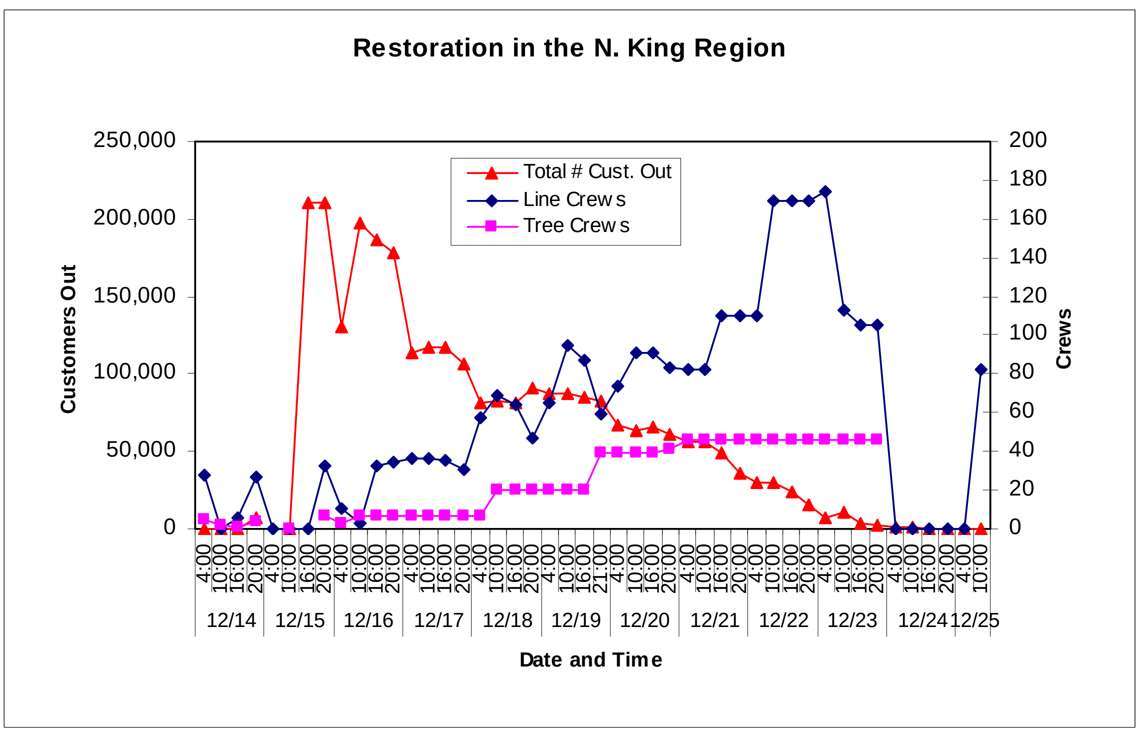
10,000
8,000
6,000
4,000
2,000
0
Crews
5
4
4
3
3
2
2
1
1
0
Total # Cust. Out
Line Crews
Tree Crews
12/14
12/15
12/16
12/17
12/18
12/19
12/20
12/21
12/22
12/23
12/24
12/25
Date and Time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Customers Out
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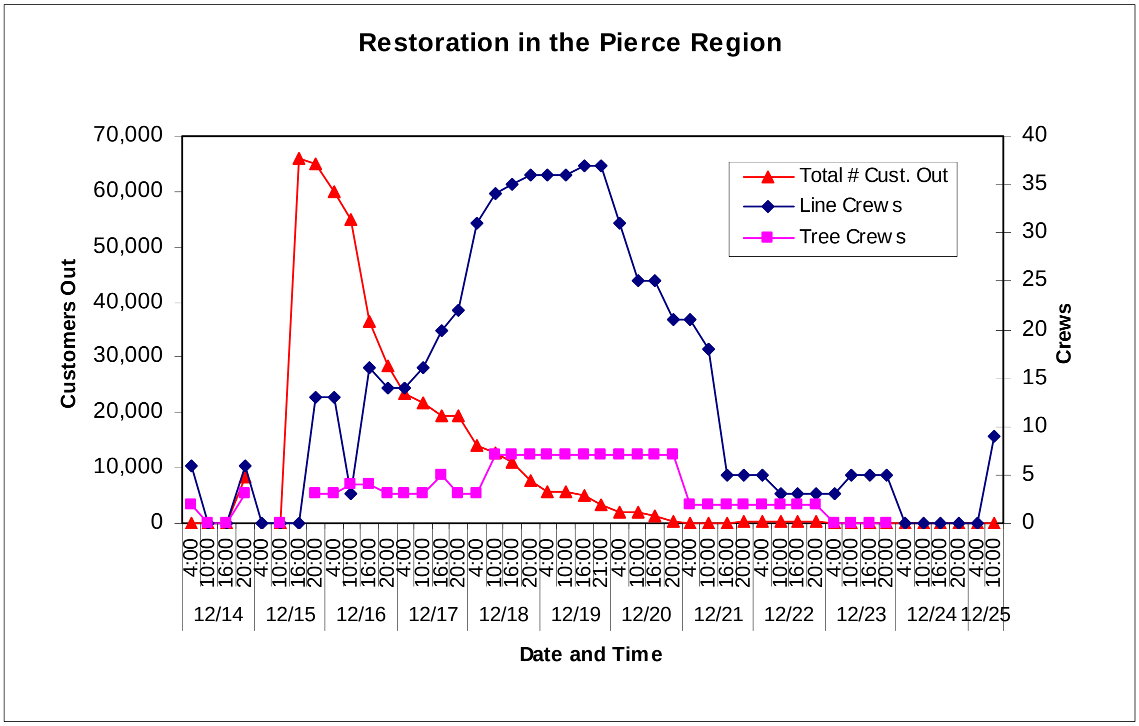
200,000
150,000
100,000
50,000
0
Crews
200
180
160
140
120
100
80
60
40
20
0
Total # Cust. Out
Line Crews
Tree Crews
12/14
12/15
12/16
12/17
12/18
12/19
12/20
12/21
12/22
12/23
12/24
12/25
Date and Time


Restoration in the Pierce Region
Customers Out
Crews
Total # Cust. Out
Line Crews
Tree Crews
Date and Time
12/14
12/15
12/16
12/17
12/18
12/19
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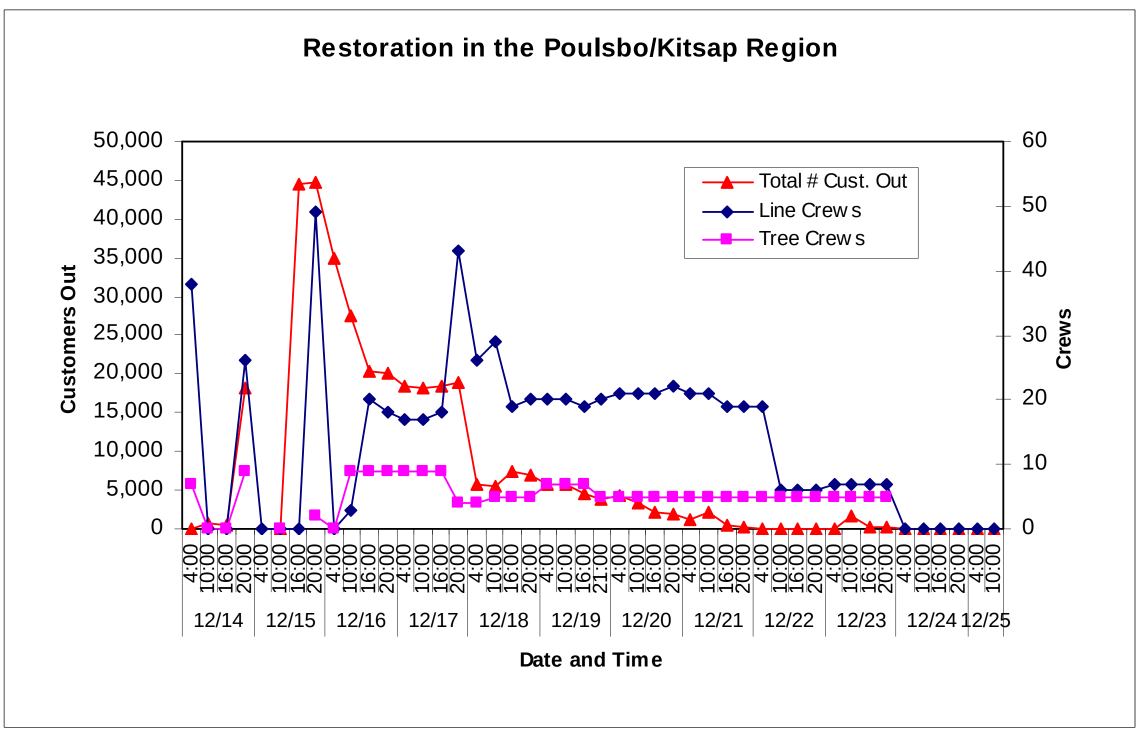
12/23
12/24
12/25


Restoration in the Poulsbo/Kitsap Region
Customers Out
Crews
Total # Cust. Out
Line Crews
Tree Crews
Date and Time
12/14
12/15
12/16
12/17
12/18
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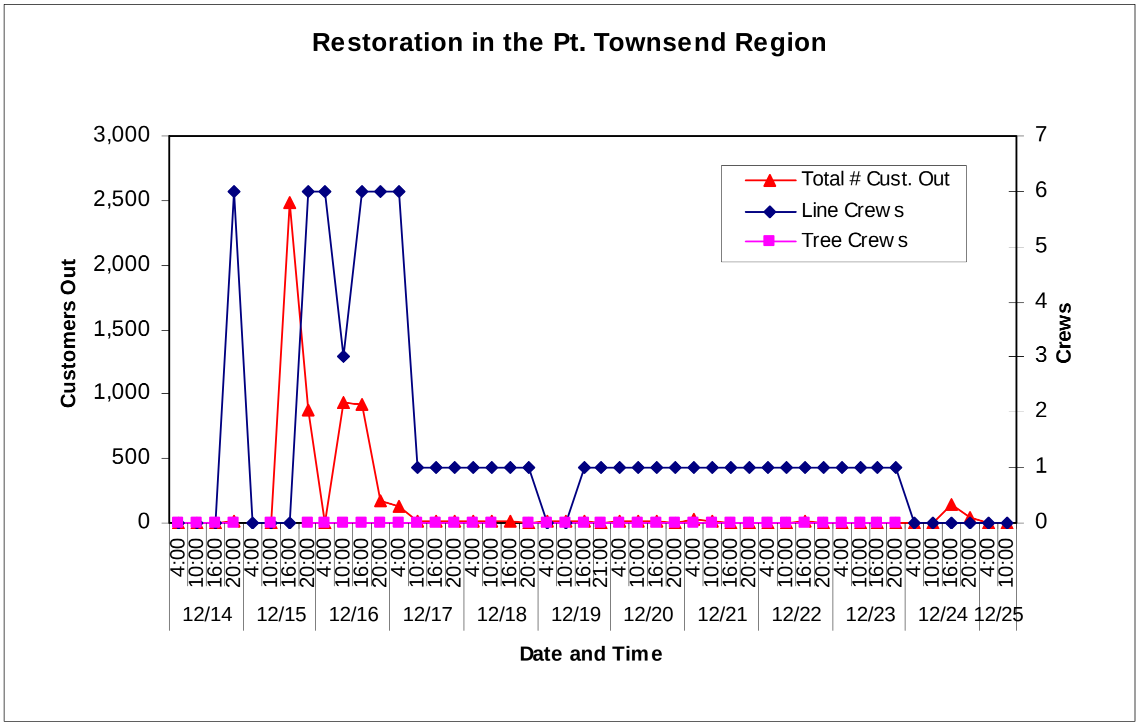
12/23
12/24
12/25


Restoration in the Pt. Townsend Region
Customers Out
Crews
Total # Cust. Out
Line Crews
Tree Crews
Date and Time
12/14
12/15
12/16
12/17
12/18
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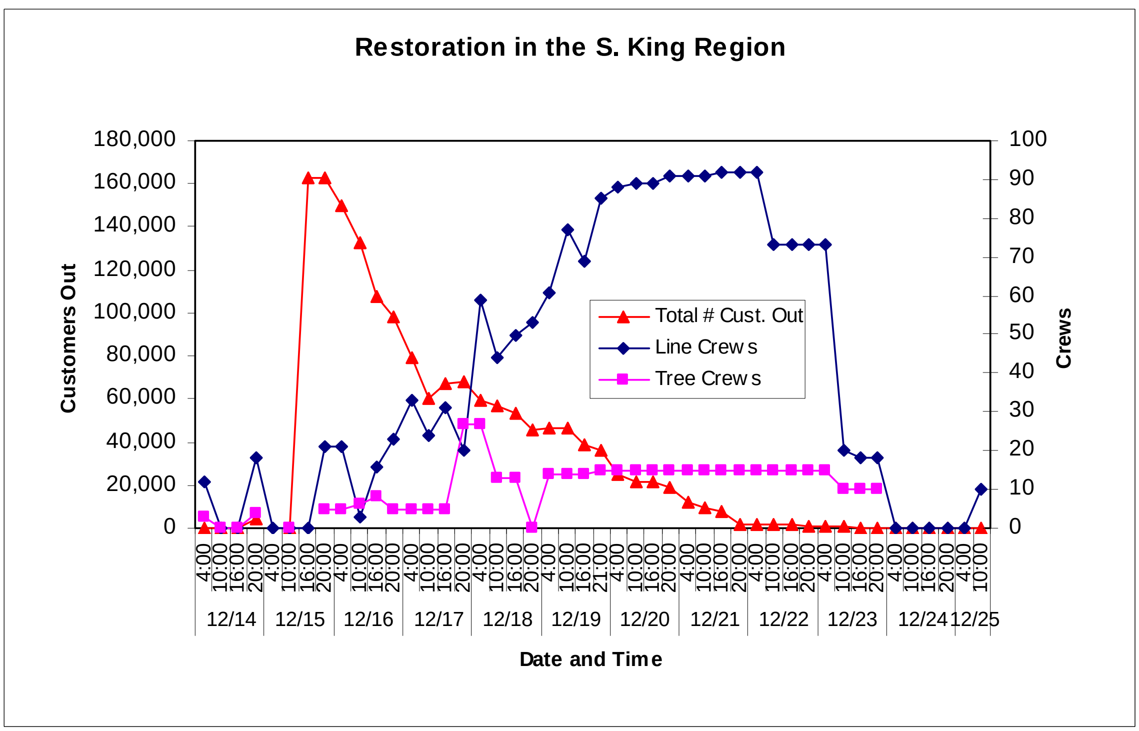
12/23
12/24
12/25


Restoration in the S. King Region
Customers Out
Crews
Total # Cust. Out
Line Crews
Tree Crews
Date and Time
12/14
12/15
12/16
12/17
12/18
12/19
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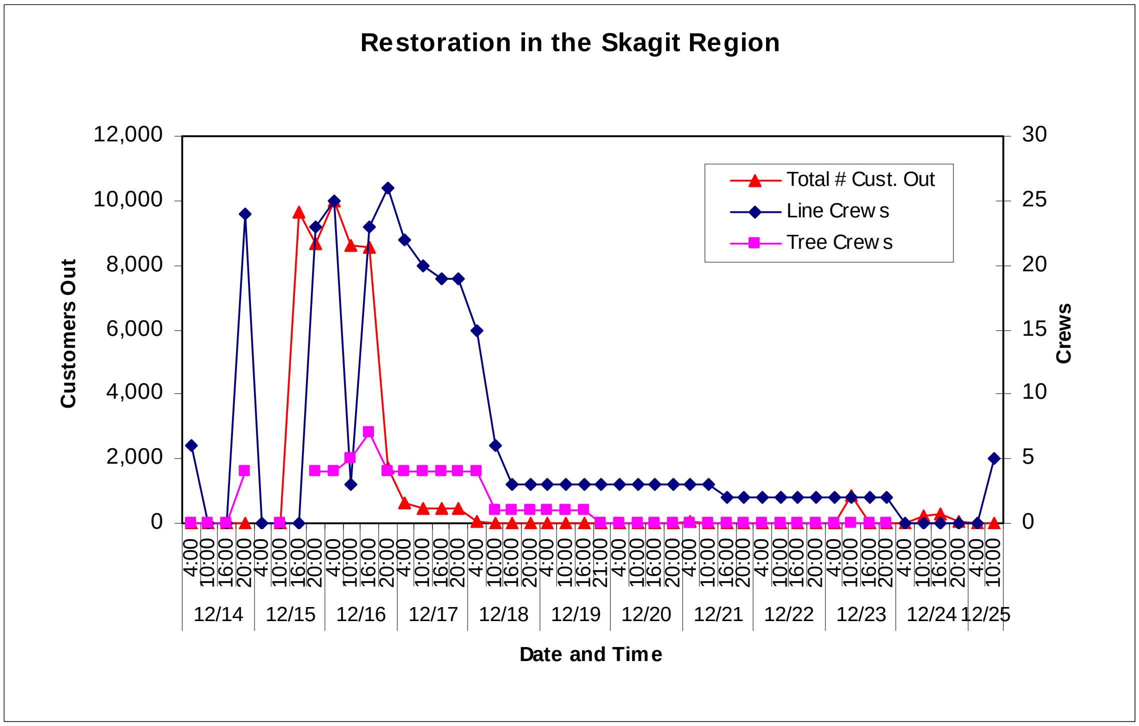
12/23
12/24
12/25


Restoration in the Skagit Region
Customers Out
Crews
Date and Time
Total # Cust. Out
Line Crews
Tree Crews
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10,000
8,000
6,000
4,000
2,000
0
30
25
20
15
10
5
0
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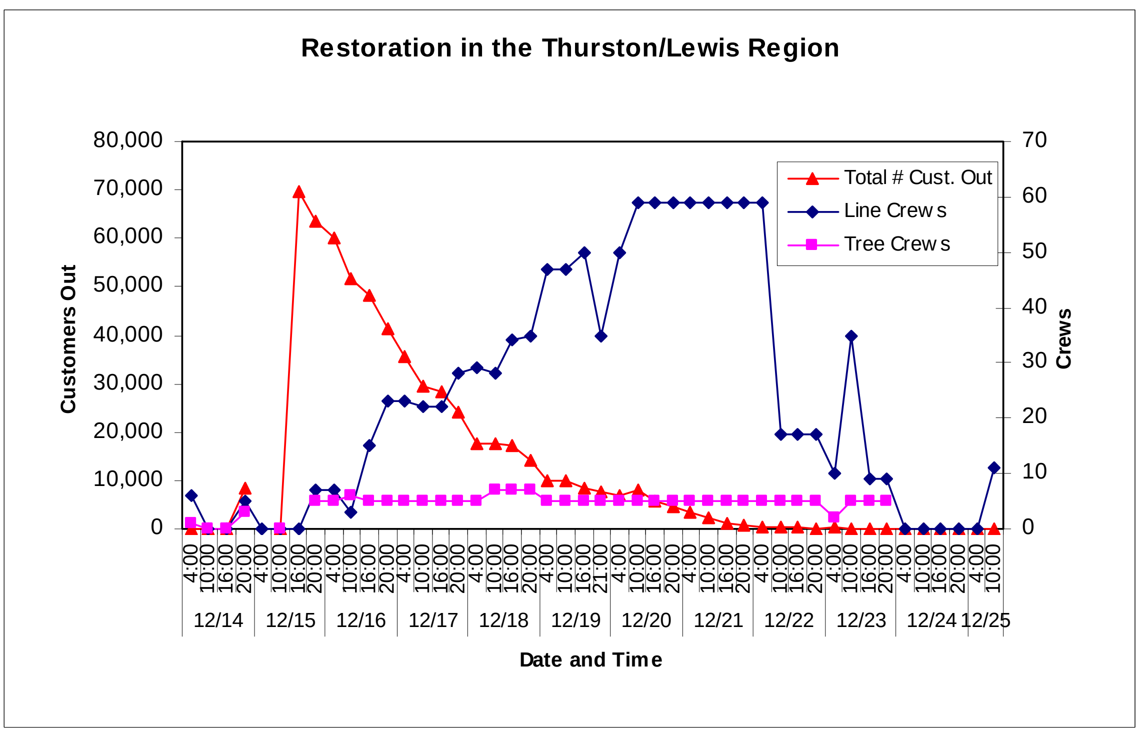
12/23
12/24
12/25


Restoration in the Thurston/Lewis Region
Customers Out
Crews
Date and Time
Total # Cust. Out
Line Crews
Tree Crews
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70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
70
60
50
40
30
20
10
0
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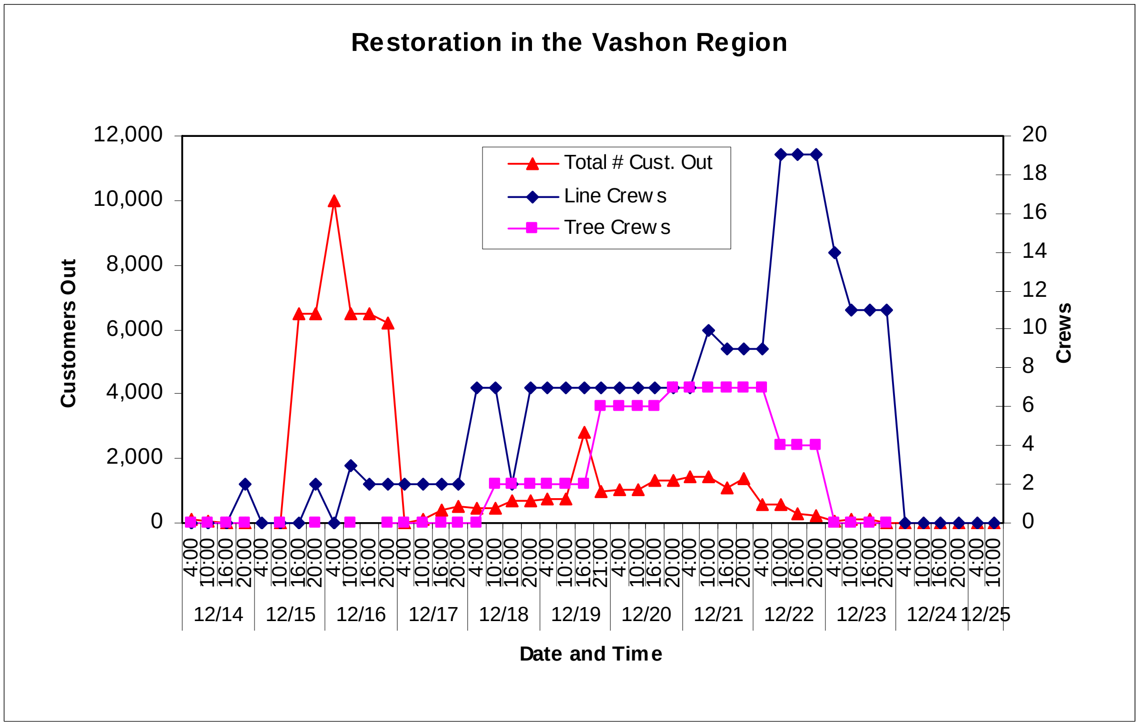
12/23
12/24
12/25


Restoration in the Vashon Region
Customers Out
Crews
Total # Cust. Out
Line Crews
Tree Crews
Date and Time
12/14
12/15
12/16
12/17
12/18
12/19
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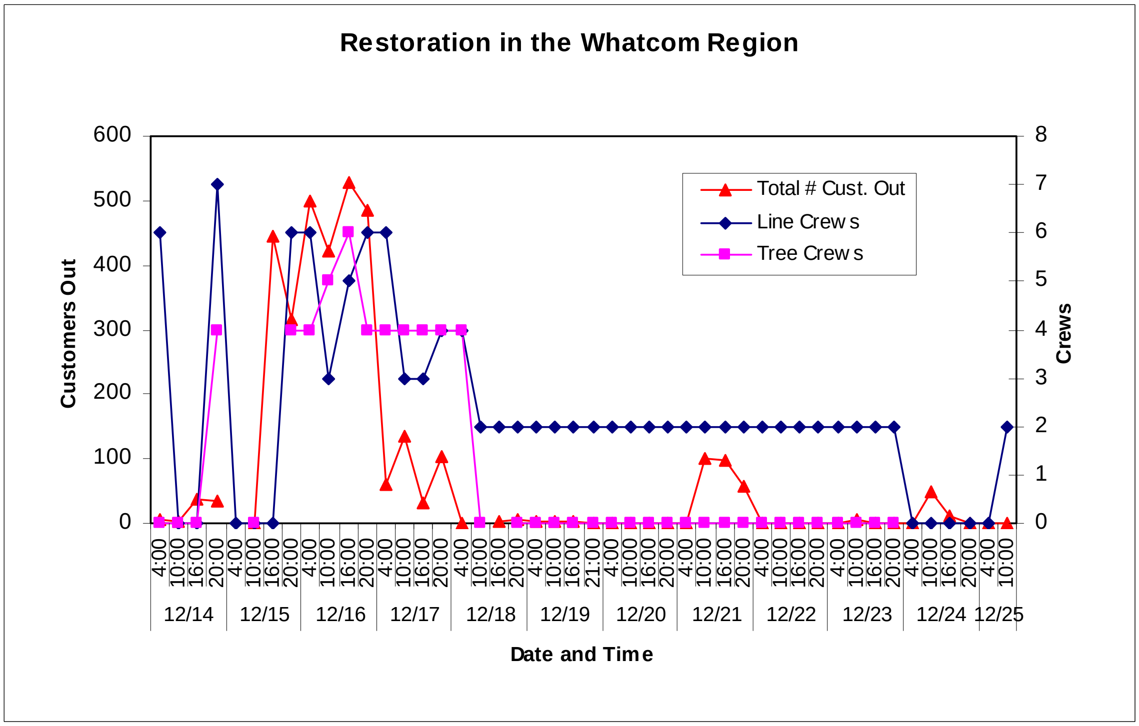
12/23
12/24
12/25


Restoration in the Whatcom Region
Customers Out
Crews
Total # Cust. Out
Line Crews
Tree Crews
Date and Time
12/14
12/15
12/16
12/17
12/18
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12/21
12/22
12/23
12/24
12/25

APPENDIX B: CERP Position Descriptions

EOC Descriptions

Work Location	Temporary Job Title	Duties and Responsibilities	Training Expectations
Corporate EOC	EOC Director	The EOC director provides Corporate (strategic) oversight and financial authority to response efforts. Once the EOC is opened, the Director becomes the information focal point for the executive management team and may respond to media inquiries about emergency response activities as needed by Corporate Communications.	Emergency Response Overview; EOC Orientation
	EOC Manager	Coordinates opening of the EOC and determines level of response required for each emergency. Coordinates with EOC Duty Manager to obtain resources needed for restoration. Balances available resources against system damage and realigns overall efforts when estimated restoration times are significantly skewed between regions. Oversees overall event reporting and ensures periodic detailed reports are issued.	Emergency Response Overview; EOC Orientation
	EOC Duty Manager	Works with Puget Sound Energy EOC Director and Manager to acquire resources needed for emergency events. Ensures resources for crews, damage assessors, CLX data entry personnel, etc. are trained and qualified for emergency response functions. Coordinates movement of regional resources and out-of-area crews that may be required for major events including equipment, fleet, travel and accommodations. Requests additional resources from PSE EOC Manager as required to augment operating base personnel; e.g., damage assessors, crew coordinators, drivers, CLX information specialists, crew supervisors, etc.	Emergency Response Overview; EOC Orientation

	EOC Communications Coordinator	Coordinates with EOC Director and Manager to ensure timely and accurate communications with the media. Coordinates messaging with Operations, Access Center and regional Communications Coordinators to ensure that restoration information is consistent across all communications channels.	Emergency Response Overview
Corporate EOC	EMS Analyst	Assesses system damage through electronic sensors located in substations and along major transmission lines (SCADA, EMS, DMS) and provides information. Focuses primarily on providing outage information at the substation and transmission line level. Ensures transmission, substation status information is communicated to storm boards	Emergency Response Overview EMS Training
	I/T Manager	Responsible to provide resolution oversight to reported hardware, application, network or key interface issues. Coordinates with PSE's helpdesk, network, application and desktop personnel to assure failures are quickly resolved or appropriately escalated, ensuring mission-critical technology tools are returned to service a soon as may be practicable.	Emergency Response Overview
	Manager Electric First Response	Works with EOC Duty Manager, PSE EOC Manager, On-duty System Operations Supervisor and PSE First Response Supervisors. Coordinates company-wide first-response resource allocation including decisions to move first response servicemen out of area, etc.	Emergency Response Overview
	Resource Coordinator	Assists in the allocation and retention of resources as required by field operations including assessors, additional crews, flaggers, etc. Works with EOC Duty Manager to ensure adequate crew availability and may call out and assign non-Potelco, off-system, out-of-state, and/or mutual assistance utility crews. May also call out specialty contractors (flagging, tree removal, helicopter and environmental, etc.) as required by PSE and	Emergency Response Overview

Work Location	Temporary Job Title	Duties and Responsibilities	Training Expectations
		for service restoration. Make arrangements for border crossings, ferry travel, and emergency road openings as required. Tracks foreign and contract crews as they change locations within PSE's service territory.	
Corporate EOC	Data Specialist	An outage data expert. Familiar with CLX and AMR outage tools. Tracks progression of outages and customer calls; archives history of event at regular intervals. May also perform DDD analysis.	Emergency Response Overview; EOC Orientation
	Administrative Support	Obtains and organizes periodic detailed reports for each impacted area and collates into regular updates for internal audiences such as, customer service, Corp Communications and, external audiences such as, State / County / City EOC's and American Red Cross.	Emergency Response Overview
	911 Call Taker	Answers emergency calls from 911 agencies, police, etc. reporting downed wire, fires, and blocked right-of-ways. Enters reported information into CLX, ensuring priority outage reports are sent to operating bases.	Emergency Response Overview; 911 Call Taker Training
	On-duty System Operations Supervisor	A regularly staffed PSE position responsible for initiating the emergency response. Also responsible for: Monitoring weather and regularly communicating with PSE staff and Potelco field operations. Notifying Potelco management and EOC duty management to activate emergency response plans. Monitoring emergency event escalation, restoration efforts and overall recovery of the electric system.	Emergency Response Overview

Operating Base Position Descriptions

Work Location	Temporary Job Title	Duties and Responsibilities	Training Expectations
Operating Base	Storm Manager	Directs or manages area storm operations, emergency response assignments, assessment, and restoration. Primary contact person with EOC, System Operations, Substations, Transmission, and Access Center. Assesses needs for additional resources, coordinating with EOC for external resources and assistance as required. Coordinates with the Damage Coordinator, Crew Coordinator and EOC to prioritize restoration activities.	Emergency Response Overview; CLX Outage Management
	First Response Supervisor	Provides support for Potelco Operating Base Manager as required. Supervises and monitors local area first responders (servicemen) and electric dispatchers to ensure adequate response. Reassigns first responders for service restoration and damage assessment as appropriate. Provides Corporate EOC with information as requested. May act as Operating Base Manager for shift coverage as require	Emergency Response Overview; CLX Outage Management
	Storm Board Coordinator	Reports to the Potelco Storm Manager. Analyzes outages and tracks needed repairs and location of assigned resources. Receives information from servicemen, CLX, 911 call-takers, damage assessors and others on location. Packages damage information by area for efficient restoration. Reviews / prioritizes response to emergencies reported via 911 agencies.	Emergency Response Overview; CLX Outage Management

Work Location	Temporary Job Title	Duties and Responsibilities	Training Expectations
Operating Base	Storm Board Analyst	Assists the Support Storm Board to coordinate and prioritize restoration and identify circuits. Provides DDD and EMS expertise as required; e.g., sub-circuiting outages for CLX. Assists CLX data entry process to ensure customer system updated accurately and timely. Works with Damage Coordinator to determine damage assessment needs and coordinate damage assessors for the designated area.	Emergency Response Overview; CLX Outage Management; DDD and or EMS
	Storm Board Assistant	Provides support to Storm Board coordinator. Reviews available outage information and records emergency. Assists in prioritizing work and communicates assignments to damage assessors, electric dispatcher and crew coordinator. Updates Storm Board and ensures CLX reflects current status. Assists with analysis and prioritizing of emergencies reported via 911 agencies.	Emergency Response Overview
	Damage Assessment Coordinator	Reports to the Potelco Storm Manager Oversees and coordinates the damage assessment and restoration prioritization for the operating base. Manages and assigns qualified personnel to damage assessment duties. Ensures the Storm Boards are updated and that CLX updates are consistent, timely and accurate. Assists in prioritizing restoration efforts. Communicates status and locations of assessment teams within the area. Coordinates with Storm Board management to prioritize restoration activities	Emergency Response Overview; CLX Outage Management; Damage Assessment Training
	Damage Assessor	Reports to the Damage Assessment Coordinator. Assesses system damage in designated areas. Records damage and material needs and relays the information to the Storm Board.	Emergency Response Overview; Damage Assessor Training

Work Location	Temporary Job Title	Duties and Responsibilities	Training Expectations
Operating Base	Crew Coordinator (General Foreman)	Reports to the Potelco Storm Manager. Oversees the line crew restoration effort throughout the event. Ensures field resources are deployed efficiently for safe and timely restoration. Coordinates with the Emergency Response Manager and Damage Coordinator to prioritize restoration.	Emergency Response Overview
	Service Dispatcher	Reports to PSE First Response Supervisor. Dispatches PSE Servicemen and Potelco two-person emergency crews to 911 calls, critical switching, patrolling, and secondary service restoration. May work with some autonomy early in event and later works in close coordination with storm board staff as event escalates and overall event management shifts to the storm board coordinator.	Emergency Response Overview; CLX Outage Management
	CLX Specialist	Updates CLX Outage Management information system regularly throughout the emergency to ensure prompt, accurate information to the Access Center and EOC.	Emergency Response Overview; CLX Outage Management
	Area Coordinator	From a remote location, using assigned resources, manages all restoration activity (damage assessment, restoration prioritization and related crew assignments) to restore extensively damaged areas. Assigned areas may be defined electrically, such as all circuits from specific substations or geographically using landmark boundaries.	Emergency Response Overview
	Contract Crew Coordinator	Reports to the Crew Coordinator (GF). Leads crews to damaged areas and works ahead of crews to see that effective restoration methods are being followed, material and other needs are met. Ensures “foreign” contract crew personnel are informed of required safety, construction and switching practice information.	Emergency Response Overview; Contract Crew Coordinator Training, First Aid

Work Location	Temporary Job Title	Duties and Responsibilities	Training Expectations
Operating Base	Communications Coordinator	Works closely with local operating base management throughout the emergency to ensure that critical customer loads (e.g., healthcare, area shelter locations, etc.) are appropriately identified and prioritized for restoration. Monitors outages impacting Major and Business Accounts as well as specific customer groups or areas. Coordinates with the Media Representative in the EOC (or, corporate communications when the EOC is not open) to ensure that notifications and updates provided locally are consistent with messages issued through Corporate Communications and the Access Center. Responds to specific customer inquiries from major account or key business customers (e.g., schools, healthcare facilities, grocery store chains, etc.). Works with the Major Account Representative(s) in the EOC to coordinate major and key customer response. Provides information to local media, municipalities, and county emergency response departments (when the EOC is not open) on damage assessment and outage restoration efforts.	Emergency Response Overview
	Driver	Safely operates vehicle while Damage Assessor visually assesses and records circuit damage	Driver Training
	Make it Safe	Dispatched to locations where primary wire is reported to be down. Ensures site safety until qualified electrical workers are on-scene.	Emergency Response Overview; Make it Safe Training

Appendix C: Summary of Conclusions and Recommendations (with section and page references)

Appendix D: Glossary of Terms

Term	Description
PSE	Puget Sound Energy
CERP	Corporate Emergency Response Plan
EOC	Emergency Operations Center
Base	Storm Base
Board	Storm Board
AOC	Area Pods – Area Operating Centers
DA	Damage Assessment
Assessors	Damage Assessor
DATool	Damage Assessment Form
Potelco	Service Provider
CLX	PSE's Current Consumer and Outage Information System
DDD	Distribution Data Display
EMS	Energy Management System
DMS	Distribution Management System
FRS	First Response PSE Servicemen
CSR	Customer Service Representative
CRM	Community Relations Manager
IVRU	Interactive Voice Recognition Unit
CIS	Customer Information System
OMS	Outage Management System
AMI	Advanced Metering Infrastructure
T&D	Electric Transmission and Distribution
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
EMS	Energy Management System
DMS	Distribution Management System
GIS	Geographic Information System
WMS	Work Management System
MWF	Mobile Workforce Management System