BC HYDRO
WINTER STORM REPORT

October 2006 – January 2007

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1 EXECUTIVE SUMMARY

The winter of 2006-2007 was one of the most severe storm seasons faced by British Columbians in recent memory. Arctic fronts swept through the northern Interior and left 75-120 cm of snow. Pacific storms brought pounding rain and destructive winds across the Lower Mainland and Vancouver Island. In all, over 800,000 BC Hydro customers, or an estimated 1.6 million residents, experienced at least one power outage between late October and the middle of January.

The severity of the storms' impact on our customers was also unprecedented. Fully three-quarters of all customer-hours lost to power outages in 2006-2007 was the result of these storms. And while the overall inconvenience to our customers was immeasurable, we do know that 14.7 million of the 19.6 million customer-hours lost this year were storm-related. To put this in perspective, prior to this, the highest total number of customer-hours lost was 7.4 million in fiscal year 2004.

The main purpose of this report is to assess BC Hydro's storm response and restoration performance, quantify the associated costs, and identify areas for improvement. Five of the most damaging storms are analyzed in detail at the end of this report.

What these reports show is that power outages were caused by storm-related damage to BC Hydro's transmission and distribution systems. Wind and heavy snow caused trees and branches to fall on power lines. Throughout most of the winter, heavy rain loosened the soil which weakened root systems and made trees more susceptible to falling onto power lines during storms that brought gale-force winds.

Four of the five major storms affected communities from Hope to the Lower Mainland and Vancouver Island. At the height of the storm on December 15, the number of customers without power at any one moment peaked at 240,000. Over 170,000 customers in the Lower Mainland and Vancouver Island were affected by three of the storms, and some customers were without power for up to six days.

For all the storms, however, the vast majority of affected customers (80%) were restored to service within 48 hours. This was mainly due to the hard work and dedication of BC Hydro and contractor crews that worked many long days to restore power, often under adverse conditions.

In many ways, our customers were well served by those who removed fallen trees and limbs, made downed wires safe, snow shoed through the backwoods to access damaged lines, worked countless hours in the rain and cold, and ultimately restored power to customers. Only to do it all again as one storm followed another.

As a result of these experiences, we have identified areas where we can serve the public even better. Many lessons learned during one storm were applied to the next, and we are working hard to ensure necessary improvements are in place by the next storm season. One of the areas identified for improvement is with our customers' first point of contact with BC Hydro: the phone system. Many dropped calls, busy signals, long waits on hold, and inaccurate restoration times caused a great deal of frustration and confusion. These are areas in which we can and will improve. We know, for example, that the number of calls our system received peaked to about 140,000 on November 26. Nearly 48,000 of those callers heard a busy signal. During regular hours, our call capacity is approximately 6,500 calls per hour. At the height of the storms, the call volume grew to almost 40,000 calls per hour. At minimum, we have to increase our call capacity capabilities, or use alternatives, to ensure that we can better inform our customers during storm events.

We plan, for example, to make the necessary changes and investments to increase our call capacity, provide better training to our customer service representatives, use new technologies to our advantage, and better prepare ourselves and the public in advance of storm season.

Our internal procedures and emergency response plans have also improved. Since the corporate reorganization in June 2006, emergency response plans at the corporate level and across the main divisions of BC Hydro have been updated to better prepare for storms and other emergencies. Clearer roles and responsibilities, regular training, and formalized protocols for staff members linked to emergency response scenarios are included in our emergency management. In other words, a more fully integrated team response will improve both internal and external communication and coordination, and ultimately provide the customer with more timely and accurate information during the restoration period.

The storms also have helped us identify areas of our distribution system that are most vulnerable to the impact of severe weather. We plan to invest in these areas to increase the resiliency of our system. For example, we have identified over 250 circuits that have historically been vulnerable to storms. These circuits represent only 21% of our entire system, but they contribute over 50% of annual customer-hours lost. Reducing the overall number of outages and the length of each outage are key BC Hydro priorities.

Finally, the majority of outages on the distribution system are due to trees and branches that come into contact with overhead lines. To help prevent future damage from hazard trees, BC Hydro plans to invest more in vegetation management, including a more aggressive focus on removing hazard trees outside of BC Hydro right-of-ways, which is a cost-effective way to improve system resiliency.

A summary of all other plans for improvement can be found in Section 11 of this report.

2 BACKGROUND

2.1 Purpose of Report

In the winter of 2006-2007, British Columbia was faced with one of the most severe storm seasons in recent history. From the period between October 2006 and January 2007, B.C. was hit with five major storms which presented BC Hydro with the challenge of restoring power caused by damage to the hydroelectric system. These storms are the focus of this report and are individually reviewed (see Appendix 1-5).

The purpose of this report is to:

- assess the nature and causes of the electrical service interruptions during the storm period from October 2006 – January 2007;
- assess BC Hydro's response and repair performance and the associated costs incurred;
- summarize key lessons learned; and
- make recommendations and investment plans to:

    a. lessen the damage to BC Hydro's electrical distribution system from future severe incidents;
    b. improve restoration efforts;
    c. provide more timely and useful information for customers who have lost power; and
    d. quantify the costs associated with the recommendations above.

2.2 Scope and the Approach

In order to fulfill the purpose of this report, BC Hydro has conducted a comprehensive review for each of the following major storms:

- Oct. 27/06 Snowstorm: Burns Lake/Vanderhoof
- Nov. 15/06 Windstorm: Lower Mainland/Vancouver Island
- Nov. 26/06 Snowstorm: Lower Mainland/Vancouver Island
- Dec. 11-15/06 Windstorm: Lower Mainland/Vancouver Island
- Jan. 9/07 Windstorm: Lower Mainland/Vancouver Island

The reviews were conducted by interviewing a wide range of BC Hydro employees involved in the restoration process.

2.3 The Organization: Who was Involved?

- **Corporate Emergency Preparedness Group (CEPG):** The CEPG, under the direction of Safety, Health, and Environment, is responsible for establishing corporate-level procedures and directions to be followed whenever an emergency is declared. The Corporate Emergency Plan provides the overall framework and direction from which each of the business groups implement their respective emergency response plans, relevant to their core functions and responsibilities.

- **Generation:** Generation operates and manages hydro and thermal generation facilities throughout the province. It is responsible for all of BC Hydro's generating facilities. It provides emergency response services at generation-associated substations and switchyards for Field Operations. Generation has prepared Generation Emergency Plans (GEP) for the facilities in its regions.

- **Field Operations:** Field Operations manages BC Hydro's distribution line facilities and provides the resources to respond to emergency events affecting all non-generation components of BC Hydro's electric system, including distribution, transmission and telecontrol assets. It contracts to BCTC for the operation of the distribution system through BCTC's Area Control Centres. Field Operations has prepared a draft Field Operations Emergency Response Plan, dated October 2006.

- **BC Transmission Corporation (BCTC):** BCTC is a crown corporation that is responsible for planning, operating and maintaining BC Hydro's transmission system. BCTC is accountable for emergencies associated with transmission lines and substations, as well as for real time operation of the system (generation, transmission, and distribution components) during emergency situations. BCTC has contracted responsibility to BC Hydro's Field Operations group for response actions for all components at the field level. Field Operations has delegated responsibility for response actions in generation-related switchyards to Generation. BCTC has developed a Transmission Emergency Response Plan.

- **Customer Care:** Customer Care is accountable for the customer Call Centres which are staffed by an external service provider (Accenture Business Services for Utilities). During storms and major outages, Customer Care ensures appropriate Call Centre staffing levels are in place to deal with call volumes and that Call Centre agents have the most up-to-date information from the field. Customer Care also ensures that agents provide customers with information that is consistent with what is being communicated externally through media and the BC Hydro website. Key Account Managers also provide a direct link to their customers to keep them informed. Customer Care has produced a Situational Operations Plan to respond to storm situations.

- **Corporate Affairs:** Corporate Affairs is responsible for communications with external organizations, the public and with BC Hydro employees. Corporate Affairs is currently formalizing and updating its Emergency Communications Plan (Outages).

3 BC HYDRO PRE-STORM PREPARATION

3.1 Emergency Response Planning

3.1.1 Corporate Emergency Plan

BC Hydro updated its Corporate Emergency Plan (CEP) in October 2006, after the corporate reorganization in the summer of 2006. The CEP is included in this report as Appendix 6. One of the priorities of the reorganization was to focus on corporate-wide emergency planning.

For example, since the corporate reorganization, one of the key initiatives was to establish a Duty Coordinator role. This role, on call 24 hours a day, seven days a week, is to be aware of all emerging issues affecting BC Hydro at any given time, to support those in charge of response and recovery operations, and to communicate with senior executives and affected business groups so they are informed of a situation as early as possible. This new role will improve overall control of emergency management. However, this role was not yet in place during the storm season, which started three months after the reorganization.

Under the CEP, each business group mentioned in Section 2.3 is to have its own emergency response plans that is coordinated with the CEP and which can be activated should an emergency be declared a “high level” emergency.

The five levels of BC Hydro’s emergency response organization are:

- BC Hydro’s Corporate Emergency Centre (CEC) or BC Hydro/BCTC Unified Corporate Emergency Centre
- Field Operations Emergency Coordination Centre (FOECC)
- Area or Regional Emergency Centre (regional “storm rooms”)
- Headquarters Emergency Centre (local offices)
- Incident Site

In the CEP, an emergency is defined as any situation involving company personnel, infrastructure, facilities or operations that may endanger life, property, the environment, or that may seriously affect normal BC Hydro operations or its reputation. Most emergencies can be handled by the business groups at the incident site, headquarters or area/regional level without activating the CEC. The CEC is to be activated when there is a major emergency requiring a corporate response strategy, and/or coordination of resources and information needed to support the business groups. A high-level emergency leading to CEC activation typically has one or more of the following characteristics:

- more than 100,000 customers are without power;

- the estimated time for restoration of service is greater than 72 hours;
- there is concern for public or employee safety;
- there is significant (or potentially significant) media and public interest.

3.1.2 Field Operations Emergency Plan

Following the 2006 corporate reorganization, Distribution Operations and Field Services merged their respective emergency response plans into the current draft Field Operations Emergency Response Plan (FOERP), dated October 2006. This document was used by Field Operations during the storms as a framework for their emergency response.

The FOERP provides a framework for responding to storm forecasts, assessing storm damage, taking preliminary action, coordinating resources, directing regional managers, leading the response effort, and activating storm rooms and higher level responses.

3.1.3 Customer Care and Corporate Affairs

Neither of these business groups had a formal emergency response plan prior to this storm season. The Corporate Affairs group follows the procedures outlined in the Corporate Emergency Plan (Section 4.8), which outlines the roles and responsibilities of the Information/Liaison Group. This group is led by a senior manager in Corporate Affairs, with the assistance of managers and staff from Customer Care to:

- communicate to employees, stakeholders and the public;
- collect information regarding an emergency's effect on customers;
- liaise with Community Relations Managers regarding regional issues;
- liaise with municipal, regional, provincial and federal agencies as required.

3.2 Resource Planning

3.2.1 Labour

In response to storms and other emergencies, BC Hydro draws from the following pool of labour to restore power:

- BC Hydro field staff: 345 Power Line Technicians (PLTs). There are also 50 vacancies for PLT positions that Hydro is currently seeking to fill. It has been challenging for BC Hydro to attract and retain skilled PLTs in the current tight labour market. The additional 50-60 staff may have resulted in reduction of overall outage duration during the first 12 hours of the storms, as it usually requires that amount of time to mobilize contractor crews to the affected areas. BC Hydro is looking at ways to enhance its attraction, retention and motivation of its critical employees.

- Construction services: approximately 40 PLTs.
- Outside contractors: approximately 250-300 line and 100 vegetation management contractors across B.C.

3.2.2 Emergency Line Agreements

BC Hydro has Emergency Line Agreements with all contractors of emergency line work. This guarantees BC Hydro a specified number of resources in case of an emergency. BC Hydro has the right-of-first-refusal before the contractors can accept other offers of work.

3.2.3 Mutual Aid Agreement

BC Hydro has a Mutual Aid Agreement with FortisBC to send available crews in case of an emergency. BC Hydro also has similar agreements with the City of New Westminster and Puget Sound Energy (PSE). The mutual aid agreement was not invoked with PSE because of their own restoration efforts for the same storms.

3.2.4 Call Centres

Customer Care is responsible for managing the Customer Care portion of the agreement with Accenture Business Services for Utilities (ABSU). This includes the Call Centres at Edmonds (Burnaby) and at Vernon. There are 144 work stations at Edmonds and 40 at Vernon. ABSU has approximately 130 agents available to cover three shifts per day when a storm occurs, which works out to approximately 80-100 agents at any given time. Credit and collections staff (another 31 seats) are trained to take trouble calls as well.

3.3 Staff Training

Field Operations regularly conducts pre-storm training in the fall. This includes:

- identifying the need for non-traditional responders, such as designers, who are qualified to make an assessment of damage but not make repairs. (Note: After the corporate reorganization in June 2006, designers were merged with Field Operations. This change improved the coordination of resources for damage assessments during the storms.)
- preparing storm rooms for use (phones, computers, etc);
- briefing and reviewing roles and responsibilities with Regional Managers; and
- providing training for using the POWERON system to manage storm restoration progress.

Customer Care training includes:

- annual refresher training for agents in October/November;

- a coordinated effort by BC Hydro and ABSU to improve agents' customer-relations skills, as well as improving accuracy when handling trouble calls;
- a separate Quality Assurance process for measuring how well agents handle trouble calls. Agents are measured on a number of factors: using proper greeting, verifying customer information, listening attentively, maintaining polite relationship with the caller, demonstrating customer care, providing correct information, offering further assistance, etc. The results are provided to Customer Care on a monthly basis with action plans on where agents need additional coaching.

3.4 Weather Forecasting

The Customer Restoration Centre (CRC) and senior managers in Field Operations receive notification of weather warnings from Environment Canada. Based on the expected severity of the weather, plans are implemented by senior-level managers once the extent of possible damage is determined.

For example, in the first few storms, plans to mobilize crews were done when the storm occurred. With the forecast of a much more severe storm in mid-December, however, crews were mobilized to travel from other regions to the expected affected areas prior to the storms.

4 WEATHER

The storms that hit B.C. between October 2006 and January 2007 were extreme in their duration, severity and the level of damage they inflicted on BC Hydro's transmission and distribution systems. The weather conditions for the five major storms that are the focus of this report are described below.

4.1 October 27, 2006

A Pacific weather front met a cold weather front coming from the Northern coast. These fronts stalled over the Skeena Valley and the Bulkley Valley Lakes Districts. For two days, heavy wet snow fell on the area, leaving an accumulation of 75 to 120 cm. By the third day, temperatures dropped to -10°C, and an additional 30 cm of snow fell in some areas. A weather snow storm warning was issued for these areas 24 hours prior to the event.

In Northern B.C., heavy, wet snow
toppled trees and limbs onto distribution lines.

4.2 November 15, 2006

Heavy rains and winds intensified by mid-November, with gale-force gusts up to 145 km/h knocking down many trees already weakened by the previous month's heavy rain.

An intense frontal system over the Eastern Pacific hit the South and Central coast of B.C. Just ahead of the system, southeast winds of 70 km/h to 100 km/h developed over northern Vancouver Island and the central coast. Winds were clocked at over 100 km/h at the Abbotsford airport.

The most damaging characteristics of this storm were the high sustained gusts of wind, coupled with heavy rains that loosened the soil. This combination resulted in many trees falling on distribution lines.

On the evening of Nov. 14, BC Hydro received storm warnings from Environmental Canada. With the help of our in-house meteorologist, we assessed where the storm was most likely to hit.

4.3 November 26, 2006

On November 19, a Pacific storm brought 90 mm of rain and strong winds to coastal B.C. Then a weather warning was issued that an Arctic ridge over the BC Interior would combine with a Pacific low pressure system over southwest B.C. The result, on November 26, was 20-40 cm of heavy snow across Greater Vancouver, Victoria, and the rest of the South Coast. On November 27 and 28, the Arctic front spread across the Lower Mainland and temperatures dropped as the skies cleared (-12°C in Vancouver).

The storm dropped 40 to 60 cm of snow in the eastern Fraser Valley. Abbotsford Airport broke its one-day snowfall record for November with 44 cm. Snowfall at Vancouver International Airport amounted to 39 cm. Victoria had six days of snow with back-to-back 15+cm days.

This major snowstorm was followed by a week of cold temperatures, which fell as low as -36^{o}C in northern B.C. and -12^{o}C at Vancouver Airport. As a result, the weight of the heavy snow brought more branches and trees down on power lines. When the snow did melt, tree branches sprang back up and caused even more damage to power lines.

4.4 December 11-15, 2006

On December 11, a weather warning from Environment Canada predicted heavy rain and very strong winds for southern B.C. Southeast winds of 60 to 90 km/h developed over the southern coast and continued to persist throughout the evening. A strong onshore flow associated with the low produced over 50 mm of rain in some regions. The windstorm swept through all areas of the Lower Mainland and Vancouver Island. The Fraser Valley, North Vancouver Island and the Sunshine Coast were hit particularly hard.

On December 15, Environment Canada issued another warning. This time, a very powerful Pacific storm was moving across southern B.C. Behind the storm, westerly winds of up to 100 km/h hit the south coast. The storm brought heavy rainfall to the eastern Fraser Valley, south Vancouver Island and the Sunshine Coast.

4.5 January 5-9, 2007

A strong south-westerly flow brought moderate to heavy precipitation and very mild temperatures across the entire province in the first week of January.

Then a weather warning was issued on January 5, as cold northwest winds blew in and temperatures dropped to zero degrees across the Lower Mainland. Heavy rain hit the South Coast on January 9, followed immediately by an intense cold front.

The coastal storm intensified the second week of January and cold Arctic air started moving southward and out toward the coast, reaching the Greater Vancouver area on January 10 for the city's second major Arctic outbreak of the season. Northwest winds at Vancouver Airport reached 78 km/h, gusting to 98 km/h.

5 IMPACTS

5.1 Impact Overview

The severity of the storms in 2006-2007 caused significant damage to the electrical system, which left approximately 800,000 different customers without power at least once during the winter. At the height of the storms, approximately 240,000 customers were without power (on December 15). Outages lasted for many hours and in some cases many days. Many BC Hydro distribution lines as well as transmission lines and substations were affected. The table below provides a detailed summary of the overall impact to our system and to our customers for each storm.

Major Storms	Oct 27/06	Nov 15/06	Nov 26/06	Dec 11-15/06	Jan 5-9/07
Safety:					
Employee injuries or fatalities	None	None	None	None	None
Public injuries or fatalities	None	None	None	None from wires down. (See Section 5.2.1.)	None
Impact to the System:					
Generation assets	There were no major impacts to generation assets, downstream stakeholders or dam safety.	There were no major impacts to generation assets, downstream stakeholders or dam safety.	There were no major impacts to generation assets, downstream stakeholders or dam safety.	There were no major impacts to generation assets, downstream stakeholders or dam safety.	There were no major impacts to generation assets, downstream stakeholders or dam safety.
# of damaged trans. circuits (note 1)	9	8	12	12	7
# of damaged distr. circuits	12	100	150	181	88
Impact to the Customers:					
Communities Impacted	Burns Lake Vanderhoof Smithers	Lower Mainland and V. Island	Lower Mainland and V. Island	Lower Mainland and V. Island	Lower Mainland and V. Island
# of customers out at the peak	19,900	226,000	92,600	240,300	120,399
# of customers out after 24 hours	8,231	55,000	72,500	78,794	22,224

Major Storms	Oct 27/06	Nov 15/06	Nov 26/06	Dec 11-15/06	Jan 5-9/07
# of customers out after 48 hours	4,457	12,000	25,000	52,212	6,306
# of customers out for more than three days	2,431	2,000	2,703	4,474	21
Communities from which customers were out for more than three days	Burns Lake Vanderhoof Ft. St. James	Bamfield Nitinat Lions Bay	Gulf Islands Brentwood Bay, Saanichton Areas of Van. and Victoria	Gulf Islands Brentwood Bay, Saanich, Sooke, Sidney, Bowen Island, Deep Cove, Areas of Van. and Victoria	None
Call Centre Response:					
# of calls received	63,500	209,000	258,000	305,000	241,000
# of calls answered (either through call agents or IVR)	63,500	164,000	199,000	242,000	133,000
# of busy signals	0 (note 2)	44,500	59,000	63,000	108,000

Note 1: The distinction between transmission and distribution circuits or feeders is that distribution circuits are constructed to operate at 35kV or lower. The primary distribution circuits/feeders include a trunk portion as well as single-phase and three-phase laterals that supply energy to customers' meters. In the table above, the "# of damaged distr. circuits" refers to full feeder/circuit outages (i.e., breaker in the substation is open). The vast majority of storm-related damage was to BC Hydro's distribution system, not its transmission system, which is why this report focuses almost exclusively on BC Hydro's distribution system (see Causes of Outages later in this section).

Note 2: Customers still might receive a busy signal in the TELUS network, but reports from TELUS say there were none.

5.2 Safety

5.2.1 Public Safety

During the restoration process, BC Hydro's first priority is public safety. There was no evidence of anyone from the public being injured by damaged or downed electrical lines during the storms. Tragically, however, a couple from Burnaby died from carbon monoxide poisoning caused by using a gas-powered generator indoors after the storm on December 15. Prior to and following this incident, BC Hydro issued warnings to customers, asking them to exercise caution

when using generators, and to use them only in well-ventilated areas. We will continue to advise customers to use extra caution when using generators.

There was also one near-miss incident. The Sooke Fire Department reported a downed line during the mid-November storm. While waiting for a BC Hydro crew to respond, a firefighter picked up the line and moved it off the road. The wire was not live.

BC Hydro and the B.C. Fire Chief's Association have established a joint task force to identify and develop solutions to improve responses during storms and other major events. One of the key objectives is to provide a coordinated effort and a single point of contact for addressing issues that may arise between first responder departments and BC Hydro.

Trees and adverse weather are the most significant causes of outages, totaling 77% of all customer-hours lost for fiscal year 2007.

5.2.2 Employee and Contractor Safety

With very little time to recover between storms, our crews dedicated many long days under adverse working conditions to restore power for customers. With our focus on safety as a first priority, there were no serious employee/contractor accidents associated with the restoration effort.

5.3 Customers and Communities

The majority of the communities affected by the winter storms stretched from Hope to the Lower Mainland to Vancouver Island, with the exception of the October storm in the north of B.C., which affected the communities of Smithers, Houston, Hazelton, Burns Lake, Vanderhoof, and Fort St. James (an area of approximately 64,000 km ^{2}).

5.4 Electrical System

The storms caused widespread disruption to the distribution system, resulting in 14.7 million customer-hours lost, or 75% of the 19.6 million customer-hours lost in fiscal year 2007. Prior to this, the highest number of customer-hours lost in a year was 7.4 million in fiscal year 2004.

BC Hydro identified 256 circuits that are consistently the most vulnerable to storms and their impacts. We noted that while the reliability performance for a particular community may be good, there can be circuits within that community that are more vulnerable to storm damage. These 256 circuits represent only a fifth of the system circuits, yet they contribute to over half of annual customer-hours lost. For example, over the last four years, some of these circuits experienced an annual average of 10 outages of up to 10 hours per outage (i.e., an average of up to 100 hours lost per year). This compares to the yearly average customer outage duration of 3.8 hours in fiscal year 2007.

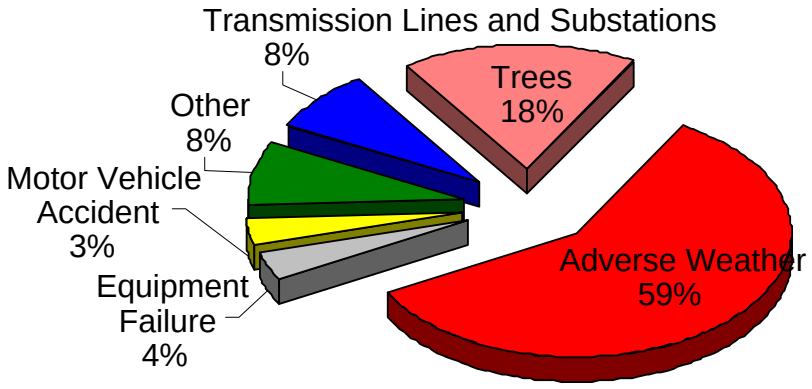
5.5 Causes of Outages

The BC Hydro distribution system serves over 1.7 million customers in a service area encompassing 854,000 km^2 with about 48,000 km of overhead and 7,800 km of underground distribution lines. As shown in the graphs below, most power outages in fiscal year 2007 were caused by interference with the distribution system (92%), while the remainder related to transmission line and substation outages.

Trees and adverse weather are the most significant causes of outages, totalling 77% of all customer-hours lost for fiscal year 2007. This is up from 44% in the previous year. The power goes out when: trees or branches fall on power lines and either bring them down or short them out; when snow, wind and rain cause trees and other debris to fall on our lines or knock down our poles; when a car hits a pole; or when animals or people contact our lines.

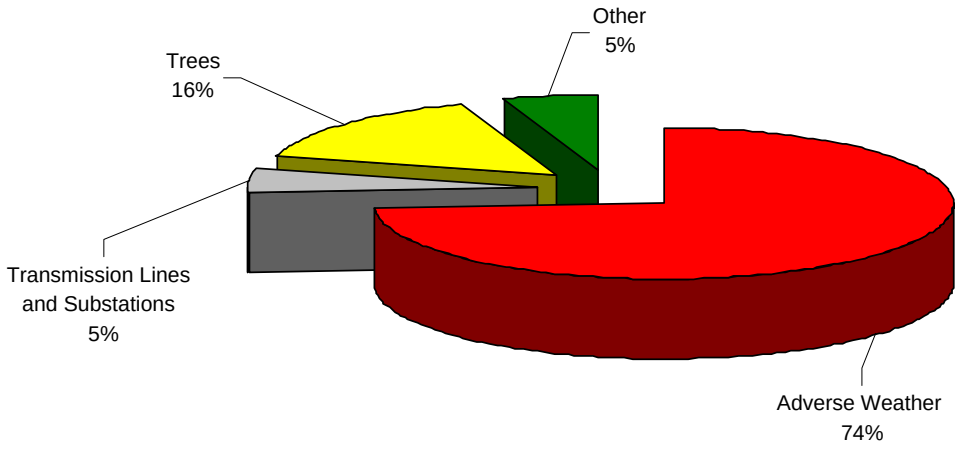
F2007 Causes of Outages

(19.6 Million Customer Hours Lost)



F2007 Causes of Outages during Major Storms

(14.7 Million Customer Hours Lost)



6 RESTORATION COSTS

In fiscal year 2007, BC Hydro incurred $47.2 million in restoration costs related to equipment or infrastructure failure caused by weather-related events. Of that total amount, $9 million related to overhead costs for support services such as Information Technology, Human Resources, safety and management services. Of the remaining $38.2 million incurred, $36.7 million related to the five major storms described in this report, and $1.5 million to minor events.

For accounting purposes, BC Hydro considers a "major event" as a single event that meets one or more of the following criteria:

- More than 100,000 customers are simultaneously without power;
- The event is province-wide or encompasses a large geographical region;
- The restoration period is greater than two days, or additional resources from outside an affected region are required;

And:

- The operating costs associated to restoring the power to customers exceed $1 million.

A "major storm," such as the five storms reviewed in this report, is a single weather-related event that meets all of the criteria described as a "major event."

Table A below shows the costs that BC Hydro incurred in its restoration efforts for the five major storms from October 2006 to January 2007:

Table A: Major Storms

Storm Dates	Details	Peak # customers without power	Areas Affected	Restoration period (# days)	Net Major Storm Costs ($ millions)	Ref
Oct 27, 2006	Snowstorm	19,900	Vanderhoof	7	1.9	
Nov 15, 2006	Windstorm	226,000	LM / VI	6	6.3	
Nov 26, 2006	Snowstorm	92,600	LM / VI	7	8.4	
Dec 11, 2006	Windstorm	240,300	LM / VI	10	15.4	
Jan 9, 2007	Windstorm	120,400	LM / VI	6	4.7	
					36.7	
	Maintenance plans that were not executed due to storm activity				(1.8)	1
	Minor storm budget under expenditure				(2.0)	2
	Net proposed cost deferral				32.9	

1) Operating expenditures for planned maintenance work that was not carried out due to the redeployment of resources to assist with the restoration effort.
2) Other storm costs incurred for minor storms for the fiscal year amounted to $1.5 million.
Fiscal 2007 storm restoration budget is $3.5 million; therefore, variance is $2 million, to be excluded from application for recovery.

In the past five years, BC Hydro has budgeted approximately $4.3 million/year for restoration costs relating to storm events. With the exception of fiscal year 2006, we have consistently been spending over that budgeted amount by about $2 million every year.

Under a normal storm season, service restoration costs have been relatively controllable and were budgeted accordingly. However, it was impossible to have anticipated the magnitude and the number of major storms that swept through B.C. in fiscal 2007. The unprecedented magnitude of the $36.7 million in restoration costs for those storms cannot be absorbed within the existing storm restoration budget of $3.5 million that was used to set fiscal 2007 rates. It is common practice for utilities under the B.C. Utilities Commission's jurisdiction to apply for and receive approval to allow for recovery of major expenditures in respect of an uncontrollable, unforeseeable and extraordinary event.

6.1 Storm Cost Analysis

The table below shows the different categories of costs for each of the five major storms:

Storms	**Oct. 27/06**	**Nov. 15/06**	**Nov. 26/06**	**Dec. 11/06**	**Jan. 9/07**	**Totals**	**%**
Internal Costs:							
Labour	349	1,946	1,818	3,446	872	8,431	23%
Construction Services	68	522	376	674	98	1,737	5%
Materials	20	335	309	725	207	1,596	4%
Travel	33	101	121	233	32	520	1%
Vehicles	54	391	329	586	197	1,557	4%
Subtotals	**524**	**3,295**	**2,953**	**5,664**	**1,406**	**13,841**	**38%**
External Costs:							
Contractors	1,390	2,876	5,287	9,418	3,232	22,203	60%
ABSU	25	126	139	217	46	553	2%
Other	4	26	26	54	15	125	0%
Subtotals	**1,419**	**3,028**	**5,452**	**9,689**	**3,293**	**22,881**	**62%**
TOTAL	**1,943**	**6,323**	**8,405**	**15,353**	**4,699**	**36,722**	**100%**

The majority of the costs were labour costs charged both internally and by external contractors to restore power.

- **Internal headcount**: total number of employees who charged any time to storm accounts. This would include employees working part-time on the storms, i.e., to support staff, designers, etc.
- **Contractors**: estimated number of staff at the peak of the storms based on logs kept. The volume of the staff required would be lower near the end of the restoration period.

Our resource mix for each storm is shown in the table below:

Resources

Storms	Oct. 27/06	Nov. 15/06	Nov. 26/06	Dec. 11/06	Jan. 9/07	Average LM/VI storms	% total
Internal Headcounts							
PLTs	21	212	163	210	165	188	21%
Designers	-	53	45	97	70	66	7%
Apprentices	2	50	43	47	43	46	5%
Vegetation Coordinators	-	10	8	10	7	9	1%
Managers	6	52	34	63	35	46	5%
Other front line staff	14	129	109	205	100	136	15%
Subtotals - front line staff	**43**	**506**	**402**	**632**	**420**	**491**	**55%**
Support staff	1	33	26	60	25	36	4%
Subtotals	**44**	**539**	**428**	**692**	**445**	**527**	**59%**
Construction Services Headcounts							
PLTs	2	29	14	26	9	20	2%
Other	5	23	13	27	7	18	2%
Subtotals	**7**	**52**	**27**	**53**	**16**	**38**	**4%**
Line staff	121	295	259	270	129	238	27%
Vegetation contractors	16	112	104	98	56	93	10%
Subtotals	**137**	**407**	**363**	**368**	**185**	**331**	**37%**
TOTAL	**188**	**998**	**818**	**1,113**	**646**	**896**	**100%**

Average Power Line Technicians (PLTs) rates $/hr

Storms	Oct. 27/06	Nov. 15/06	Nov. 26/06	Dec. 11/06	Jan. 9/07	Avg
Internal (note 1):						
Regular	65	65	65	65	65	65
Overtime	76	76	76	76	76	76
Blended Rate	73	72	70	72	70	71
Construction Services	61	65	64	64	65	64
Contractors						
Line Contractors						
Regular	94	89	90	88	92	90
Overtime	146	141	130	143	139	140
Veg Contractors	67	61	60	99	79	73

Note 1: BC Hydro internal labour rates for PLTs include salary and benefits loading.

6.2 Internal Labour

The internal labour resources (including Construction Services) used during the storms amounted to approximately $10.2 million or 28% of the total costs.

For each storm, labour hours and dollars were collected and reviewed to draw the following conclusions:

- Approximately 500 employees were directly involved in the restoration effort at the peak of each storm in the Lower Mainland/Vancouver Island, including an average of 188

power line technicians (PLTs) and 46 apprentices. On average, 66 designers were also in the field to help with damage assessments.

- On average, crews worked 10 to 12 hours/day on storm restoration. About 65% of their work was overtime, since some of the restoration period stretched over a weekend. This ratio is consistent with work done by the contractors, based on a review of invoices.
- The average rate of pay for all front line staff was about $58 per hour for regular shifts and $72 per hour for overtime shifts. The largest pool related to PLTs with average rates of $65 per hour for regular time and $76 per hour for overtime.
- Approximately 85% of internal labour charges were identified as storm-response related, while 15% of the time charged related to permanent repairs made to the temporary fixes that had been done during the storms. Temporary repairs were made in some cases in order to restore power and quickly move on to the next trouble call. (If, for example, a pole is damaged or broken off at the top, it can be stabilized in approximately two hours, compared to at least half a day for a crew to acquire and install a new pole.)

6.3 Vehicles

Total vehicle costs charged internally amounted to approximately $1.6 million, or 4% of the total costs.

For each storm, vehicle hours were reviewed and compared to total labour hours to confirm that the amounts charged were reasonable. On average, about 200-250 vehicles were used during each storm. The number of vehicle hours was approximately 50% of total labour hours charged, which is reasonable since one vehicle is usually used by a two-person crew, on average.

6.4 Contractor Costs

Total contractor costs amounted to $22.2 million, or 60% of the total costs. Of the total contractor costs, approximately 80% related to line work and 12% to vegetation work.

Line and Vegetation contractor invoices over $10,000 were reviewed, representing about 40% of the total $22.2 million in contractor costs. Summarized below are all contractor costs in the following categories:

Storms (in $000's)	Oct. 27/06	Nov. 15/06	Nov. 26/06	Dec. 11/06	Jan. 9/07	Totals	%
Contractor Costs:							
Line contractors	838	2,426	4,595	7,105	2,819	17,782	80%
Vegetation	278	287	473	1,382	187	2,607	12%
Flagging	13	77	42	242	50	423	2%
Excavation	212	18	28	156	8	421	2%
Helicopters	42	32	8	252	11	345	2%
Other transportation	1	17	29	54	20	121	1%
Equipment Rental	-	3	-	9	3	15	0%
Other	6	17	113	219	134	489	2%
TOTAL	**1,390**	**2,876**	**5,287**	**9,418**	**3,232**	**22,203**	**100%**

6.4.1 Line Contractors

The amount under Line Contractors, noted in the table above, includes labour costs, meals, and vehicle charges. Approximately 80% of those costs are labour related. The average rate charged by contractor PLTs was $90 per hour for regular time and $140 per hour for overtime.

Based on our review, the number of hours charged were consistent and reasonable, as confirmed by log books kept by storm coordinators/field managers.

The average regular time-overtime ratio (40%-60%) was consistent with the ratio charged by BC Hydro PLTs (35%-65%).

In aggregate, the total storm costs are significant and would be considered above the approval limits of the senior management for incurring those costs. However, based on our review, the existing controls over the transaction approvals and processing were effective during this storm season. None of the costs spent on any one contractor for each storm exceeded the expenditure approval limit ($6 million) of the Senior Vice President of Field Operations. High level estimates of costs could be improved earlier when a major storm is expected.

6.4.2 Vegetation Contractors

Approximately 95% of the hours billed by vegetation contractors were at the regular time rate. This is reasonable, given that vegetation work is typically performed during daylight hours.

During our review, we noted that some vegetation work was conducted *after* the restoration period of each storm. It is reasonable to expect some vegetation work done after the response period related to the removal or pruning of damaged trees caused by the storm, but that some work also may have been done on newly identified hazard trees. As a result, these costs ($781,000) were not included in the overall cost of the storms and have been classified as part of BC Hydro's vegetation maintenance program - Hazard Tree Removal Program.

6.5 Materials

Total material costs amounted to approximately $1.6 million or 4% of the total costs. The bulk of the materials required were for replacement of damaged distribution assets, including poles, conductors, and cable ducts, etc. About 300 poles and over 700 overhead transformers were replaced during the storms. The $1.6 million does not include approximately $780,000 of transformer replacement costs which have been capitalized which is consistent with the accounting treatment under normal procedures.

For the most part, materials were secured and available for crews to use during the restoration process. Overall, $370,000 or 23% of the $1.6 million of supplies were delivered directly to the various sites due to the lack of supply in stock at our stores.

Nearly 500 employees were directly involved in the restoration effort
at the peak of each storm, including as many as 188 power line technicians.

7 RESTORATION RESPONSE

7.1 Response Procedures and Systems

BC Hydro's response procedures and systems are used to: analyze trouble-call information, organize and dispatch field crews, and provide feed back to customers about the progress of repairs and estimated times of restoration.

7.1.1 Resources

BC Hydro employs the following resources during its response to storms:

- call centres contracted to ABSU in the Lower Mainland and Vernon
- Customer Restoration Centre (CRC)
- crew dispatch areas (storm rooms)
- field crews from both BC Hydro and contractors
- BCTC control centres

7.1.2 Preliminary Response Actions

Once Environment Canada predicts a severe storm, the following actions are taken by BC Hydro:

- If the storm is expected to hit at the end of a normal work day, Field Operations staff are retained at the storm headquarters in preparation for the restoration efforts. If the storm is expected to be overnight in a work day, a small group of crews are retained for emergency response and preparation while others are sent home to rest in case they are needed in the overnight period. If weather conditions are so extreme that road access is difficult or line work would be dangerous (i.e., the wind is still gusting and lines are still coming down), crews may be held back until conditions allow work to be done. If the storm is predicted to be extremely severe (December storms), crews are mobilized to travel from other regions to the expected affected areas prior to the end of their shifts. Contractors are notified that they may be called in all cases above.
- Plans are made to ensure that adequate line and design and support resources will be available to respond.
- Availability of external line contractors is determined. Availability of internal resources (design, line, support) is assessed and secured.
- Depending upon the expected severity of a storm, the availability of additional resources is determined (external contractors and BC Hydro staff outside of warning area). The factors for bringing in outside crews include estimates of how long the event is expected to last and how long it will take for resources to travel and arrive onsite.

- Preparations are made to open the regional or area emergency centres (storm rooms) in the warning areas.
- In some cases, additional external contractor resources are mobilized before a storm hits. Because external resources come from the South Interior and the storms can affect transportation in the mountain passes, the external contractors are put on the road before the storm hits. External contractor mobilization time is approximately 8 to 12 hours, depending on the weather.
- The BC Transmission Corporation is advised of preparations being made by Field Operations to ensure sufficient BCTC Control Centre staff are available.

Despite the extensive damage caused by the storms, BC Hydro crews and contractors were able to restore power to 80% of customers within 48 hours.

7.1.3 When a Storm Hits

When BC Hydro customers experience electrical outages, they are directed to call a trouble number (1-888 POWERON). During business days from 7 a.m. to 8 p.m., trouble calls are handled through the call centres. The agent at the call centre enters key information of the trouble calls into the POWERON system. From this information, the CRC assesses and dispatches a field crew based on the severity of the damage. After hours and on the weekend, the CRC takes the trouble calls from customers directly, as well as dispatches crews from the appropriate headquarters. In addition, first responders (police, fire, etc) have a separate emergency trouble call number that is directed to the CRC to prioritize restoration for those centres.

During a major outage, the CRC focuses strictly on analyzing the batches of trouble calls received from the Call Centres and sets priorities for restoration. For example, public safety is BC Hydro's number one priority, so a trouble call for a line down will be responded to first. The regional managers activate the appropriate storm rooms to coordinate resources and dispatch crews for further damage assessments and repairs. Designers are used during storms to help with the damage assessment process, which is a better use of resources.

Another reason designers are valuable to the assessment process is that they can confirm whether a trouble call requires further attention. For example, some customers reported a line down situation which in some cases was not the case. In fact, it was a TELUS or cable line that was down, not a BC Hydro power line, and a designer spared a repair crew from making an unnecessary trip to the site.

In other words, obtaining accurate assessment of the location and extent of trouble is very important to:

- determine what additional crews, vehicles, or materials may be required;
- establish priorities according the System Operating Orders (Section 7.1.4):
- advise the call centre of the estimated restoration time via POWERON so it can respond to customers inquiring about the expected outage duration.

BCTC has five control centres around the province. This is where the system operators monitor and control the distribution and transmission feeder circuits in a particular region. Field crews maintain radio/telephone contact with the control centre to request switching on/off of power for circuit repairs. This supervisory control function is critical for the safety of the crews.

Once the FOECC is set up, conference calls with regional managers are held approximately every four hours (or as required) to assess overall damage, coordinate the dispatch of resources, share damage assessments and communicate the most up-to-date estimated time of restoration. Staff from Corporate Affairs and Customer Care attend these conference calls in order to use the information gathered to fulfill their responsibilities.

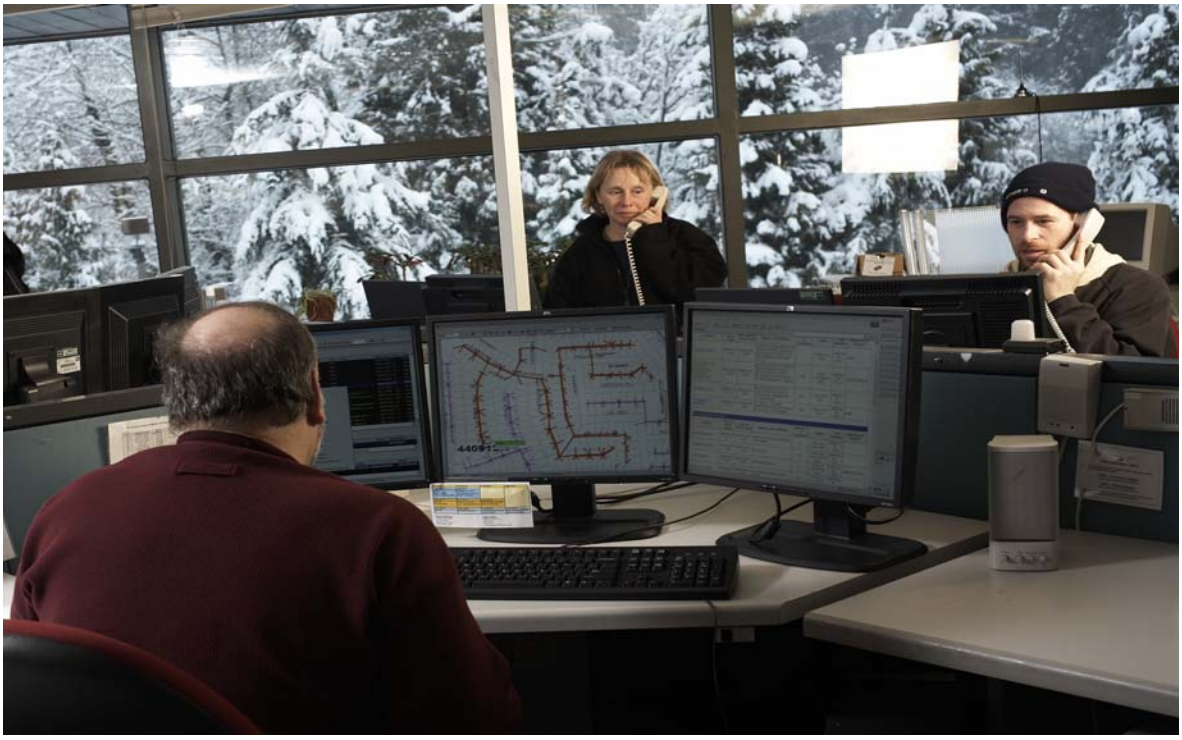
7.1.4 Priorities for Restoration

The priority for restoring power is based on BC Hydro's System Operating Orders. They are listed here in the order of the top priority first:

1. Public safety (lines down)
2. Generation and transmission facilities necessary to supply distribution customers
3. Communication facilities for civil authorities
4. Hospitals

5. First-line emergency responders: police stations, fire stations, ambulance stations, municipal emergency centres
6. Facilities as directed by municipal, provincial, federal authorities (for example, facilities needing power for the “common good” might include a pumping station, or a recreation centre that is temporarily accommodating evacuees)
7. Utility facilities: gas, sewer, water, telephone, cellular
8. Emergency reception centres (schools, civic centres)
9. Identified special needs customers (community care centres, senior centres, well water customers)
10. General commercial, industrial, and residential customers

Customers from priorities 3 to 8 above can have a dedicated number to contact the CRC directly to notify us of their outages. We do not prioritize the special needs customers unless they call in through POWERON and identify themselves to request for priority services.



Staff at the Customer Restoration Centre received calls from customers about power outages and placed them in priority of restoration, with public safety (lines down) being the top priority.

7.2 Key Findings from Storm Reviews

- Overall, BC Hydro crews and contractors were able to restore power to the majority of affected customers (80%) within 48 hours.
- Line crews (BC Hydro and contractors) worked in a safe manner; there were no deaths or serious injuries. Tragically, however, a couple from Burnaby died from carbon monoxide poisoning caused by using a gas-powered generator indoors after the storm on December 15.
- With the northern B.C. storm, many crew members were away from home or away for long hours and could only occasionally come home to sleep and change clothes.
- The BC Hydro credit card and personal credit card systems fail when power and phone lines go down. There was nothing in place to support the crews when they needed fuel, food and other basics in the early stages of restoration – especially in the remote locations.
- Given various labour agreements, line crews were initially scheduled to work 16-hour shifts. With each storm providing new lessons learned, it was determined that 12- to 14-hour shifts would be more effective for severe storms that required more careful resource management.
- Estimated times of restoration were not reliable (accurate) until about 24 hours into a storm.
- Even though BC Hydro did not formally activate the Corporate Emergency Centre (CEC), the restoration effort improved with each storm as lessons learned were applied. Coordination among the different business groups improved over the storm season. Senior managers were regularly briefed on the restoration process.
- The damage/restoration reporting system was under-utilized in some cases. One example given was of a crew being sent to a wire down situation that serviced two or three customers. At the same time, there was a subdivision of over 500 customers left without power because the higher trouble repair priority was given to the wire down. Had the crew been aware of the bigger picture, they would have made the wire down situation safe and then proceeded to restore power to the subdivision. The CRC determined that part of the problem was that the field offices (in the north only) were not using the full POWERON Remote system, mainly because staff were in the process of getting trained on the system when the October storm hit.
- Some crews were tied up over an extended period doing damage assessments and restoration on the ground in remote areas when they could have been employed more effectively at other higher priority areas.
- The centralized allocation and coordination of crews and contractors improved over the storm season, which helped prioritize restoration efforts toward areas with the greatest need.

7.3 Plans for Improvement

Three key areas for improvement have been identified.

- Improving communication with customers throughout the restoration process by:
  - Providing more accurate estimated times of restoration
  - Delivering consistent messaging
- Improving the internal organizational processes for storms by:
  - Having up-to-date plans and procedures
  - Practicing storm room roles and responsibilities
  - Training all personnel involved in emergency management roles
- Improving the resiliency of the system by:
  - Investing in increased vegetation management
  - Improving the resiliency of circuits that are most vulnerable to storm damage
  - Providing back-up diesel generators to some communities that are difficult to access during major storms (mainly due to terrain)

For example:

- Plans, procedures and training for those expected to participate in emergency responses and the Corporate Emergency Centre will continue to be clarified and updated.
- Communication in the field will be improved in emergency situations to ensure assessments and estimates are accurate. Customers need to be given more realistic estimated times of restoration early into a storm (within the first 24 hours) so as not to raise expectations of a quick or immediate restoration. Once damage assessments are done, more precise estimated restoration times can be given (usually after the first 24 hours).
- Storm rooms will establish “best practices” and clearly identify and document roles and responsibilities, staffing, and training. This should include pre-storm training and exercises for staff to practice their storm restoration roles.
- More training in the POWERON Remote system is required earlier in the season to ensure that field staff are familiar with its capabilities and operation.
- Better support to employees and their dependents in isolated areas should be provided to ensure meals, fuel and materials are available.
- Options will be explored with BCTC to reduce delays experienced in getting clearances and switching during storms.

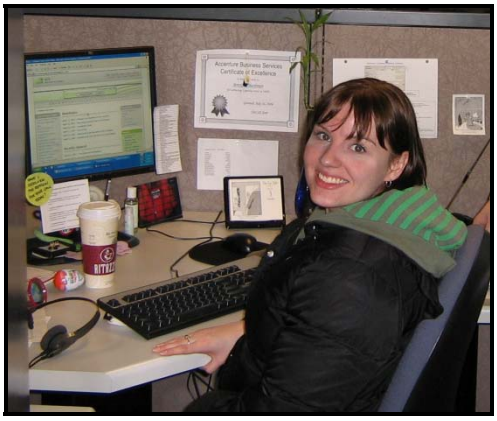
8 CUSTOMER OUTAGE RESPONSE AND SERVICES

8.1 Customer Response Procedures and Systems

Customer Care manages the customer experience when there are massive outages due to storms. In order to successfully fulfill this role, Customer Care depends on the assistance of other groups across BC Hydro and ABSU.

Under normal operating hours, the call centre system can handle approximately 6,500 calls per hour. BC Hydro uses the Interactive Voice Response (IVR) messaging as well as agents to handle incoming calls. The IVR is able to recognize the location of customers and link it to POWERON to give out the estimated restoration time. The IVR handles approximately 60% of calls while the agents handle the other 40%.

There are 25 Key Account Managers to deal with approximately 650 industrial and commercial key account customers, representing 4,500 companies across 50,000 locations in B.C. These representatives are responsible to be in contact with those customers to ensure they have accurate estimated restoration times to assist them in managing their business operations.



During the December storm, some customer service agents worked 12-hour shifts for 13 days straight.

8.2 Key Findings from Storm Reviews

- Under normal outage conditions, the current call capacity is regularly exceeded. With the widespread and extensive outages experienced during the storms, the phone lines became overloaded which caused a large number of busy signals, dropped calls and long wait periods. At the height of the storms, the call volume grew as high as 37,500 calls per hour.
- As the queues grew and wait times became longer, frustrated callers started to call other listed BC Hydro staff numbers, local offices, or approached local crews working on the

restoration. This distracted the crews from working and offices from managing and prioritizing the restoration.

- By the November 15 storm, when the phone system failed temporarily on the first day, BC Hydro started using En-Route messaging – which was heard before a customer was routed to the BC Hydro phone number – to let them know we were experiencing storm-related troubles with our system. The content of the message improved over the storm season, along with more frequent updates (specific areas and communities that were still out) and information about the restoration process. This message was updated as many as five times a day, which helped reduce the number of calls to a more manageable level.
- Call centre agents did not always have the most current information to share with customers (ETRs, etc.). It was found that 90% of customer requests for information were for ETRs. The next-most asked question was about the cause of outages.
- Call centre agents needed to know more about how the restoration process works in order to share it with customers.
- Customers want and are relieved to receive "context" information (location and extent of the storm, damage, etc.) as much as an estimated time of restoration. For customers, no amount of information would be viewed as too much. Frustrated and angry customers said they were better off getting restoration times that were days away than promises of shorter-term restoration times that could not be met.
- As lessons learned from one storm were applied to the next, messages delivered from call agents to customers were more consistent with media advisories.
- Call agents worked long hours under very stressful situations, often dealing with customers who were angry and frustrated. During the December storm, some agents worked 12-hour shifts for 13 days straight.
- Some initiatives were taken but were not effective and were cancelled after the initial trial:
    - At one point, the En-Route messaging was used to advise customers to call 911 to report public safety issues, such as line down situations. This affected the volume of calls to the 911 call centre and hindered our ability to know where, for example, the lines were down.

8.3 Plans for Improvement

In order to improve the customer experience, BC Hydro plans to:

- Increase Hydro's call capacity, as discussed in Chapter 10.
- Raise awareness of storm season issues and encourage outage preparedness at both the customer and the community levels, as discussed in Chapter 10.
- Improve the quality and consistency of information provided to customers to manage their expectations before, during and after storms.

9 COMMUNITY OUTAGE PREPARATION AND COMMUNICATIONS

9.1 Communication Plans and Community Preparation

During a major event causing power outages, one of BC Hydro's primary communications tasks is to seek the most up-to-date storm information (extent of damage, restoration efforts, estimated times of restoration, etc.) and to share it with the media and the public as soon as possible. Another responsibility is to develop and coordinate a consistent message within the organization that can be shared among all business groups.

9.1.1 Resources

External communication during the storms was provided primarily by one media relations manager, supported by the Director of Communications and three Community Relations Managers.

Besides using weather forecasts from Environment Canada and BC Hydro's internal meteorologist, other storm and restoration information was gathered through direct communication with Field Operations and by participating in conference calls. These calls provided valuable information for dissemination to the media and public.

9.1.2 Storm Response

- Approximately one day in advance of the storms, Corporate Affairs staff were advised to be on call and to provide support to the Director of Communications and Media Relations Manager (writing advisories, web support, etc.).
- Media advisories were posted to the website as soon as new information was available. For example, each BC Hydro media advisory contained at least three key elements: storm-related causes and effects (extent of damage, number of customers without power, estimated time of restoration, etc.); what actions BC Hydro was taking to restore power; and public safety reminders (staying away from downed wires, proper use of generators).
- The following is an example of a media advisory sent during the December 2006 storm:

BC Hydro outage update: 10:45 a.m., December 15, 2006

Major Windstorm Event – BC Hydro Outage Update

More than 240,000 customers are currently experiencing outages due to the wind storm that hit early this morning. The hardest hit areas are the Lower Mainland and South Vancouver Island.

The storm has caused extensive damage to the system, including downed power lines and poles. BC Hydro is predicting that some customers may be without power for several days.

BC Hydro and contract crews have started the evaluation process. Restoration will be completed in priority sequence. Crews will focus on restoring power to hospitals, care homes, pump stations and water treatment plants and then focus on restoring large circuits.

As many as 800 BC Hydro and contractor staff are responding to the outages and will continue to work quickly and safely to restore power.

BC Hydro is aware of all major outages and is not asking customers to call in additional outages at this point.

BC Hydro is reminding customers to be extremely cautious around downed power lines. The public should stay back at least 10 metres or 33 feet.

Customers should exercise caution when using generators, connecting appliances directly to the unit and assuring they are in a well-ventilated area. Please do not connect your home portable generator directly to a house wiring system as it can create unsafe conditions for line crews working on the system.

Contact:
BC Hydro Customer Service
1 888 POWERON
Phone: 1 888 769-3766

- By the third storm, multiple media advisories were being sent to the media and posted to the website. This was an effective means of both keeping the public/media up to date and assisting call agents with the most current status of the restoration effort.
- Community Relations Managers were involved in providing information to their communities and local/regional media outlets.
- As lessons learned from one storm were applied to the next, better liaison and lines of communication with all business groups ensured that corporate-wide information was

both accurate and synchronized as best as possible (i.e., no contradictions with the IVR and what the Media Relations Manager might have just reported through the media). This was not the case for the first two storms.

9.2 Key Findings from Storm Reviews

- Providing regular web updates was a useful supplement to information being delivered via the media. The call centre, especially, was able to share the information when talking with customers.
- Allowing media personnel to follow select BC Hydro field crews on occasion was a useful means of delivering a powerful image of the storms' impact and the effort required to restore power.
- Conversely, restoration crews were not often comfortable having media close to or within the vicinity of areas under repair. This was mainly due to safety concerns for those not qualified (media) to be in the area. This concern for safety extended to members of the public that approached line crews for news and information.

9.3 Plans for Improvement

In order to improve outage communication and community preparation, BC Hydro plans to:

- Continue updating and formalizing detailed roles and responsibilities in communication emergency response plans.
- Continue to include public safety instructions to residents in media updates, but also add customer-related information during extended outages about: the status of BC Hydro's call centre (i.e., BC Hydro is aware of and apologizes for busy signals or long waits to talk to customer service agent, etc.); any relevant information for specific communities about shelters or "warming" centres; links to other internal or external websites about "what to do" during an outage.
- Provide additional communication in advance of storms to help customers plan and prepare.

10 INVESTMENT STRATEGY

10.1 Background

As a result of severe weather conditions in the winter of 2006-2007, many BC Hydro customers experienced more frequent and extended outages than average. These storm-related outages highlighted a number of process and systems gaps related to outage communications, along with issues concerning system resilience and community preparedness and response.

Since 1999, there has been a sustained increase in the number of storms and other major events compared to other periods in BC Hydro's operating history. Because of this trend, and the impact of the storms this winter, we plan to invest in areas that will both improve outage communication with customers, and enhance the resiliency of the most vulnerable portions of the distribution system.

BC Hydro plans to enhance the resiliency
of the most vulnerable portions of the distribution system.

10.2 Outage Communication Improvements

Based on customer feedback and research, we know that our current overall customer satisfaction level remains strong in fiscal year 2007, with reliability continuing to be a lead driver of satisfaction. Even with the recent storm season, it is only when a residential or small/medium business customer experiences more than two outages within the past six months that overall satisfaction with BC Hydro deteriorates. For key account customers, this breaking point happens sooner, after one outage.

Further research on outage communications has shown that while our customers are generally satisfied with BC Hydro's overall performance in providing reliable electricity and restoring power quickly, they are less satisfied specifically with the level of outage communication during a major event. Currently, the outage information available to customers is often not as accurate or timely enough to help them make personal or business decisions.

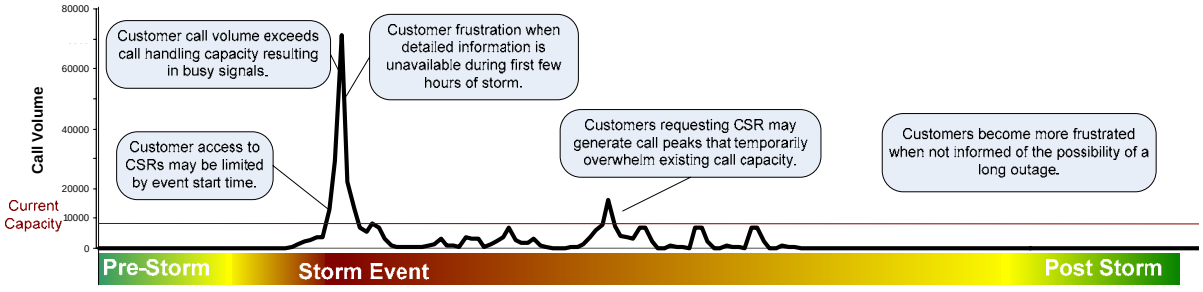
Both formal customer research results and direct customer feedback indicates outage communication is both important to customers and represents an area where they would like us to improve. Over the past year, we have been systematically working to address customer requirements before, during and after outages through an effort called Outage Communication Initiative.

10.2.1 Meeting Customer Expectations

Under normal outage situations, customers generally expect:

- to be able to speak with a Customer Service Representative (CSR) within five minutes;
- to be able to receive a good estimate of when power will be restored within 30-60 minutes of the start of an outage;
- that power will be restored within 60 minutes of the estimated time of restoration; and
- to be served by knowledgeable and respectful CSRs.

Customers' current experience when they call during a storm varies greatly with call volumes and the capabilities of our systems and processes to manage the calls, as illustrated in the diagram below. This in turn depends on the time of day and when within the storm period the customer calls.



Typically, about 15% to 40% of customers experiencing an outage will call to report it, and most of these customers will call during the first two hours of the outage. This represents the first and most significant call volume peak for the outage. During regular call centre operating hours of 7 a.m. to 8 p.m., BC Hydro is capable of handling approximately 6,500 calls per hour through a

combination of interactive voice response system (IVR) and CSRs (this average is dependent upon the number of CSRs and the length of calls). At the height of the recent storms, the call volume was almost 40,000 calls per hour. This high volume resulted in many customers experiencing busy signals and, to a lesser extent, dropped calls and long waits to speak with a CSR.

In the early stages of a major storm-related outage event, estimated restoration times (ETRs) are not available until the extent and nature of outages are evaluated. For example, during the December storm, it was not possible for BC Hydro crews to give even "ball-park" ETRs for the first 24 hours because the severity of the storm, and the number of outages, made it difficult for BC Hydro crews to make an assessment of all the damage to our distribution system. This delay in receiving information causes frustration for customers who are not aware of BC Hydro's power restoration process. This can be mitigated through context setting messaging and regular updates on our progress. There are significant opportunities to automate and streamline internal processes for gathering and disseminating this information.

Some communities have historically been more vulnerable to longer duration outages because of their location on the service grid, rough terrain or other access issues. These communities can benefit from outage preparation and need an easier way to stay informed of the restoration situation.

10.2.2 Outage Communication Investment Plan

BC Hydro is planning to address customer needs by improving the quality of outage information delivered to customers (the message), how the information is delivered (the method), and by raising customer awareness about the importance of outage preparation and response.

Our investment plan will significantly enhance the customer experience through initiatives and improvements in the following areas:

- **Preparation:** to significantly raise awareness of storm season issues and encourage outage preparedness at both the customer and community levels;
- **Initial Call Peak Management:** to increase call handling capacity to meet call volumes anticipated for outages affecting between 100,000 and 250,000 customers with minimal busy signals and reduced wait times;
- **Communications and Expectation Management:** to improve the quality and consistency of information provided to customers to manage their expectations before, during and after storms and assist communities in responding to outages.

Preparation

BC Hydro is planning a variety of communication campaigns to help customers prepare for outages from major storms and other significant events, and to shape their expectations about the power restoration process. This will include initiatives such as billing inserts and targeted collateral to residential and small-medium business customers prior to storm season; articles in e-newsletters; advertisements in community newspapers and radio stations; outreach at large events; promoting the purchase of emergency outage preparedness kits by offering coupons; and leveraging the media to raise awareness of the importance of being prepared.

Proactive community engagement meetings are proposed for up to 20 communities per year which have been identified as vulnerable to longer-duration outages. Some of these meetings have already begun (see Appendix for an example of a briefing given to the community of Bowen Island). The goal of these meetings is to work with communities to identify critical load facilities and outage preparation needs, understand their backup power needs, and help coordinate their own community emergency response plans. These meetings represent a new and resource-intensive approach for BC Hydro and may result in providing some level of assistance to local governments in their emergency response.

In the case of remote communities, where access during storms and potential damage to service lines are an issue, the optimum solution may be for the community to operate one or more back-up generators. For less remote communities, the optimum solution may be for BC Hydro to own and operate a fleet of community facility-scale generators for lease or borrow by municipalities. Clear criteria for qualifying for assistance will need to be determined and conveyed to communities to ensure equity expectations are carefully managed.

Storm preparation also includes BC Hydro developing a storm staffing plan for the Call Centre, ongoing enhancements to trouble call handling, and improved training for Field Operations dispatchers. Planned improvements to existing telephony and supporting systems will be made.

Initial Call Peak Management

Existing call handling systems will be supplemented by a third party high-capacity call provider to manage the initial call volume peak experienced early in the storm cycle. Customers who call will also receive general information through pre-recorded messages regarding the extent of damage, possible lengths of outages and safety issues. The existing proactive outbound messaging system currently offered to Key Account customers would be expanded to all business customers.

Communications and Expectation Management

Storm-related information, including localized restoration progress, estimated restoration times, and what to do during an outage will be made available to customers through a variety of channels. We will also coordinate with municipalities and/or the Provincial Emergency Program to convey information regarding community emergency response plans. Additional resources will be assigned to implement storm response plans and ensure consistency and accuracy of the information provided by call centre agents, media, wireless channels, and our IVR and website.

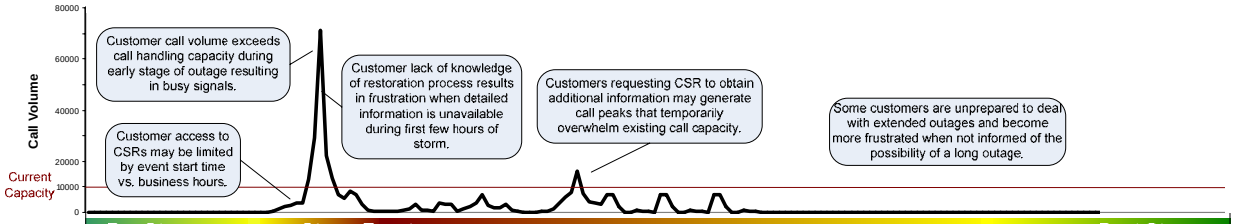
Strategies to manage subsequent, lower volume peaks using BC Hydro's existing systems infrastructure (telephony, IVR, website) and additional resources will be implemented to ensure continued customer access to the call centre agents for the duration of the event. Additional resources for the call centre could be drawn within the existing ABSU agreement and BC Hydro staff (subject to contract and collective agreement limitations).

The estimated total costs of this plan are summarized as follows:

Investment Strategy: (000's $)	Operating Costs	F2008 Capital	Total
1) Call peak management: increase call capacity to handle a major event causing 100,000 - 250,000 customer outages	$ 480	$ 970	$ 1,450
2) Communication & expectation management: improve the quality of outage information through a variety of communication channels	700	530	1,230
3) Preparation: increase customer and community awareness and preparation for storm season	2,400	-	2,400
4) Preparation: provide a fleet of up to 18 units of facility-scale backup diesel generators for community use, based on specific as-required criteria.	100	1,500	1,600
TOTAL	**$ 3,680**	**$ 3,000**	**$ 6,680**

Annual investment in operating costs will continue to be on average $4 million/year to maintain these initiatives. However, capital costs will be lower after fiscal year 2008.

A summary of the proposed outage communication improvements is presented below.



	Preparation	Initial Call Peak Management	Communications & Expectation Management	Follow-up & Debrief
Desired Outcome	**Customers and Communities informed & ready for storm season**	**Customers are able to contact us, report an outage and obtain the information we have regardless of call volumes**	**Customers are provided consistent outage information via improved and additional channels** **Impacted Communities kept informed and supported**	**Lessons learned inform continuous improvement efforts**
Channel Enhancements	• CSR storm staffing plan & refresher training • Optimizing existing telephony environment • Timely storm warning through media	• Automated outage reporting & messaging via high volume call answering provider • Prerecorded context setting and safety messages to prioritize calls • Proactive Messaging ○ Expand to all business customers	• Call Centre Capacity ○ Supplement CSR capacity via off site call centres and BCH staff ○ BC Hydro automated outage reporting ○ Localized restoration messages in phone network ○ Virtual call hold - on hang-up maintains customer's place in queue and frees up line ○ Automated call to confirm restoration and identify pockets of outages • Additional and improved channels: ○ Web, wireless ○ Leverage media for updates	
Information Quality	• Improved skills training for dispatchers • Restoration information process improvements		• Additional resources to assist in CRC and storm rooms to analyze & disseminate info	• Internal storm debrief
Customer & Community Outreach	• Proactive engagement with up to 20 at risk Communities per year • Integrated customer preparation campaigns via various channels •		• Dedicated contact for impacted communities • Execute backup power provisions for up to 6 communities	• Follow up with impacted Communities

10.3 System Resiliency Improvements

10.3.1 Reliability: The Urban/Rural Gap

Urban customers have a higher reliability performance than rural areas due to more flexibility in the grid to provide alternative sources of energy. At the same time, rural residents expect to be more connected than they did in the past, and they are increasingly building their communities based on that assumption.

BC Hydro has made it a priority to focus on improving the reliability performance in communities that are the most vulnerable to outages and/or longer outage durations. For example, five years ago, the worst eight communities for reliability performance were: Port Hardy, Powell River, Golden, Sechelt, Vanderhoof/Burns Lake, the Gulf Islands, Revelstoke and Valemont. In order to reduce outages and outage duration for those communities, BC Hydro focused on vegetation management and increased the use of shielded overhead cables and circuit reconfigurations, where applicable. Today, only three of those communities remain on

our list of trouble spots (Port Hardy, Revelstoke and the Gulf Islands), which is not for a lack of funds or effort to enhance the system in those areas, but because of the particular challenges of their remote locations.

Today, customers in the urban areas are experiencing, on average, less than one outage a year, and each lasts about 2.5 hours. Customers in rural areas are experiencing, on average, about 2.4 outages a year, and each lasts about 2.75 hours. Although this is the average for rural areas, the range can vary significantly. For example, in some extremely remote areas such as the Queen Charlottes, customers can experience, on average, 16 outages and about six hours per outage per year (excluding storms).

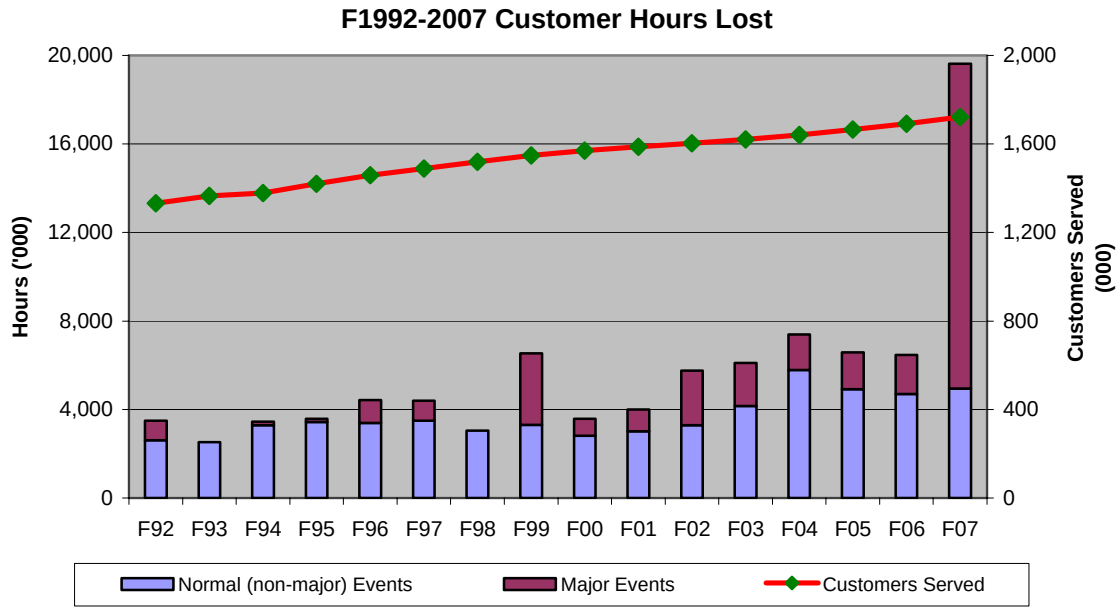
10.3.2 Increasing Occurrence of Major Storms

In recent years, major weather-related events have occurred with increasing frequency and impact. B.C. averaged less than two major events per year during the 10-year period from fiscal years 1992 to 2001, but averaged five per year in the last five years between fiscal years 2002 and 2006.

These major events accounted for 29% of annual customer-hours lost during fiscal years 2002 to 2006, up from 21% during fiscal years 1992 to 2001.

The series of major wind and snow storms this winter caused widespread disruption to the distribution system, resulting in 14.7 million customer-hours lost. This represents 75% of the 19.6 million customer-hours lost in fiscal year 2007. Prior to this, as chart 10.3.2 indicates, the highest total customer-hours lost was 7.4 million in fiscal year 2004.

Chart 10.3.2: Customer Hours Lost (Normal and Major Events 1992-007)



10.3.3 Areas of the Distribution System Most Vulnerable to Storm Impacts

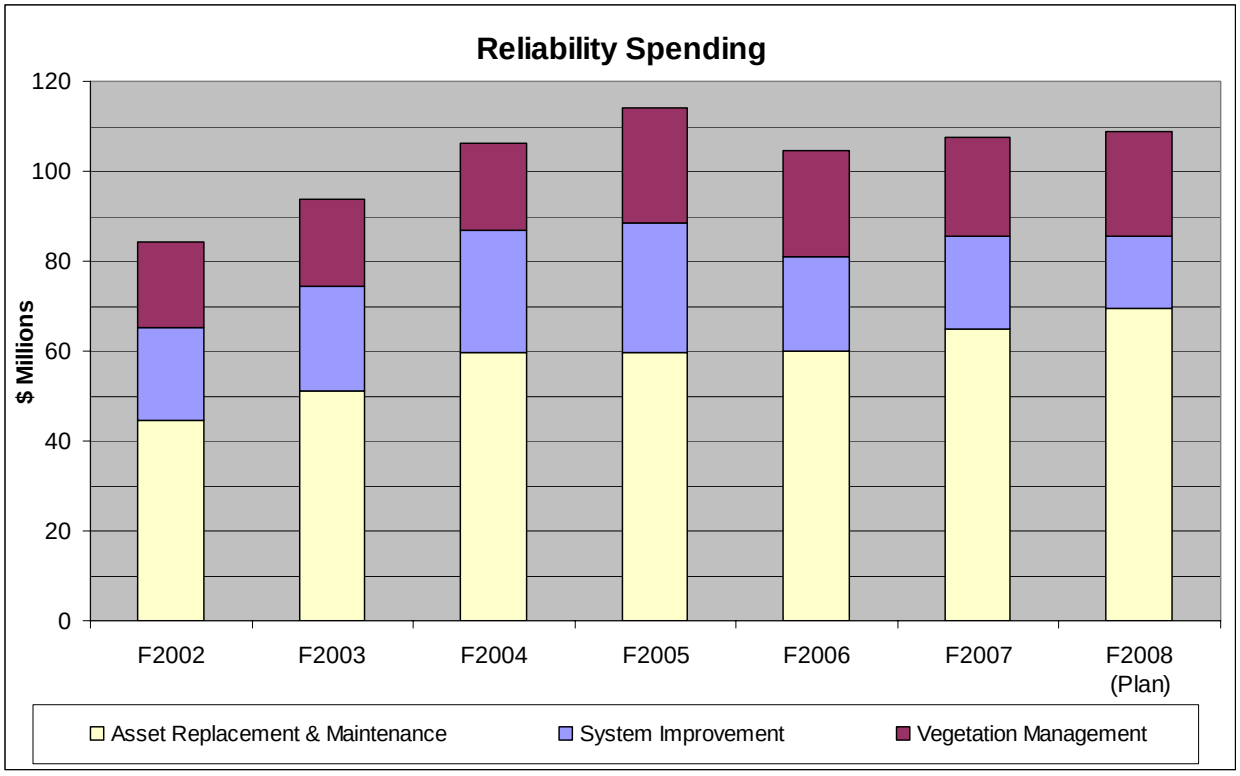
BC Hydro examined the reliability performance of all the communities it serves that were impacted by storms over the last four years (fiscal years 2004 to 2007). In total, BC Hydro identified 256 circuits, or a fifth of the total of 1,200 distribution circuits across the province, that are particularly vulnerable to the affects of storms. These 256 circuits collectively account for over half of the total customer-hours lost due to major events.

It would be incorrect to conclude, however, that the *entire* community in which these worst-hit circuits are located is considered vulnerable to outages – only the neighbourhood or area that is affected by that particular circuit. In other words, while a community may have good overall reliability, there may be circuits within that community that are more vulnerable to storm damage than other circuits.

10.3.4 BC Hydro's Historical Reliability Investment

BC Hydro invests in its distribution system in order to build new lines for customers, maintain the health of its system assets, ensure public and worker safety, meet regulatory requirements, and improve reliability. Certain capital projects and all vegetation management expenses are specifically focused on reliability performance. In general, however, all categories of spending positively impact reliability.

The following chart provides the portion of BC Hydro's investment over the last seven years that contributed to distribution system reliability.



Spending to maintain the current level of system reliability has remained relatively constant at approximately $100 million a year related to the following activities:

Asset Replacement and Maintenance

More than half of asset investment is focused on maintaining the condition of the assets, or asset health. It is important to maintain asset health to ensure the capability of the distribution system to deliver reliable power to customers. The total spending for asset replacement and maintenance has been approximately $55 million per year. Equipment repairs include the on-going condition testing and replacement of poles, cables, and transformers that are at the end of their life. These repairs are done in order to avoid the risk of equipment failure, which increases outages.

System Improvements

This type of work includes technical modifications to the system such as relocating lines in vulnerable areas to a more secure or protected area, automating the distribution system, and providing backup distribution feeders. On average, BC Hydro spends approximately $23 million per year on this work.

Vegetation Management

Vegetation management accounts for approximately $22 million per year. BC Hydro's Vegetation Maintenance Program consists of two main components: cyclical maintenance and the hazard tree program.

- **Cyclical Maintenance:** this process involves keeping vegetation on the distribution system corridors from growing into the power lines. Areas are managed on a two- to eight-year cycle depending on vegetation growth characteristics and the geography of the area. For example, urban areas with faster growing trees such as weeping willows, birch and other species will be put on a shorter maintenance cycle (two to four years). In rural areas, trees tend to be native trees with more uniform growth characteristics, therefore rural maintenance cycles tend to be longer (four to eight years).
- **Hazard Tree Program:** this program consists of identifying and prioritizing off-corridor trees that have a high potential for failure and therefore can damage our distribution system. This program is not intended to address threats from severe weather conditions such as hurricane-force winds, record rainfall events, ice storms, or earthquakes.

BC Hydro plans to identify and prioritize for removal
trees that have a high potential to damage the distribution system.

10.3.5 How BC Hydro Can Harden the System and Improve Restoration Efforts

BC Hydro's asset investment plan for the distribution system has been based on maintaining reliability performance at pre-defined levels excluding major events. Excluding major events is the standard practice for benchmarking performance in the electricity industry. Because major events have occurred more frequently in recent years (mostly storm related) – which have impacted on reliability performance and service delivery to our customers – we propose that investment be increased to offset or overcome the impact of major events on our customers and communities. A System Resiliency Plan has been developed to address this issue.

10.3.6 System Resiliency Plan

BC Hydro is in the process of moving towards a "SmartGrid". This is a 10-year, long-term vision to automate the distribution system and create a network which will improve system resiliency. The SmartGrid model would allow BC Hydro to use two-way communication systems that could immediately identify and bypass trouble spots and better balance the overall loads on the grid.

Over the next five years, we will take the preliminary steps to implement that vision, which includes plans to:

- **Harden the System**: increasing the ability of the system to withstand or avoid interference.
- **Improving Restoration Efforts**: building flexibility into the system in order to reroute power and reduce outage restoration times.

We will focus on these four specific priorities to harden the system and improve restoration efforts:

10.3.6.a More Vegetation Management

The majority of outages on the distribution system are due to trees and tree branches that come into contact with overhead lines. Vegetation management, such as removing high-risk trees outside of BC Hydro right-of-ways, is a cost-effective way to improve the resiliency of the system against storms.

10.3.6.b Undergrounding Lines

When BC Hydro makes capital improvements to the distribution system, all decisions are based on lowest life-cycle costs. Typically the most cost-effective option is to build overhead lines. For example, in comparing alternatives to make the distribution system more resilient, especially against storms, vegetation management and circuit reconfiguration may be equally as effective as undergrounding, and at a much lower cost.

There is considerable empirical evidence to support this course of action.

An Edison Electric Institute study noted that burying power lines can cost up to 10 times what it costs to install overhead power lines. And while underground power systems tend to have fewer power outages, the duration of these outages tend to much longer. (By comparison, it is relatively easier both to locate a fault on an overhead line and to repair it, which results in shorter duration outages). Moreover, underground power lines are not immune from outages during storms. One study found that system reliability had become such a concern for two Maryland utilities that they reversed course and have replaced their underground distribution system with overhead lines.

There are some situations, however, where undergrounding might be a viable and realistic solution. For example, where terrain and vegetation control is difficult, undergrounding may be justified to avoid frequent and costly overhead restoration costs. As well, where reliability cannot be achieved because of overhead line susceptibility to storms and frequent interruptions, undergrounding may provide the right solution to meet reliability performance commitments.

10.3.6.c Technical Modifications

Technical modifications that can improve system resiliency include:

- Vertical Construction: rebuilding overhead lines in a vertical rather than a horizontal construction to reduce hazard exposure to the power lines.
- Hendrix Cables: using partially insulated cables in areas where vegetation management is difficult. This solution is appropriate in wooded areas away from human habitation.
- Circuit Realignment: moving circuits to terrain that has less vegetation or other hazards, or that is more readily accessible to crews.
- Stronger guy wires: adding stronger guy wires to poles to better hold them in place.

10.3.6.d Distribution Automation and Redundancy

Strategies to improve restoration efforts during a major event include:

- Building back-up circuits.
- Increasing the capacity of existing lines so that they can take on greater load if one part of the system goes down.
- Adding more automated switching devices on the lines in order to be able to shut down smaller sections of lines.

10.3.7 Investment Proposal

The System Resiliency Plan will focus investment on the 256 circuits that are most vulnerable to the impact of storms. BC Hydro is planning to spend $200 million over five years (fiscal years

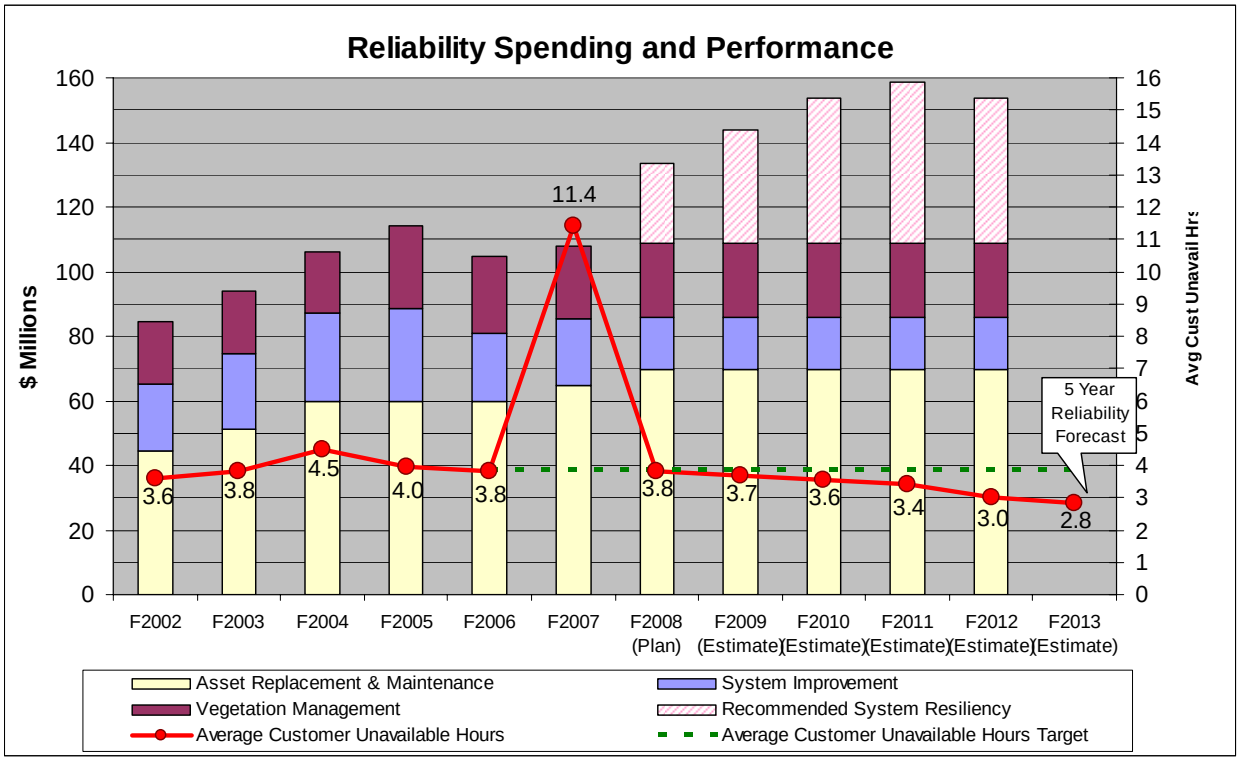
2008 – 2012) in order to strengthen the system and reduce, by fiscal year 2012, the average annual customer-hours lost by 40-60 minutes, from the fiscal year 2006 overall average of 3.8 hours. (The fiscal year 2007 overall average was 11.4 customer-hours lost, due to the impact of these major storms). Reduced trouble cost spending of approximately $10 million over the five years of the project will also be a significant benefit of this investment.

	F2008	5 Year Plan (F2008 - F2012)
Cost for System Resiliency Plan	$25 million	$200 million
Improvements in # of circuits	60-65	up to 256
Reduction in the system average interruption duration	6-9 mins	40-60 mins

For a small number of communities, there are limited technical and cost-effective opportunities to harden the circuits. In those circumstances, BC Hydro's 5-year plan will help the communities to better prepare for storms or identify a client-side solution such as diesel generators or distributed generation.

While the focus of this investment strategy is on hardening the most vulnerable parts of the system to the impacts of major events, it will also result in benefits to reliability performance outside of major events. Moreover, it will begin to close the performance gap among communities, since most of the 256 circuits are in rural areas and parts of suburban areas. For example, the proposed additional spending of $25 million in fiscal year 2008 on system resiliency would target the 60-65 circuits that have been the most affected by storms over recent years.

To illustrate, the diagram below shows the expected reliability improvements we could achieve after the project is completed in fiscal year 2012. The benefits are expressed as a reduction in the overall number of hours that power is unavailable to our customers.



BC Hydro plans to improve incrementally in these areas from F2009 - F2012. However, this longer term strategy will need to be integrated with the overall BC Hydro investment plans in the upcoming F2009/2011 Revenue Requirements Application.

10.4 Conclusion

In fiscal year 2008, BC Hydro plans to spend $31.7 million in the following areas to improve our performance by the next storm season:

	F2008		
Investment Strategy: (000's $)	**Non-capital**	**Capital**	**Total**
1) Call peak management: increase call capacity to handle a major event causing 100,000 - 250,000 customer outages	$ 480	$ 970	$ 1,450
2) Communication & expectation management: improve the quality of outage information through a variety of communication channels	700	530	1,230
3) Preparation: increase customer and community awareness and preparation for storm season	2,400	-	2,400
4) Preparation: provide a fleet of up to 18 units of facility-scale backup diesel generators for community use, based on specific as-required criteria.	100	1,500	1,600
5) System resiliency: Improve the distribution system resiliency to 60-65 circuits out of the total 256 circuits	4,500	20,500	25,000
TOTAL	**$ 8,180**	**$ 23,500**	**$ 31,680**

11 SUMMARY OF PLANS FOR IMPROVEMENT

In order to improve storm response procedures and systems, BC Hydro plans to:

- Improve communication with customers throughout the restoration process by:
  - Providing more accurate estimated times of restoration
  - Delivering consistent messaging
- Improve the internal organizational processes for storms by:
  - Continuing to up-date plans and procedures
  - Practicing storm room roles and responsibilities
  - Training all personnel involved in emergency management roles
- Improve the resiliency of the system by:
  - Investing in increased vegetation management
  - Improving the resiliency of circuits that are most vulnerable to storm damage
  - Providing back-up diesel generators to some communities that are difficult to access during major storms

In order to improve the customer experience, BC Hydro plans to:

- Increase BC Hydro's call capacity.
- Raise awareness of storm season issues and encourage outage preparedness at both the customer and the community levels.
- Improve the quality and consistency of information provided to customers to manage their expectations before, during and after storms.

In order to improve outage communication and community preparation, BC Hydro plans to:

- Continue updating and formalizing detailed roles and responsibilities in communication emergency response plans.
- Continue to include public safety instructions to residents in media updates, but also add customer-related information during extended outages about: the status of BC Hydro's call centre (i.e., BC Hydro is aware of and apologizes for busy signals or long waits to talk to customer service agent, etc.); any relevant information for specific communities about shelters or "warming" centres; links to other internal or external websites about "what to do" during an outage.
- Provide additional communication in advance of storms to help customers plan and prepare.

APPENDICES

Storm Review 1:
Oct. 27/06 Snowstorm – Burns Lake/Vanderhoof

Storm Review 2:
Nov. 15/06 Windstorm – Lower Mainland/Van. Island

Storm Review 3:
Nov. 26/06 Snowstorm – Lower Mainland/Van. Island

Storm Review 4:
Dec. 11-15/06 Windstorm – Lower Mainland/Van. Island

Storm Review 5:
Jan. 5-9/07 Windstorm – Lower Mainland/Van. Island

Corporate Emergency Plan

Example of Community Meetings – Storm Updates

11.1 STORM REVIEW: OCTOBER 27, 2006

11.2 SNOW STORM: NORTHWEST B.C.

1. Weather

- On October 27, 2006, a Pacific weather front met a cold weather front coming from the Northern coast. These fronts stalled over the Skeena Valley and the Bulkley Valley Lakes Districts. During the next two-day period, an accumulation of 75 to 120 cm of heavy wet snow fell on the area. By the third day, temperatures dropped to -10°C, and an additional 30 cm of snow fell in some areas. A snow storm warning was issued for these areas 24 hours prior to the event.

2. Communities Affected

- Communities affected included Smithers, Houston, Hazelton, Burns Lake, Vanderhoof, and Fort St. James – an area of approximately 64,000 sq. kms.

- At its peak, 20,000 customers were without power. By Monday, October 30, 90% of customers were restored. Roughly 800 customers were still without power on Thursday, November 2. The last customers in the affected areas were restored on Sunday, November 5.

3. Impact to the Electrical System

- Heavy snow and ice accumulated on conductors and guy wires causing cross-arm timbers to break and transmission conductors to sag into the distribution phases on the under-built structures. Failures occurred on both hydro transmission lines and distribution systems. BC Hydro crews faced significant issues with access as a result of the depth of the snow. The 60kV system feeding Vanderhoof and Fraser Lake Substations failed due to heavy icing conditions.

- The vast number of trees on the distribution lines required tree trimmers to assist the line crews. In some cases, 10 or more trees per span fell on the distribution system. Access to the lines was hampered by tall brush and shrubs, as well as debris from previous vegetation maintenance programs.

4. Restoration Effort

- The three biggest challenges to the restoration effort were access to damaged lines (due to the amount of snow and poor driving conditions), the limited amount of manpower to conduct the restoration, and the ineffective use of the POWERON system (the storm hit before the scheduled pre-storm training for POWERON for that area).

- On Friday, October 27, some power outages started occurring by mid-afternoon.

- The loss of two transmission lines in the evening left Burns Lake substation without a power supply. Transmission crews began to patrol lines but could not reach them due to the amount of snow and extremely restricted highway visibility. In one case, a crew had to snow shoe through waist-deep snow to access a damaged circuit.

- For the first two days, it was virtually impossible to obtain a proper assessment of the damage because the roads and highways were impassable due to nearly 1.2m of wet heavy snow.

- On Saturday, October 28, power line technicians (PLTs) from Vernon and a Key Account Manager from Vancouver were available to assist with the restoration effort. The transmission line to the Burns Lake Substation was severely damaged from a broken cross arm timber and trees across the conductor in two locations. Transmission crews, brought in from Prince George, made repairs to re-energize the Burns Lake Substation. After about 18 hours, the majority of Burns Lake had its power restored.

- Distribution crews in Vanderhoof and Fraser Lake began restoration efforts, beginning with the main feeds to the community and the major rural circuits. Smithers had only one bucket truck to accommodate repairs in Hazelton, Smithers, and Houston. Moreover, there were no vegetation crews in Vanderhoof, therefore the line contractors and local line crew had to remove hundreds of trees to restore power until resources could be sent from Prince George.

- By Sunday, October 29, the snow finally stopped, with accumulations of 120-170 cm in Burns Lake, 80 cm at Decker Lake, 30 cm at Fort St. James, and 60 cm reported at Smithers. It is estimated that 4,500 customers were still without power.

- Crews did not use the POWERON system to provide updates on the restoration, partly due to the difficulty of getting back from remote locations

to enter the information into the system, and partly due to lack of knowledge on how to use the system (they were scheduled for a refresher course the same week that the storm happened). This caused problems for the Customer Restoration Center (CRC) to pass along information to agents to update customers.

- By Monday, October 30, Prince George office staff were asked to assist in trouble restoration procedures. Office staff were instructed to close out completed trouble orders because the Trouble Centre was back-logged. Office staff recommended that trouble orders not be cleared until customers were contacted. Staff began to call 600 customers directly to confirm if power had been restored.

- On Tuesday, October 31, all major distribution and transmission circuits were restored, but some very remote feeders were still out. The CRC determined that field offices were using a "paper system" and not the POWERON Remote system. Concerned that no trouble orders were being cleared, the CRC began contacting customers to determine if power had been restored.

- On Wednesday, November 1, seven Prince George vegetation management contractor crews were dispatched to the storm area along with two crews from Clearwater. With the addition of nine more PLT's as well as 15 tree contractors, staffing at Burns Lake was up to 43.

- By Friday, November 3, approximately 200 customers were still without power in 10 communities. Approximately 60 workers were still involved in the restoration. On Saturday, November 4, 30 customers in Fraser Lake and 26 in Vanderhoof were without power as well as 336 south of Burns Lake. By Sunday, power was restored to all communities, with only sporadic outages caused by new snow after the main restoration.

5. Customer Communications

- The most common complaint from our customers was their inability to get through to POWERON, and the incorrect restoration information they were provided. A lack of training on the full POWERON Remote system led to confusion and duplication of trouble orders.

- At the beginning of the storm, customers were given estimated restoration times even though the full extent of the damage was still unknown or being assessed.

- According to the CRC, customers were very understanding until about October 30, then their mood deteriorated as the restoration extended into the fourth day and beyond. For example, one resident phoned three times and

was "promised" a specific time that power would be restored. When this time was exceeded, he called a fourth time only to be told that there was no record of his previous calls or any other reports for the area in which he lived.

- There were no deaths or serious injuries to BC Hydro staff, contractors or the public during the restoration effort.

6. Public and Community Communication

- BC Hydro's media and community relations departments provided updates to local media and the CBC. Media Relations in Prince George assisted with informing the public on the damage and the restoration process. Their efforts were deemed "highly commendable" by the various managers dealing with the restoration.

7. Key Findings

- The response to this storm was very good, especially given the severe weather conditions and staffing challenges, but several issues did not work as well as they should have.

- For example, the damage/restoration reporting system created some confusion in the field. One of the examples given was of a crew being sent out to a wire down situation that serviced two or three customers. At the same time, there was a subdivision of over 500 customers left without power because the higher trouble repair priority was given to the wire down. Had the crew been aware of the bigger picture, they would have made the wire down situation safe and then proceeded to restore power to the subdivision. Again, the CRC determined that part of the problem was that the field offices were not using the full POWERON Remote system.

- BC Hydro staff credit card and personal credit card systems fail when power and phone lines go down. There was nothing in place to support the crews when they needed fuel, food and other basics in the early stages of the restoration.

- Many of the crews were away from home or away for long hours and could only occasionally come home to sleep and change clothes. It was recommended that BC Hydro should develop a system of checking on employees' dependents to ensure they are safe and able to survive until power can be restored.

- Staff refresher training for the POWERON Remote system should be done earlier to ensure all personnel are ready for storm season. Updates and

amendments to the system must be brought forward in a timely fashion to ensure field staff are current with the system operation.

- Cooperation and communication in the field need to be increased in emergency situations to ensure data and estimates are accurate.

8. Summary of Storm Impacts:

Safety:	**Description**
Employee safety: # of serious injuries Any fatalities	 None None
Public injuries or fatalities	None
Impact to the System:	
Generation assets	There were no major impacts to generation assets, downstream stakeholders or dam safety. Therefore, generation emergency plans were not activated.
# of damaged transmission circuits	9
# of damaged distribution circuits	12
Impact to the Customers:	
Communities Impacted	Burns Lake, Vanderhoof, Smithers
At the peak # of customers out	19,900
# of customers out after 24 hours	8,231: Restoration efforts still hampered by access problems and new damage caused by heavy snowfall
# of customers out after 48 hours	4,457
# of customers out for more than three days	2,431
Communities from which customers were out for three to six days or more	Burns Lake Vanderhoof Ft. St. James

Call Centre Response:	
# of calls received	63,500 with the peak on Oct. 29th at 18,500 calls
# of calls answered (either through call agents or IVR)	63,500 with the peak on Oct. 29th at 18,500 calls
# of busy signals	0

9. Storm Cost Analysis

The table below summarizes the storm expenditures:

$ thousands

	Expenditures	Loadings	Totals	Adj		Revised
Internal Costs:						
Labour	596.7	(235.4)	361.3	(12.1)	[1]	349.2
Construction Services	67.8		67.8			67.8
Travel	33.1		33.1			33.1
Vehicles	71.5	(17.8)	53.7			53.7
Stores Materials	22.4	(2.3)	20.1			20.1
Total Internal Costs	791.5	(255.5)	536.0	(12.1)		523.9
External Costs:						
Contractors	1,734.3	(208.9)	1,525.4	(135.6)	[1]	1,389.8
ABSU	25.0		25.0			25.0
Other	4.4		4.4			4.4
Total External Costs	1,763.7	(208.9)	1,554.8	(135.6)		1,419.2
TOTAL	2,555.2	(464.4)	2,090.8	(147.7)		1,943.1

[1] **Adjustments required as not qualified storm expenditures.**

- A review of the expenditures for this particular storm was conducted. The scope of this review included extracting information from the financial systems and reviewing specific elements against contracts, standards, past practice or external resources for comparability, given the circumstances of the storm. The data collected and analyzed included time charged to the storm by all affiliations, internal charges received from Construction Services, internal vehicle usage charges, Materials Management (Stores) issues and external contractor invoices greater than $10,000.

- The timing of expenditures needed to be considered in the context of the following definitions: Restoration is being defined as any labour or expenditure charged from Oct. 27 through Nov. 2. Permanent repair of damage that was temporarily fixed during the storm is defined as any labour or expenditure charged after Nov. 2.

- Expenditures of $1.9 million charged to this storm were confirmed. Total adjustments deducted from this storm amounted to $147,700. $12,100 was related to regular time charged to this storm by some Management and Professional (M&P) and COPE employees. These charges were not considered to be eligible unless the employees' regular positions were being backfilled by temporary staff in order for them to work on the storm. It was unclear whether those positions were backfilled, therefore the amount was deducted from the storm costs. In addition, $135,600 of vegetation costs related to work done during the repair period. It is reasonable to expect some vegetation work done after the response period to clean up any damaged trees caused by the storm. However, it was unclear whether the work done related to those trees or newly identified hazard trees, therefore it was more prudent to deduct that amount from the storm costs.

- The expenditures are further described by category below.

Labour

- Total internal labour charges amounted to $349,200. Of this total, BC Hydro reviewed $334,000 in relation to labour hours and dollars and noted the following:

    - 44 employees with PLTs being the largest group at 21 qualified individuals and two apprentices with an average of 130 hours for both response and repair efforts. Average hours by PLTs over the seven day storm response were 89 hours. The various categories of employees all played a role in the storm response and repair.

				Regular		Overtime	
Job Title	**Employees**	**Hours**	**Dollars**	**Avg hours/ employee**	**Avg Rate ($/hr)**	**Avg hours/ employee**	**Avg Rate ($/hr)**
Power Line Technicians	21	2,724.8	198,740	37.3	65.1	92.4	76.1
Manager	6	511.8	53,930	28.1	90.2	66.5	109.6
Electricians	3	371.5	25,519	44.7	60.0	118.8	73.6
Apprentices	2	380.0	20,343	52.3	46.5	137.8	56.2
Storekeepers / Material Handlers	4	224.5	12,060	13.0	44.5	46.4	55.7
Other Trades	2	207.5	12,036	27.0	49.4	76.8	61.0
Field Services Administrator	2	154.0	7,350	30.0	39.4	62.0	49.8
Coop Student/Youth Hires	2	118.5	3,533	15.8	17.2	43.5	34.4
Communications and P&C	1	4.5	364	1.0	67.9	3.5	84.7
Front Line Employees	**43**	**4,697.0**	**333,875**	**33.1**	**62.2**	**81.1**	**74.4**
Admin	1	18.0	792	18.0	44.0		
Support Employees	**1**	**18.0**	**792**	**18.0**	**44.0**		
Total	**44**	**4,715.0**	**334,667**	**32.7**	**62.0**	**81.1**	**74.4**
Adjustments			14,561				
Total Labour charged			**349,228**				

    - The number of overtime hours is 3,407 or 73% of the total hours charged to the storm. The restoration period stretched over the weekend which is paid as overtime for the full day. This is higher than the percentage of contractor hours charged to overtime during the same period which was at 66%.

- 66% of the labour was for restoration and 34% for repair.

Construction Services

- Total charges from construction services amounted to $67,800.

- Details of the internal charges from Construction Services indicated that the bulk of the staff were PLTs (2) and driver/helpers (2). 565 hours were charged at a blended regular/overtime rate of $61/hour, well below the outside contractor community blended rate.

Vehicles

- 26 separate vehicles were charged to the storm totalling $53,700. Using the number of employees who worked on the storm and the expected number of employees per vehicle, the vehicle count appears consistent with the breakdown of labour resources above, (i.e. the number of two- and three-person PLT crews, vegetation coordinators conducting physical inspections) which is approximately 43 front line employees. In addition, crews may use different vehicles for different shifts. Total hours charged to vehicles is 2,488, which is consistent with the number of front line employees and the hours they worked as shown above.

Contractors

- Total contractor costs amounted to $1.4 million. The list of contractors with billings greater than $100,000 includes:

Contractor Name	Billings
A.J. Nickerson Excavating	195,778
Twin River Power Ltd.	192,919
Plowe Power Systems Ltd.	183,009
Asplundh Canada Inc.	179,749
R.R. Interior Power & Electric Ltd.	167,069
Davey Tree Expert Co. of Canada, Ltd.	145,788
Esc Electrical Service Contracting Ltd.	110,483
Other less than $100,000	214,943
Total Contractors	1,389,737

- A breakdown of contractors by type is below:

Contractor Type	$ Amount	%
Line and accrued contractors	837,700	60.3%
Vegetation	278,132	20.0%
Excavation	211,783	15.2%
Helicopters	42,135	3.0%
Flagging	13,102	0.9%
Other	5,770	0.4%
Transportation	1,115	0.1%
Total	1,389,737	100%

- Contractor invoices were collected for review where the invoice amount was greater than $10,000. This amounted to 87 of the 368 contractor invoices charged to this storm. For each invoice, the dollars and hours charged, the dates worked, regular versus overtime billing and support costs were collected and reviewed.

- Vegetation contractor costs as a proportion of total contractor costs were higher in this storm due to heavy, wet snow slowing down the time required to clear trees off of lines as well as the long circuits and the long travel time required to get to trouble areas.

- Of the $800,000 in line contractors, BC Hydro reviewed $400,000 of labour on those invoices. Of this total, 34% was realized during regular hours whereas 66% was billed for overtime hours. This is lower than internal PLT labour hour allocations between regular and overtime of 71/29.

    - Average PLT contractor regular hour billing rate was $94/hour and the overtime billing rate was $146/hour, both in alignment with rates prescribed in the emergency line agreement but at the higher end of the billing range based on job classification.

- For vegetation contractors, 96% of the hours billed were at a regular rate compared to 4% at overtime rates. This is a consistent result given that vegetation response is not typically performed in non-daylight hours, which tend to be billed at overtime rates.

- None of the vendors had billings greater than $1 million, which is the delegated contract/commitment approval level for the General Manager, Distribution.

Materials

- Material expenditures for this storm totalled $20,000. The bulk of the material costs were for replacement of damaged distribution assets, including poles, conductors, cable ducts, etc.

- Due to a lack of supply (cross arms), $11,000 in materials were procured by the Materials Management Business Unit (MMBU) but were delivered directly to the various sites as required without being received at MMBU. This was done to expedite the restoration efforts.

11.3 STORM REVIEW: NOVEMBER 15, 2006

11.4 WINDSTORM: LOWER MAINLAND AND VANCOUVER ISLAND

1. Weather

- Heavy rains and winds intensified by mid-November, with gale-force gusts up to 145 km/hour knocking down many trees already weakened by the previous month's heavy rain.

- On November 10, 2006, the Customer Restoration Centre (CRC) received storm alerts from our in-house meteorologist. On November 15, 2006, an intense frontal system over the Eastern Pacific hit the South and Central coast of British Columbia, spreading heavy rain and strong winds. Just ahead of the system, southeast winds of 70 km/h to 100 km/h developed over northern Vancouver Island and the central coast. Winds were clocked at over 100 km/h at the Abbotsford airport.

- The most damaging characteristics of this storm were the high sustained gusts of wind, coupled with heavy rains that loosened the soil. This combination resulted in many trees falling on distribution lines.

- The storm started the morning of November 15 at approximately 4 a.m.

2. Communities Affected

- Almost all communities in the Lower Mainland between Hope and Squamish were affected, as well as the Sunshine Coast. On Vancouver Island, significant damage occurred in the Nanaimo, Parksville, Port Alberni and Courtenay areas, and parts of the Gulf Islands.

- By 8 p.m. on the night of November 15, the number of customers without power peaked to approximately 226,000, or 13% of all BC Hydro customers. The effects of the storm would last until November 20, when power was finally restored to the Village of Lions Bay, Bamfield and Nitinat Village.

3. Impact to the Electrical System

- Some of BC Hydro's transmission and distribution assets were damaged by the storm. Over 100 distribution circuits failed at the peak of the storm. The most difficult transmission challenge was the two transmission lines that were severely damaged at Lions Bay. Trees fell on both the substations and transmission lines, resulting in the entire Village of Lions Bay being without power until November 20.

- The distribution line to Bamfield and Nitinat was also heavily damaged. This line runs approximately 70 km along a road in extremely poor condition. As a result, it took crews days just to clear the roads of fallen trees and branches to get into the damaged areas in order to restore power. A mobile generator was used to restore Nitinat Village.

4. Restoration Effort

- Starting at approximately 4 a.m. on November 15 – when the leading edge of the storm hit Vancouver Island – the number of customers without power was estimated to be about 10,000.

- By 9 a.m., the storm hit the North Shore and the number had increased to approximately 20,000 customers.

- By noon, the storm began sweeping through most of the Lower Mainland and approximately 90,000 customers were without power.

- By about 8 p.m., the number of customers without power on Vancouver Island and the Lower Mainland peaked at approximately 226,000.

- BC Hydro's regional managers activated the six storm rooms in the following sequence to take over the dispatching of crews from the CRC:

    - 10am: Vancouver Island
    - 12am - 1pm: Abbotsford, Surrey, North Shore
    - 2pm: Edmonds
    - 3pm: Coquitlam

- At this stage, crews of Power Line Technicians (PLTs) and designers were deployed to assess and repair damage at the regional levels using available staff and contractors in their areas. (Line crews can assess and repair; designers can only assess and report back to headquarters.) Some crews from Surrey were sent over to Vancouver Island in the morning as a precaution against ferry closure.

- The first Field Operations Emergency Centre conference call was initiated by Neil Sharpe, General Manager for Lower Mainland and Vancouver Island, at 3pm. (Conference calls were held every day approximately every five hours between 6 a.m. and 8 p.m.) Those in attendance at the first call included Neil Sharpe; Eric Valois, Manager, Delivery Services; Donia Snow, General Manager for the Interior; four regional managers (Vancouver Island, Lower Mainland North, Lower Mainland South, and South Interiors); Warren Quan; and Elisha Moreno from Corporate Affairs. Information was shared regarding damage assessments and reports, crew complements and deployments, and the current state of resources for possible re-deployment between regions.

- At the next conference call at 8 p.m., the team was brought up to date on the latest assessment of the storm, and a decision was made to keep a small number of crews overnight for public safety (wires down, for example). The rest of the crews were sent home for a rest period. Night managers planned the dispatch of crews based on priorities assessed by the CRC.

- The next morning, line crews and designers were sent out at 6 a.m. to assess the damage. Some crews from the North Shore were sent to South Lower Mainland as it was the worst hit area.

- During the restoration effort, Field Operations received damage assessments from field crews, assigned resources, and prioritized "trouble calls" based on BC Hydro's System Operating Order. Unless "special needs" customers (old-age homes, for example) were identified as such during a trouble call, they were not treated or prioritized any differently than other large blocks of customers.

- In some cases, crews were able to make immediate repairs to restore power. In other cases, temporary repairs (fixing but not replacing a broken pole, for example) were made to restore power in order to move on to the next trouble call or until a larger crew was available.

- Major repairs to restore power, which in some cases took crews 12 hours or more to complete, were conducted from November 16 to 20. Helicopters were used by senior Field Operations staff, when weather permitted, to assist in damage assessment. For example, crews were sent to Summit Drive in North Vancouver, but it took over 36 hours to clear the roads to get in and assess the damage. If it had been possible to use helicopter services to conduct a damage assessment, management would not have committed valuable resources for that community until later.

- The Provincial Emergency Program (PEP) opened its regional office in Surrey in the late afternoon on Nov. 15. At PEP's request, one of BC Hydro's Field Operations staff from South Lower Mainland was sent over to work with

them. BC Hydro was not aware if any other Provincial Regional Emergency Centres were opened.

- By the evening of November 15, approximately 226,000 customers were experiencing outages. By the end of November 16, approximately 75% of these customers had been restored.

- From the morning of November 16 to November 20, power was restored to the remaining 25% of customers affected by the storm. Most of these trouble calls were to areas where the damage was significant and/or access to the area was restricted. For example, restoration was significantly hampered by the difficulty in accessing remote areas, impassable roads and in one case by a landslide on North Vancouver Island in the vicinity of Bamfield, which hampered Hydro crews from moving into the area. An attempt was made to use helicopters to get crews into Lions Bay, but weather conditions didn't allow for it.

- By 4 p.m. on November 19, power was restored to most Vancouver Island customers. By 6 p.m. on the same day, power was restored to most Lower Mainland customers, and by 6 p.m. on November 20, power was restored to the last three communities (Lions Bay, Bamfield, Nitinat).

- There were no deaths or serious injuries to our staff, contractors or the public during the restoration effort.

5. Customer Communications

- At 6 a.m. on Nov. 15, the volume of customer calls increased as the storm started battering most of Vancouver Island and the Lower Mainland.

- At about 9 a.m., the volume of customer calls into Accenture Business Services for Utilities' (ABSU) Burnaby call centre location caused the Interactive Voice Response (IVR) to operate intermittently. This caused a large number of busy signals and/or dropped calls. After approximately one hour of trouble-shooting, BC Hydro switched back to the old IVR software, which caused some of the calls to be misdirected. Call overloads had also crashed the Telus lines coming in, resulting in a "not in service message" being heard.

- By noon, BC Hydro decided to reroute all calls through the Vernon IVR. By 3 p.m., the Vernon system started to fail. This was caused by a phone switch problem with Telus.

- By 6 p.m. on Nov. 15, both the Burnaby and Vernon systems were fully functional. BC Hydro also used an "en-route" announcement message – which was heard before a customer was routed to Hydro, the IVR or an agent – to let them know we were experiencing storm-related troubles with our system.

- By noon on November 16, Customer Care staff was also involved in the Field Operation conference calls. Many customers were upset that estimated restoration times were either inaccurate or conflicting with media or BC Hydro Communications messages.

- The CRC was responsible for updating outage notifications on our web site. Because the web page update process is still manually intensive, the CRC only updated the website periodically and only with very general messaging as they were busy with assessing and prioritizing trouble calls.

- The CRC was responsible for updating estimated times of restoration (ETR) for individual outages that would be played in a message on the IVR. Due to the large number of outages, updates were done en masse for larger areas (i.e., Victoria Area encompassed Victoria, Saanich, Sooke, etc.) after confirmation from Regional Managers and District storm rooms. Since these ETRs were averages for a larger area, some customers were restored much earlier and some much later.

6. Public and Community Communication

- BC Hydro's Media Relations Manager attended all the Field Operations conference calls. After each call, Lower Mainland news media were updated about BC Hydro's restoration efforts and the approximate number of customers without power.

- By November 16, media picked up that there were certain areas still without power: Lions Bay, Bamfield, and Surrey. However, BC Hydro was not able to give accurate estimated restoration times.

- By the middle of the restoration (November 18), BC Hydro coordinated "embedded" media to follow vegetation crews during the restoration effort.

- Community Relations Managers assisted with communication efforts by providing information to community leaders and the local media outlets.

7. Key Findings

- Even though BC Hydro did not formally activate the Corporate Emergency Centre (CEC), the restoration effort was coordinated through the business groups.

- Communication between some lines of business were effective (Field Operations and Communications), but initially there was limited or no line of communication with Customer Care.

- Major technical challenges with Customer Care telephone systems hindered the customer "experience" nearly as soon as the first impacts of the storm were felt.

- Some crews were tied up over an extended period doing damage assessments and restoration on the ground in remote areas when they could have been employed more effectively at other higher priority areas such as the Summit Drive incident.

- ETRs can be improved to give a more realistic estimate.

8. Summary of Storm Impacts:

Safety:	**Description**
Employee safety: # of serious injuries Any fatalities	None None
Public injuries or fatalities	None One near-miss incident: Sooke Fire Department reported a downed line. While waiting for a BC Hydro crew to respond, a firefighter picked up the line and moved it from the road. The wire was not live.
Impact to the System:	
Generation assets	**Cheakamus** - Both the primary and secondary power sources for the spillway gates were out during the storm. A newly installed diesel generator was available on site to provide power for spillway gate operation. Access to site via Highway 99 was not available due to fallen trees, but staff were available on site to operate the generator had it been required. A pre-spill of approximately 150 cm was in place during the storm event and generation was kept at near capacity. The reservoir level remained relatively low throughout the storm, so there was no

	dam safety risk. Subsequently, an additional diesel generator with remote start capabilities from the control center has been installed to mitigate the risk of not being able to get staff to site in a storm. **Clowhom** – The single power line was down from Nov. 15 to 18 during a period when no staff was on site. The generating unit did have some damage from the storm during the automatic shutdown sequence. The station backup diesel generator automatically started as designed and autospill capability for the spillway gates was available, but not required, during the storm. An additional backup diesel for the gate operation has since been installed at site, and requirements for site staffing during storms have been implemented. For this storm, there were no major impacts to generation assets, downstream stakeholders or dam safety. Therefore, Generation emergency plans were not activated.
# of damaged transmission circuits	8: The most difficult transmission challenge was the feed to Lions Bay substation due to the terrain. BCTC did not activate its emergency response plan but dealt with BC Hydro Field staff under normal operating orders to prioritize restoration to transmission lines and related substations.
# of damaged distr. circuits	100

Impact to the Customers:	
Communities Impacted	Almost all communities in the Lower Mainland, Fraser Valley, Abbotsford, Hope and Squamish, the Sunshine Coast and on Vancouver Island with significant damage occurred in the Nanaimo, Parksville, Port Alberni and Courtenay areas and some of the Gulf Islands.
At the peak # of customers out	226,000 More than half were in the Fraser Valley and Abbotsford areas.
# of customers out after 24 hours	55,000 Approximately 75% restored About 35,000 of the customers still without power were in the Fraser Valley and Abbotsford areas.
# of customers out after 48 hours	12,000 Approximately 95% restored
# of customers out for more than three days	2,000
Communities from which customers were out for three	Bamfield Nitinat Lions Bay

to six days or more	Summit Drive – North Vancouver
Call Centre Response:	
# of calls received	209,000 calls with the peak on Nov. 15 at 131,000 call
# of calls answered (either through call agents or IVR)	164,000 calls with the peak on Nov. 15 at 99,000 calls
# of busy signals	44,500 with the peak on Nov. 15 at 32,000 calls
	These figures do not include customers that could not even get through the phone lines.

9. Storm Cost Analysis

The table below summarizes the storm expenditures:

$ thousands

	Expenditures	Loadings	Totals	Adj		Revised
Internal Costs:						
Labour	3,049.7	(1,032.9)	2,016.8	(71.0)	[1]	1,945.8
Construction Services	521.5		521.5			521.5
Travel	101.4		101.4			101.4
Vehicles	484.6	(93.7)	390.9			390.9
Stores Materials	408.3	(73.1)	335.2			335.2
Total Internal Costs	4,565.5	(1,199.7)	3,365.8	(71.0)		3,294.8
External Costs:						
Contractors	3,307.3	(394.4)	2,912.9	(36.5)	[1]	2,876.4
ABSU	126.2		126.2			126.2
Other	25.9		25.9			25.9
Total External Costs	3,459.4	(394.4)	3,065.0	(36.5)		3,028.5
TOTAL	8,024.9	(1,594.1)	6,430.8	(107.5)		6,323.3

[1] Adjustments required as not qualified storm expenditures.

- A review of the expenditures for this particular storm was conducted. The scope of this review included extracting information from the financial systems and reviewing specific elements against contracts, standards, past practice or external resources for comparability, given the circumstances of the storm. The data collected and analyzed included time charged to the storm by all affiliations, internal charges received from Construction Services, internal vehicle usage charges, Materials Management (Stores) issues and external contractor invoices greater than $10,000.

- The timing of expenditures needed to be considered in the context of the following definitions: restoration is being defined as any labour or expenditure charged from Nov. 15 through 20; permanent repair of damage that was temporarily fixed during the storm is defined as any labour or expenditure charged after Nov. 20.

- Expenditures of $6.3 million charged to this storm were confirmed. Total adjustments deducted from this storm amounted to $107,500. Based on our review, $71,000 related to regular time charged to this storm by some Management and Professional (M&P) and COPE employees. These charges were not considered to be eligible unless the employees' regular positions were being backfilled by temporary staff in order for them to work on the storm. It was unclear whether those positions were backfilled, therefore the amount was deducted from the storm costs. In addition, $36,500 of vegetation costs related to work done during the repair period. It is reasonable to expect some vegetation work done after the response period to clean up any damaged trees caused by the storm. However, it was unclear whether the work done related to those trees or newly identified hazard trees, therefore it was more prudent to deduct that amount from the storm costs.

- The expenditures are further described by category below.

Labour

- Total internal labour charges amounted to $1.9 million for this storm. Of that, we collected and reviewed $1.5 million in detail and noted the following:

    - 539 employees with Power Line Technicians (PLTs) being the largest group at 212 qualified individuals and 50 apprentices with an average of 53 hours. Average hours by PLT over the six day storm response were 45 hours. The various categories of employees all played a role in the storm response and repair.

    - Details of the various employee categories are:

				Regular		Overtime	
Job Title	**Employees**	**Hours**	**Dollars**	**Avg hours/ employee**	**Avg Rate ($/hr)**	**Avg hours/ employee**	**Avg Rate ($/hr)**
Power Line Technicians	212	11,169	804,041	20.4	65.08	33.3	76.11
Design	53	881	53,265	7.2	46.89	16.7	62.86
Manager	52	1,698	174,577	18.2	87.12	28.8	104.91
Apprentices	50	3,031	160,532	21.1	46.53	41.2	56.19
Storekeepers / Material Handlers	36	1,246	66,238	19.9	44.53	26.9	55.65
Field Services Administrator	32	873	40,442	17.8	38.57	20.1	49.11
Meter & Instrument Technicians	16	621	41,287	13.9	57.54	24.9	71.48
Electricians	15	482	33,345	12.0	59.99	27.1	73.60
Other Trades	12	779	43,054	32.0	49.43	32.9	61.02
Veg Coordinator	10	812	43,922	42.8	48.12	42.7	60.77
Coop Student/Youth Hires	7	265	7,254	18.1	17.19	22.4	34.38
Mechanics	4	172	11,322	20.1	58.76	30.3	72.44
Plant Operators	3	53	3,546	7.5	57.04	15.0	69.30
Maintenance Coordinator	2	28	1,671			13.8	60.77
Communications and P&C	1	2	169			2.0	84.72
General Tradesmen	1	15	893			14.5	61.58
Front Line Employees	**506**	**22,124**	**1,485,561**	**20.0**	**58.32**	**30.0**	**71.60**
Electric Service Coordinator (CSC)	9	181	9,227	8.3	37.41	18.3	52.21
Admin	5	25	1,206	4.5	36.75	5.1	50.76
Drafter	4	35	1,523	4.0	36.75	8.8	46.37
Inspector	4	60	3,305			15.0	55.08
Other	4	62	3,712	8.1	42.30	9.4	71.63
Media	3	130	11,394	43.0	87.76	1.0	73.65
Safety	2	58	4,306	7.5	52.24	25.0	78.29
HR	2	76	6,546	29.5	82.86	16.5	100.43
Support Employees	**33**	**626**	**41,219**	**17.8**	**75.19**	**13.5**	**59.74**
Total	**539**	**22,750**	**1,526,781**				
Adjustments			419,045				
Total Labour Charged			**1,945,826**				

- The number of overtime hours is approximately 15,000 hours or 66% of the total hours charged to the storm. The restoration period stretched over the weekend which is paid on overtime for the full day. This is consistent with the percentage of contractor hours charged to overtime during the same period.

- 82% of the labour was for restoration and 18% for repair.

- The adjustments of $419,000 related mainly to approximately $260,000 charged incorrectly and the remaining $160,000 related to adjustments to estimated loadings that were removed from storm costs. As this was the first major storm in the Lower Mainland/Vancouver Island, some employees were not aware of the appropriate code to charge to this storm.

Construction Services

- Total charges from construction services amounted to $521,500.

- Details of the internal charges from Construction Services indicated that the bulk of the staff were PLTs (29) and driver helpers (13). 4,189 hours were charged at a blended regular/overtime rate of $65/hour, well below the outside contractor community blended rate.

Vehicles

- Total vehicle costs for the storm amounted to $390,900. Of this total, we collected and reviewed approximately $364,000 or 93% of the total cost and noted the following:

    - 268 separate vehicles used during that period. Using the number of employees who worked on the storm and the expected number of employees per vehicle, the vehicle count appears consistent with the breakdown of labour resources above, (i.e., the number of two- to three-person PLT crews, vegetation coordinators conducting physical inspections) which is approximately 400-500 front line employees. In addition, crews may use different vehicles for different shifts.

    - Total vehicle hours of 11,857, which is consistent with the number of front line employees and the hours they worked.

Contractors

- Total contractor costs amounted to $2.9 million for this storm. The list of contractors with billings greater than $100,000 includes:

Contractor Name	$ Amount
Allteck Line Contractors Inc.	602,894
Arctic Power Systems B.C. Ltd.	450,642
Pacific Electrical Install. Ltd	165,083
Plowe Power Systems Ltd.	142,004
Galbraith Powerline Contr. Ltd.	136,631
Vancouver Island Powerlines Ltd	134,046
A-Power Line Contracting Ltd.	106,338
Asplundh Canada Inc.	105,393
Other less than $100,000	1,033,384
Total Contractors	**2,876,415**

- A breakdown of contractors by type is below:

Contractor Type	$ Amount	%
Line and accrued contractors	2,426,661	84.4%
Vegetation	286,973	10.0%
Flagging	76,755	2.7%
Helicopters	32,353	1.1%
Excavation	17,712	0.6%
Transportation	16,486	0.6%
Other	14,960	0.5%
Equipment	2,502	0.1%
Fuel	2,013	0.1%
Total	**2,876,415**	100%

- Contractor invoices were collected for review where the invoice amount was greater than $10,000. This amounted to 47 of the 191 contractor invoices charged to this storm. For each invoice, the dollars and hours charged, the dates worked, regular vs. overtime billing and support costs were collected and reviewed.

- Of the $2.4 million for line contractors, we reviewed $1.4 million of invoices. Of this total, 32% was realized during regular hours whereas 68% was billed for overtime hours. This is consistent with internal PLT labour hour allocations between regular and overtime.

    - Average PLT contractor regular hour billing rate was $89/hour and the overtime billing rate was $141/hour, both in alignment with rates prescribed in the emergency line agreement.

- For vegetation contractors, 93% of the hours billed were at a regular rate compared to 7% at overtime rates. This is a consistent result given that vegetation response is not typically performed in non-daylight hours, which tend to be billed at overtime rates.

- None of the vendors had expenditures greater than $1 million, which is the delegated contract/commitment approval level for the General Manager, Distribution.

Materials

- Material expenditures for this storm totalled $335,000. The bulk of the material costs were for replacement of damaged distribution assets, including poles, conductors, cable ducts, etc.

- A large amount of exempt material (nuts and bolts, etc) of approximately $73,000 was charged to this storm. It is expected that this is due to the replenishment of the truck supplies from the first few storms or to ensure no lack of small parts/materials on the trucks when responding to this storm.

Exempt materials expenditures varied by storm, with some being as low as 6% of material costs and some up to 35% of material costs.

- Due to a lack of supply (i.e., cross arms), approximately $93,000 in materials were procured by Materials Management Business Unit (MMBU) but were delivered directly to the various sites as required without being received at MMBU. This was done to expedite the restoration efforts.

11.5 STORM REVIEW: NOVEMBER 26, 2006

11.6 SNOW STORM: LOWER MAINLAND AND VANCOUVER ISLAND

1. Weather

- On November 19, 2006, a Pacific storm brought 90mm of rain and strong winds to coastal B.C. Then a weather warning was issued that an Arctic ridge over the BC Interior would combine with a Pacific low pressure system over southwest B.C. The result, on November 26, was 20-40 cm of heavy snow across Greater Vancouver, Victoria, and the rest of the South Coast. On November 27 and 28, the Arctic front spread across the Lower Mainland and temperatures dropped as the skies cleared (-12°C in Vancouver).

- The storm dropped 40 to 60 cm of snow in the eastern Fraser Valley; Abbotsford Airport broke its one-day snowfall record for November with 44 cm; and snowfall at Vancouver International Airport amounted to 39 cm. Victoria had six days of snow with back-to-back 15+cm days.

- This major snowstorm was followed by a week of cold temperatures, which fell as low as -36°C in northern B.C. and -12°C at Vancouver Airport. As a result, the weight of the heavy snow brought more branches and trees down on power lines. When the snow did melt, tree branches sprang back up and caused even more damage to power lines.

2. Communities Affected

- Most of the communities between Hope and Squamish were affected in the Lower Mainland, with significant storm damage occurring at Mission, Coquitlam and on Vancouver's North Shore. Significant damage also occurred on Vancouver Island, with some of the hardest-hit areas being the Capital Regional District, Parksville, Courtenay, and Port Alberni.

- At the peak of the storm, 92,600 customers were without power; the majority of customers were restored after three days. Power was restored to all customers by December 2.

3. Impact to the Electrical System

- Approximately 150 distribution circuits were out at the peak of the storm. The major cause of damage was heavy wet snow, which caused trees to break and fall onto the distribution system. The South Vancouver Island area was hard hit from tree damage. Most roads on Vancouver Island were inaccessible (trees, snow, and ice) until municipal crews could clear them for BC Hydro to access the outages.

4. Restoration Effort

- With barely enough time to recover from the previous windstorm on November 15, BC Hydro staff and crews were again faced with a massive restoration effort. Lessons learned from other storms were also beginning to be applied, but the greatest challenge with the snow storms, compared to wind storms, was gaining access to trouble spots.

- On Vancouver Island, the regional manager contacted the Provincial Emergency Program to have snow removal crews plow roads and provide access to BC Hydro crews and contractors.

- On November 27, five contract crews from the Interior were brought in to assist BC Hydro crews. As well, a Mutual Aid agreement with Fortis BC was invoked and a crew of four responded. The City of New Westminster, under a similar agreement, provided another two crews to help with the restoration effort.

- Technical problems with the POWERON system continued to hamper efforts to acquire and share timely and accurate information between crews and the Customer Restoration Centre (CRC).

- Field Operations conference calls were held once or twice a day, with Customer Care and Communications staff in attendance from the beginning of the restoration process.

- Restoration of service during a snow storm is often more challenging than during a wind storm. For snow storms, limited access due to unplowed roads, ice and stalled privately-owned vehicles hamper the restoration effort. During a “wet snow event,” outages occur over a longer period of time as heavier snow accumulates on trees.

5. Customer Communications

- As in the first two storms, call capacity issues continued to cause busy signals or dropped calls. While these challenges persisted and were addressed as best as possible, especially regarding the Interactive Voice Response (IVR), more focus was placed during this storm on providing better information and meeting other customer needs.

- At the beginning of the storm, from 2 p.m. to midnight on November 26, a "not in service" message was heard by customers until Telus resolved the problem. It is not known how many customers this affected.

- In response to this shortcoming, one of the lessons learned from the November 15 storm was the effectiveness of the "en-route" message provided by Telus. This "pre-IVR" message was used effectively again during this storm, and to a much greater extent. It was updated at least three times per day, which resulted in nearly a 50% reduction in customer calls after each update. One of the reasons this was effective was because the message gave a greater amount of information to the customer, including estimated times of restoration. Even the added context given to customers – the extent of the storm, its location, damage, challenges for restoration crews, etc. – was found to help customers both understand the overall picture and to assist with their individual planning.

- By Nov. 27, information to the customer was again improved, and made more consistent, by sharing BC Hydro media releases with customer service representatives, who in turn communicated the latest news to customers. (For customers without power to use computers and televisions, this line of communication was one of their only means of accessing information.)

- On Nov. 28, during the final portion of the restoration, the en-route message was discontinued as call volumes diminished, but also because a media advisory was sent out asking customers to call if they were still without power (i.e., the goal was to talk to customers, not re-route them, in order to find the remaining pockets of outages). Also, knowing that some customers were going to be without power for another night, call centre agents provided information about provincial shelters.

- Conference calls held with Field Operations, Communications and Regional Field Managers once again were helpful in providing information to customers (through call agents) regarding storm and restoration updates.

- Customers were still irate with call agents as restoration times kept changing or were not being met.

- Another major challenge was getting staff in to work, given the condition of the roads. At one point, the RCMP was issuing advisories that people stay off the roads. In response, Accenture Business Services for Utilities (ABSU) extended shifts as well as providing taxi service and even hotel rooms to call center agents.

6. Public and Community Communication

- After attending Field Operation conference calls, Media Relations updated Lower Mainland news media about our restoration effort and the approximate number of customers without power.

- On November 27, the first of six media advisories were sent to the media and posted on the Hydro web site. There were two releases each day from Nov. 27 to 29, which usually occurred after a conference call with the business groups.

- These media advisories were also helpful to call centre agents, who shared the information with customers.

- Community Relations Managers assisted with communication efforts by providing information to community leaders and the local media outlets.

- Limited staff resources again left BC Hydro without an adequate backup to the Media Relations Manager. With only one Media Relations Manager on staff, the amount of quality and consistent messaging, as well as the ability to coordinate the sharing of information with other divisions, was not optimized. Other staffing resources within Communications provided valuable concurrent activity (writing media advisories, posting messages to the web) while the Media Relations Manager attended to multiple media interviews.

7. Key Findings

- Effective communication between Media Relations and the CRC was helpful in getting messages to customers.

- POWERON issues continued to plague the restoration effort. Customers were still frustrated with inaccurate restoration times.

- Not all individuals involved in storm restoration had a clear understanding of their roles and responsibilities.

- Crews experienced delays in getting clearances for work and switching due to the volume of requests that BCTC was dealing with.

- Storm rooms need to establish "best practices" and clearly identify and document roles, responsibilities and training.

- Customers want and are relieved to receive "context" information (location and extent of the storm, damage, etc) as much as an estimated time of their own restoration.

- Call centre agents needed to know more about how the restoration process works in order to share it with customers.

- Media messages posted to the BC Hydro website were helpful in providing another source of information to customers. These updates were also useful to call centre agents, leading to more consistent messaging overall.

8. Summary of Storm Impacts:

Safety:	**Description**
Employee safety: # of serious injuries Any fatalities	None None
Public injuries or fatalities	None
Impact to the System:	
Generation assets	There were no major impacts to generation assets, downstream stakeholders or dam safety. Therefore, generation emergency plans were not activated.
# of damaged transmission circuits	12, of which five were out for over 24 hrs.
# of damaged distr. circuits	150
Impact to the Customers:	
Communities Impacted	Vancouver Island/Lower Mainland: Abbotsford, Tri-cities, Vancouver, North Shore, Sechelt, and all of central Vancouver Island. Hardest hit areas were Victoria and Fraser Valley West (Surrey, Delta, Langley, Richmond)
At the peak # of customers out	92,600
# of customers out after 24 hours	72,500
# of customers out after 48 hours	25,000

# of customers out for more than three days	2,703
Communities from which customers were out for three to six days or more	Gulf Islands Brentwood Bay Saanichton Pockets of Vancouver and Victoria
Call Centre Response:	
# of calls received	258,000 calls with the peak on Nov. 26th at 142,000 calls
# of calls answered (either through call agents or IVR)	199,000 calls with the peak on Nov. 26th at 94,000 calls
# of busy signals	59,000 with the peak on Nov. 26th at 48,000
	These statistics do not include customers that could not even get through the phone lines.

9. **Storm Cost Analysis**

The table below summarizes the storm expenditures:

$ thousands

	Expenditures	Loadings	Totals	Adj		Revised
Internal Costs:						
Labour	3,053.4	(1,140.3)	1,913.1	(94.7)	[1]	1,818.4
Construction Services	375.8		375.8			375.8
Travel	120.7		120.7			120.7
Vehicles	419.4	(90.6)	328.8			328.8
Stores Materials	371.2	(62.2)	309.0			309.0
Total Internal Costs	4,340.5	(1,293.1)	3,047.4	(94.7)		2,952.7
External Costs:						
Contractors	6,052.8	(675.1)	5,377.7	(91.0)	[1]	5,286.7
ABSU	138.5		138.5			138.5
Other	25.8		25.8			25.8
Total External Costs	6,217.1	(675.1)	5,542.0	(91.0)		5,451.0
TOTAL	10,557.6	(1,968.2)	8,589.4	(185.7)		8,403.7

[1] Adjustment required as not qualified storm expenditures.

- A review of the expenditures for this particular storm was conducted. The scope of this review included extracting information from the financial systems and reviewing specific elements against contracts, standards, past practice or external resources for comparability, given the circumstances of the storm. The data collected and analyzed included time charged to the storm by all affiliations, internal charges received from Construction Services,

internal vehicle usage charges, Materials Management (Stores) issues and external contractor invoices greater than $10,000.

- The timing of expenditures needed to be considered in the context of the following definitions: restoration is defined as any labour or expenditure charged from Nov. 26 through Dec. 2; permanent repair of damage that was temporarily fixed during the storm is defined as any labour or expenditure charged after Dec. 2.
- Expenditures of $8.4 million charged to this storm were confirmed. Total adjustments deducted from this storm amounted to $185,700. $94,700 was related to regular time charged to this storm by some Management and Professional (M&P) and COPE employees. These charges were not considered to be eligible unless the employees' regular positions were being backfilled by temporary staff in order for them to work on the storm. It was unclear whether those positions were backfilled, therefore the amount was deducted from the storm costs. In addition, $91,000 of vegetation costs related to work done during the repair period. It is reasonable to expect some vegetation work done after the response period to clean up any damaged trees caused by the storm. However, it was unclear whether the work done related to those trees or newly identified hazard trees, therefore it was more prudent to deduct that amount from the storm costs.

- The expenditures are further described by category below.

Labour

- Total internal labour costs amounted to $1.8 million. Of this total, we reviewed $1.6 million of labour hours and dollars in detail and noted the following:

    - 428 employees were involved with Power Line Technicians (PLTs) being the largest group at 163 qualified individuals and 43 apprentices with an average of 78 hours. Average hours by PLT over the seven day storm response were 70 hours. The various categories of employees all played a role in the storm response and repair.

    - Details of the various employee categories are:

				Regular		Overtime	
Job Title	**Employees**	**Hours**	**Dollars**	**Avg hours/ employee**	**Avg Rate ($/hr)**	**Avg hours/ employee**	**Avg Rate ($/hr)**
Power Line Technicians	163	12,746.8	919,222	29.4	65.1	50.5	76.1
Manager	34	1,652.8	168,319	40.7	84.9	40.2	105.4
Apprentices	43	3,159.8	166,437	29.5	46.5	49.0	56.2
Field Services Administrator	30	1,636.7	75,038	30.0	39.3	38.1	49.3
Storekeepers / Material Handlers	22	971.5	51,223	18.3	44.5	32.5	55.7
Design	45	740.5	44,431	8.7	49.7	15.5	61.7
Electricians	18	644.0	44,166	14.0	60.0	27.1	73.6
Meter & Instrument Technicians	15	607.3	39,573	18.3	57.5	22.2	71.5
Veg Coordinator	8	664.0	35,759	45.4	48.1	37.6	60.8
Maintenance Coordinator	5	287.0	16,368	48.8	48.4	37.9	61.5
Other Trades	7	300.0	16,156	37.1	49.4	16.4	61.0
Coop Student/Youth Hires	4	384.5	10,035	46.3	17.2	49.8	34.4
General Tradesmen	2	123.0	7,104	20.5	50.1	41.0	61.6
Vehicle Tradesmen	3	75.0	4,604	14.0	53.9	23.5	65.9
Communications and P&C	2	10.0	688	4.8	67.9	0.5	84.7
Mechanics	1	3.0	217			3.0	72.4
Front Line Employees	**402**	**24,005.7**	**1,599,341**	**27.6**	**57.8**	**40.3**	**71.4**
Media	3	159.0	13,920	51.8	87.9	3.5	73.7
Admin	7	214.5	10,601	21.0	43.9	21.9	54.7
ESC	8	189.0	10,043			23.6	53.1
Other	4	113.5	7,491	30.0	39.4	20.9	75.6
Safety	2	78.2	6,119	20.2	52.2	29.0	87.3
Inspector	1	9.0	592			9.0	65.8
Drafter	1	6.0	221	6.0	36.8		
Support Employees	**26**	**769.2**	**48,986**	**28.8**	**65.4**	**21.5**	**62.5**
Total	**428**	**24,774.9**	**1,648,328**	**27.6**	**58.1**	**39.3**	**71.1**
Adjustments			170,051				
Total Labour charged			**1,818,379**				

- The number of overtime hours was 16,052 or 65% of the total hours charged to the storm. This is consistent with the percentage of contractor hours charged to overtime during the same period.

- 87% of the labour was for restoration and 13% for repair.

Construction Services

- Total charges from construction services amounted to $375,800.

- Details of the internal charges from Construction Services indicated that the bulk of the staff were PLTs (14) and driver/helpers (10). 2,645 hours were charged at a blended regular/overtime rate of $64/hour, well below the outside contractor community blended rate.

Vehicles

- Total charges for vehicles amounted to $328,800. Of this total, we reviewed charges totalling $313,600 which showed that 207 separate vehicles were charged to this storm. Using the number of employees who worked on the

storm and the expected number of employees per vehicle, the vehicle count appears consistent with the breakdown of labour resources above, (i.e. the number of two- and three-person PLT crews, vegetation coordinators conducting physical inspections) which is approximately 400 front line employees. In addition, crews may use different vehicles for different shifts. Vehicle hours charged to the storm totalled 11,731, which is consistent with the number of front line employees and the hours they worked.

Contractors

- Total contractor costs amounted to $5.3 million for this storm. The list of contractors with billings greater than $100,000 includes:

Contractor Name	Billings
Allteck Line Contractors Inc.	1,093,891
Vancouver Island Powerlines Ltd	267,342
B G Power Systems Ltd.	399,062
Pacific Electrical Install. Ltd	352,177
Horizon Developments Ltd.	171,726
Plowe Power Systems Ltd.	284,556
Arctic Power Systems B.C. Ltd.	301,060
Central Island Powerline Ltd.	154,983
Jaco Powerlines Ltd.	148,429
Valley Power Line Contracting Ltd	140,428
Asplundh Canada Inc.	81,765
Advanced Powerlines Ltd.	136,508
Midway Power Line Services Ltd	133,251
Davey Tree Expert Co. of Canada, Ltd	116,234
Galbraith Powerline Contr. Ltd.	129,255
Other less than $100,000	1,376,016
Total Contractors	**5,286,682**

- A breakdown of contractors by type is below:

Contractor Type	$ Amount	%
Line and accrued contractors	4,594,500	86.9%
Vegetation	472,765	8.9%
Other	113,399	2.1%
Flagging	41,814	0.8%
Transportation	28,553	0.5%
Excavation	28,172	0.5%
Helicopters	7,479	0.1%
Total	**5,286,682**	**100%**

- Contractor invoices were collected for review where the invoice amount was greater than $10,000. This amounted to 95 of the 391 contractor invoices charged to this storm. For each invoice, the dollars and hours charged, the

dates worked, regular vs. overtime billing and support costs were collected and reviewed.

- Of the $4.6 million for line contractors, we reviewed $1.8 million of invoices. Of this total, 31% was realized during regular hours whereas 69% was billed for overtime hours. This is consistent with internal PLT labour hour allocations between regular and overtime.

    - Average PLT contractor regular hour billing rate was $90/hour and the overtime billing rate was $130/hour, both in alignment with rates prescribed in the emergency line agreement.

- For vegetation contractors, 90% of the hours billed were at a regular rate compared to 10% at overtime rates. This is a consistent result given that vegetation response is not typically performed in non-daylight hours, which tend to be billed at overtime rates.

- One of the vendors had billings greater than $1 million, which is the delegated contract/commitment approval level for the General Manager, Distribution. The $1.1 million from Allteck is less than the $6 million contract/commitment approval level for the Senior Vice President, Field Operations.

Materials

- Material expenditures for this storm totalled $309,000. The bulk of the material costs were for replacement of damaged distribution assets, including poles, conductors, cable ducts, etc.

- A large amount of exempt material (nuts and bolts, etc) of approximately $73,000 was charged to this storm. It is expected that this is due to the replenishment of the truck supplies from prior storms or to ensure no lack of small parts/materials on the trucks when responding to this storm. Exempt materials expenditures varied by storm with some as low as 6% of material costs and some up to 35% of material costs.

- Due to a lack of supply (i.e. cross arms), approximately $68,000 in materials were procured by Materials Management Business Unit (MMBU) but were delivered directly to the various sites as required without being received at MMBU. This was done to expedite the restoration efforts.

11.7 STORM REVIEW: DECEMBER 11-15, 2006

11.8 WIND STORMS: LOWER MAINLAND AND VANCOUVER ISLAND

1. Weather

- On December 11, 2006, a weather warning from Environment Canada predicted heavy rain and very strong winds for southern British Columbia. Southeast winds of 60 to 90 km/h developed over the southern coast and continued to persist throughout the evening. A strong onshore flow associated with the low produced over 50 mm of rain in some regions. The windstorm swept through all areas of the Lower Mainland and Vancouver Island. The Fraser Valley, North Vancouver Island and the Sunshine Coast were hit particularly hard.

- On December 15, Environment Canada issued another warning. This time, a very powerful Pacific storm was moving across southern British Columbia. Behind the storm, westerly winds of up to 100 km/h hit the south coast. The storm also brought heavy rain to the eastern Fraser Valley, south Vancouver Island and the Sunshine Coast.

2. Communities Affected

- Most communities between Hope and Squamish as well as the Sunshine Coast suffered a significant number of outages. Vancouver Island was equally affected in the Capital Regional District and communities such as Nanaimo, Port Alberni, Courtenay and Port Hardy.

- By 3 p.m. on December 11, the number of customers without power peaked at approximately 195,000. Within 24 hours, about 80% of customers were restored, but as many as 20,000 customers were still out when the December 15 storm hit.

- At 7 a.m. on December 15, the number of customers without power peaked to approximately 240,000, which was the largest number of customers impacted throughout the storm season. Within 24 hours, about 80% of customers were restored. BC Hydro and contractor crews worked through December 21 to restore power to all remaining customers.

3. Impact to the Electrical System

- Over 180 distribution circuits failed at the peak of the storms. Powerful gusts of non-prevailing winds (from the west) were especially damaging, as they brought down trees on top of distribution lines. The line from Port Alberni to Bamfield again suffered significant damage, with over 130 spans of wire (from pole to pole) on the ground, leaving the road almost impassable.

4. Restoration Effort

- Less than two weeks after power was restored to the last remaining customers from the Nov. 26 storm, the impact of the December storms required another significant effort from BC Hydro crews and contractors to restore power to as many as a quarter million customers at the peak period on Dec. 15.

- Many lessons had been learned and applied from previous storms, including a more centralized assignment of crews and resources. After receiving weather warnings from Environment Canada and Hydro's meteorologist, Field Operations initiated a conference call ***before*** the storms hit to coordinate the assignment of crews.

- On Dec. 11, all Lower Mainland crews were sent to Vancouver Island. All southern Interior crews (except for a skeleton staff) and all southern Interior contractors were brought in to aid in the restoration prior to the storm hitting. The Mutual Aid agreement with Fortis BC was invoked and a four-person crew responded. The City of New Westminster also sent two crews to respond. On Dec. 12, a total of 34 contractor crews were on the Lower Mainland and 24 contractor crews were on the Island.

- By Dec. 13, the number of contractor crews had increased to 75, with only 14 on the Lower Mainland and 61 crews on Vancouver Island.

- On Dec. 14, there were 92 contractor crews, with 25 on the Lower Mainland and 67 on the Island.

- With the forecast predicting another major windstorm for the morning of Dec. 15, crews were sent home early in order to rest for the next day.

- When the storm hit at 6 a.m. on Dec. 15, crews were relocated again to areas anticipated to have the most damage. Crews that were in the north of Vancouver Island were relocated to south Vancouver Island and some were sent back to the Lower Mainland. All Interior crews and contractors were retained in preparation for this next stage of the storm.

- Designers were used extensively to help with damage assessments. Conference calls were held two to three times a day, and restoration times were being given in terms of days not hours.

- Vastly improved communication, cooperation and coordination among BC Hydro's business groups were seen to be the result of all the lessons learned from previous storms.

- On the morning of Dec. 15, the activation of the Corporate Emergency Center was considered. However, a lack of understanding of roles and responsibilities resulted in the restoration team resuming existing protocols. As with the other storms, senior management received regular updates on the restoration progress and issues to be resolved.

- By Dec. 21, power was restored to the last of the communities (Bamfield, Sooke, and Sunshine Coast).

- There were no deaths or serious injuries to BC Hydro staff, contractors or the public relating to wires being down during the restoration effort. Tragically, however, a couple in Burnaby died from carbon monoxide poisoning after using a gas-powered generator inside their house.

5. Customer Communications

- On the first day of the storm (Dec. 11), the number of customer calls peaked at about 103,000, with a peak of 22,000 busy signals between 3-4 p.m. As with previous storms, there continued to be technological issues with the Interactive Voice Response (IVR).

- And as with previous storms, the "en-route" messaging system was used to good effect to help reduce call volumes. The first en-route message was delivered at 5 p.m. on Dec. 11, which reduced call volume by approximately 50%. The message also included more information for the customer (compared to previous storms), including specific areas and communities that would not have their power restored until damage assessments were completed. In other words, no estimated times of restoration were given initially, which had been inaccurate in the past when given too early in the storm restoration process.

- The en-route message was updated approximately five times a day, usually after Field Operations conference calls, which again were effective at providing and sharing restoration information with call agents.

- Despite these improvements over previous storms, customers were again frustrated by either inaccurate estimated times of restoration, dropped calls,

busy signals, or not being able to talk to an agent. In some cases, given the severity of the storms hitting one after another, customers appeared to be much more frustrated with call centre agents. As learned from previous storms, customers want as much information as possible and are more inclined to be understanding of the overall challenge to restore power if they are not given "rolling" restoration times.

- When the second wave of the storm hit with even greater intensity on Dec. 15, the number of customer calls peaked at about 95,700 on that day, with a peak of 34,000 busy signals.

- To assist with the final stages of the restoration effort, an "outbound calling" initiative was tested using postal codes in areas that were still without power. Customers were called in those areas and asked to call BC Hydro if they were still without power. This initiative was tested on the North Shore and in Surrey/Delta with minimum responses from customers. BC Hydro learned that a more accurate targeting of customers who are without power (not whole areas within a postal code) might be possible using the POWERON system.

6. Public and Community Communication

- After attending Field Operation conference calls, Media Relations updated Lower Mainland news media about BC Hydro's restoration effort and the approximate number of customers without power.

- At 3 p.m. on Dec. 11, the first of multiple media advisories were sent to the media and posted to the Hydro web site. There were two releases each day from Dec. 11 to Dec. 13, one advisory on Dec. 14, one nearly every two hours on Dec. 15, and two more on Dec. 16.

- As in previous storms, these media advisories were also helpful to call centre agents, who shared the information with customers.

- Community Relations Managers assisted with communication efforts by providing information to community leaders and the local media outlets.

- More communications staff were dispatched to the Edmonds (Burnaby) location to assist with media advisories and web bulletins.

- Given the length and intensity of this storm, once again the issue of staff shortages created "burnout" situations for personnel.

7. Key Findings

- Many lessons learned from previous storms were being applied by all business groups.

- The centralized allocation and coordination of crews and contractors helped prioritize restoration efforts toward areas with the greatest need.

- POWERON and other technological challenges continued to diminish the customer experience.

- No amount of information that can be provided to customers would be viewed as too much. Frustrated and angry customers said they were better off getting restoration times that were days away than promises of shorter-term restoration times that could not be met.

- Pre-storm information to customers and communities would assist them in their own emergency planning.

- Plans, procedures and training for those expected to participate in emergency responses and the Corporate Emergency Center are currently being clarified and updated.

8. Summary of Storm Impacts:

Safety:	**Description**
Employee safety: # of serious injuries Any fatalities	 None None
Public injuries or fatalities	None from wires down. A couple from Burnaby died from carbon monoxide poisoning caused by using a gas-powered generator indoors after the storm hit on Friday Dec. 15.
Impact to the System:	
Generation assets	There were no major impacts to generation assets, downstream stakeholders or dam safety. Therefore, generation emergency plans were not activated.
# of damaged transmission circuits	12, of which nine were out for more than 24 hours.
# of damaged distr. circuits	181

Impact to the Customers:	
Communities Impacted	Vancouver Island/Lower Mainland: Fraser Valley East and West, Tri-Cities, Vancouver, North Shore, Sunshine Coast. Hardest hit was central and north Vancouver Island. On Dec 15, most of the Lower Mainland was approaching full restoration when a second system hit and caused massive damage to Vancouver, Burnaby, Coquitlam, Victoria, North Shore, and Sechelt. Central and North Vancouver Island, Fraser Valley East and West were moderately affected.
At the peak # of customers out	Dec 11: 195,000 Dec 15: 240,300
# of customers out after 24 hours	Dec 12: 38,219 Dec 16: 78,794
# of customers out after 48 hours	Dec 13: 52,212 (Increased outages in North Central Vancouver Island. New outages in Chilliwack and Victoria) Dec 17: 33,527
# of customers out for more than three days	4,474
Communities from which customers were out for three to six days or more	Gulf Islands, Brentwood Bay, Saanichton, Sooke, Sidney, Bowen/Gambier/Keats Islands, Deep Cove (Indian Arm customers), British Properties (W. Van), other pockets of GVRD, Victoria
Call Centre Response:	
# of calls received	305,000 calls with the peak on Dec. 11 at 103,000 calls
# of calls answered (either through call agents or IVR)	242,000 calls with the peak on Dec. 11 at 81,000 calls
# of busy signals	63,000 with the peak on Dec. 15 at 34,000
	These statistics do not include customers that could not even get through the phone lines.

9. **Storm Cost Analysis**

The table below summarizes the expenditures caused by this storm:

$ thousands

	Expenditures	Loadings	Totals	Adj		Revised
Internal Costs:						
Labour	5,745.9	(2,154.3)	3,591.6	(145.6)	[1]	3,446.0
Construction Services	673.6		673.6			673.6
Travel	232.9		232.9			232.9
Vehicles	763.9	(178.3)	585.6			585.6
Stores Materials	902.4	(177.9)	724.5			724.5
Total Internal Costs	8,318.7	(2,510.5)	5,808.2	(145.6)		5,662.6
External Costs:						
Contractors	10,877.0	(1,269.3)	9,607.7	(189.6)	[1]	9,418.1
ABSU	217.0		217.0			217.0
Other	53.8		53.8			53.8
Total External Costs	11,147.8	(1,269.3)	9,878.5	(189.6)		9,688.9
TOTAL	19,466.5	(3,779.8)	15,686.7	(335.2)		15,351.5

[1] **Adjustments required as not qualified storm expenditures.**

- A review of the expenditures for this particular storm was conducted. The scope of this review included extracting information from the financial systems and reviewing specific elements against contracts, standards, past practice or external resources for comparability, given the circumstances of the storm. The data collected and analyzed included time charged to the storm by all affiliations, internal charges received from Construction Services, internal vehicle usage charges, Materials Management (Stores) issues and external contractor invoices greater than $10,000.

- The timing of expenditures needed to be considered in the context of the following definitions: Restoration is defined as any labour or expenditure charged from Dec. 11 through Dec. 20. Permanent repair of damage that was temporarily fixed during the storm is defined as any labour or expenditure charged after Dec. 20.

- Expenditures of $15.4 million charged to this storm were confirmed. Total adjustments deducted from this storm amounted to $335,200. $145,600 was related to regular time charged to this storm by some Management and Professional (M&P) and COPE employees. These charges were not considered to be eligible unless the employees' regular positions were being backfilled by temporary staff in order for them to work on the storm. It was unclear whether those positions were backfilled, therefore the amount was deducted from the storm costs. In addition, $189,600 of vegetation costs related to work done during the repair period. It is reasonable to expect some vegetation

work done after the response period to clean up any damaged trees caused by the storm. However, it was unclear whether the work done related to those trees or newly identified hazard trees, therefore it was more prudent to deduct that amount from the storm costs.

- The expenditures are further described by category below.

Labour

- Total internal labour costs amounted to $3.4 million. Of this total, we reviewed in detail $3.2 million in labour hours and dollars and noted the following:

    - 692 employees were involved in this storm with Power Line Technicians (PLTs) being the largest group at 210 qualified individuals and 47 apprentices with an average of 112 hours. Average hours by PLTs over the 10 day storm response were 93 hours. The various categories of employees all played a role in the storm response and repair.
    - Details of the various employee categories are:

				Regular		Overtime	
Job Title	**Employees**	**Hours**	**Dollars**	**Avg hours/ employee**	**Avg Rate ($/hr)**	**Avg hours/ employee**	**Avg Rate ($/hr)**
Power Line Technicians	210	23,487.5	1,692,818	41.5	65.1	70.9	76.1
Manager	63	3,630.0	376,250	30.9	87.0	50.1	106.5
Apprentices	47	5,630.8	296,109	46.7	46.5	76.8	56.2
Design	97	2,716.9	168,000	12.1	48.8	25.4	63.8
Storekeepers / Material Handlers	42	2,399.0	128,551	29.7	44.5	46.5	55.7
Electricians	48	1,597.0	107,931	17.2	60.0	22.3	73.6
Field Services Administrator	30	1,812.8	82,712	35.1	39.2	38.2	49.4
Other Trades	15	1,130.5	63,397	43.8	49.4	46.3	61.0
Meter & Instrument Technicians	14	920.3	63,277	13.8	57.5	52.9	71.5
Veg Coordinator	10	1,160.3	62,833	60.7	48.1	55.4	60.8
Vehicle Tradesmen	17	707.5	44,383	15.4	53.9	30.7	65.9
Communications and P&C	10	289.5	21,043	23.1	67.9	9.1	84.7
Coop Student/Youth Hires	12	752.0	20,134	33.3	17.2	34.9	34.4
General Tradesmen	8	244.0	13,494	22.3	50.1	15.8	61.6
Maintenance Coordinator	5	166.5	9,962	14.3	51.4	27.6	61.6
Mechanics	4	126.5	8,309	20.8	58.8	16.0	72.4
Front Line Employees	**632**	**46,770.9**	**3,159,205**	**34.8**	**58.5**	**50.7**	**72.1**
Admin	10	174.8	8,685	13.1	41.2	15.3	53.4
Drafter	4	58.0	2,689			14.5	46.4
ESC	19	525.5	26,693	7.4	40.7	25.7	51.6
Inspector	9	102.0	5,761	7.5	44.0	10.5	57.5
Media	3	220.0	18,556	71.0	84.7	7.0	73.7
Other	13	264.5	23,682	7.1	84.3	22.9	90.3
Safety	2	121.0	10,064	20.0	52.2	50.5	89.3
Support Employees	**60**	**1,465.8**	**96,130**	**19.2**	**71.3**	**20.8**	**63.7**
Total	**692**	**48,236.6**	**3,255,334**	**34.1**	**58.8**	**48.3**	**71.8**
Adjustments			190,607				
Total Labour Charged			**3,445,941**				

- The number of overtime hours is 32,262 or 67% of the total hours charged to the storm. The restoration period stretched over the weekend which is paid on overtime for the full day.

- 86% of the labour was for restoration and 14% for repair.

Construction Services

- Total charges from construction services amounted to $673,600.

- Details of the internal charges from Construction Services indicated that the bulk of the staff were PLTs (26) and driver/helpers (14). 5,346 hours were charged at a blended regular/overtime rate of $64/hour, well below the outside contractor community blended rate.

Vehicles

- Total costs for vehicles amounted to $585,600. Of this total, we reviewed charges totalling $569,000 which showed that 207 separate vehicles were used during the restoration process. Using the number of employees who worked on the storm and the expected number of employees per vehicle, the vehicle count appears consistent with the breakdown of labour resources above, (i.e. the number of two- and three-person PLT crews, vegetation coordinators conducting physical inspections) which is approximately 632 front line employees. In addition, crews may use different vehicles for different shifts.

- Of those 207 vehicles, total hours charged to vehicles was 22,569, which is consistent with the number of front line employees and the hours they have worked.

Contractors

- Total contract costs amounted to $9.4 million. The list of contractors with billings greater than $100,000 includes:

Contractor Name	$ Amount
Allteck Line Contractors Inc.	2,167,375
Pacific Electrical Install. Ltd	779,324
Asplundh Canada ULC	591,151
Arctic Power Systems B.C. Ltd.	520,792
Vancouver Island Powerlines Ltd	395,342
Davey Tree Expert Co. of Canada, Ltd.	365,428
Jaco Powerlines Ltd.	284,993
Midway Power Line Services Ltd	277,697
Horizon Developments Ltd.	250,588
Central Island Powerline Ltd.	244,667
Galbraith Powerline Contr. Ltd.	220,932
Valley Power Line Contracting Ltd	204,038
Aerial Contractors Ltd.	202,385
Kodiak Powerline Contractors Ltd	192,946
Trans Power Constr. (1999) Ltd.	163,939
R.R. Interior Power & Electric Ltd.	163,022
A-Power Line Contracting Ltd.	127,380
Advanced Powerlines Ltd.	109,650
All Powerline Const. Ltd.	108,666
Addy Power Ltd.	102,384
Other less than $100,000	1,945,461
Total Contractors	**9,418,158**

- A breakdown of contractors by type is below:

Contractor Type	$ Amount	%
Line Contractor	7,104,807	75.4%
Vegetation	1,381,718	14.7%
Helicopter	251,966	2.7%
Flagging	241,561	2.6%
Other	219,240	2.3%
Excavation	156,301	1.7%
Transportation	53,500	0.6%
Equipment Rental	9,065	0.1%
Grand Total	**9,418,158**	

- Contractor invoices were collected for review where the invoice amount was greater than $10,000. This amounted to 171 of the 767 contractor invoices charged to this storm. For each invoice, the dollars and hours charged, the dates worked, regular vs. overtime billing and support costs were collected and reviewed.

- Of the $7.1 million for line contractors, we reviewed $3.7 million of invoices. Of this total, 46% was realized during regular hours whereas 54% was billed for overtime hours. This overtime to regular time ratio for contractors was lower than for internal PLT labour hours.

- Average PLT contractor regular hour billing rate was $88/hour and the overtime billing rate was $143/hour, both in alignment with rates prescribed in the emergency line agreement.

- For vegetation contractors, 86% of the hours billed were at a regular rate compared to 14% at overtime rates. This is a consistent result given that vegetation response is not typically performed in non-daylight hours, which tend to be billed at overtime rates. However, the response period did stretch over the weekend which is fully paid at the overtime rate.

- One of the vendors had billings greater than $1 million, which is the delegated contract/commitment approval level for the General Manager, Distribution. The $2.1 million from Allteck is less than the $6 million contract/commitment approval level for the Vice-President, Field Operations.

Materials

- Material expenditures for this storm totalled $724,000. The bulk of the material costs were for replacement of damaged distribution assets, including poles, conductors, cable ducts, etc.

- A large amount of exempt material (nuts and bolts, etc) of approximately $223,000 was charged to this storm. It is expected that this is due to the replenishment of the truck supplies from the first few storms or to ensure no lack of small parts/materials on the trucks when responding to this storm. Exempt materials expenditures varied by storm with some as low as 6% of material costs and some up to 35% of material costs.

- Due to a lack of supply (i.e. cross arms), approximately $161,000 in materials were procured by the Materials Management Business Unit (MMBU) but were delivered directly to the various sites as required without being received at MMBU. This was done to expedite the restoration efforts.

11.9 STORM REVIEW: JANUARY 5-9, 2007

11.10WIND STORM: LOWER MAINLAND AND VANCOUVER ISLAND

1. Weather

- A strong southwesterly flow brought moderate to heavy precipitation and very mild temperatures across the entire province in the first week of January.

- Then a weather warning was issued on January 5, 2007, as cold northwest winds blew in and temperatures dropped to zero degrees across the Lower Mainland. Heavy rain hit the South Coast on Jan. 9, followed immediately by an intense cold front.

- The coastal storm intensified the second week of January and cold Arctic air started moving southward and out toward the coast, reaching the Greater Vancouver area on Jan. 10 for the city's second major Arctic outbreak of the season. Northwest winds at Vancouver Airport reached 78km/h, gusting to 98 km/h.

2. Communities Affected

- Almost all communities in the Lower Mainland and Vancouver Island were affected along with the Sunshine Coast. On Vancouver Island, significant damage occurred in Nanaimo, Parksville, Port Alberni and Courtenay, and parts of the Gulf Islands. Hardest hit were Fraser Valley West, Vancouver, Burnaby, the North Shore (N. and W. Vancouver), the Sunshine Coast, and the Tri-Cities.

3. Impact to the Electrical System

- Nearly 90 distribution circuits failed at the peak of the storm. On January 6, the number of customers without power peaked at approximately 87,000. Nearly 60,000 customers were restored by Jan. 7, but then the second wave of the storm hit on Jan. 9, and the number of customers without power peaked to approximately 120,000. Within 24 hours, 80% of customers were restored, and within 48 hours, 95% of customers were restored.

4. Restoration Effort

- As with the storms in October, November and December, Hydro staff and crews were faced with a massive restoration effort. Lessons learned from other storms were now being fully applied.

- Problems with the POWERON system continued to hamper efforts to acquire and share timely and accurate information between crews and the Customer Restoration Centre.

- Conference calls were held once or twice a day with the main business groups.

5. Customer Communications

- Given the continued problems with BC Hydro's Interactive Voice Response (IVR) system, the first en-route message was posted at 10:30 am on Jan. 6. It was revised later that afternoon, and at 9:30 am on Jan. 7. It was turned off in the afternoon of Jan. 7 as the call volume subsided.

- Because the en-route message was successful in previous storms, Accenture Business Services for Utilities (ABSU) requested that the en-route message be initiated as soon as the storm hit on Jan. 5. This request was denied as BC Hydro needed to allow enough customers to call in with information to help in the assessment of the extent of outages, after which en-route was activated on Jan. 6.

- En-route was turned on again on Jan. 9 at 6 p.m. and revised at 8 p.m. that night and left on all night. It was turned off again at 10 a.m. on Jan. 10 as the call volume subsided.

- Concerned about customers not being able to contact BC Hydro with power lines down, enroute announcements were used on Jan. 9 to advise customers to call 911 if there was a public safety issue. (This had never been attempted before.) The 911 centre indicated their call volumes had increased dramatically.

- A "call choking" message was also initiated by the call center on Jan. 6. This system recognizes high call volumes and sends a message saying: "We are receiving a high volume of calls. Please call again later." Customers were extremely irritated by this, to the point that even field crews were getting negative feedback from customers who said they'd rather hear a busy signal than be told to call back and then cut off. The "call choking" system was turned off at 10 a.m. on Jan. 9.

6. Public and Community Communication

- As in previous storms, media advisories were sent out regularly and were helpful to call center agents, who shared the information with customers.

- Community Relations Managers assisted with communication efforts by providing information to community leaders and the local media outlets.

7. Key Findings

- Many lessons learned from previous storms were being applied by all business groups.

- The centralized allocation and coordination of crews and contractors helped prioritize restoration efforts toward areas with the greatest need.

- POWERON and other technological challenges continued to diminish the customer experience.

- Advising customers to call 911 for line down situations is not to be done again.

- En-route messaging should not be initiated too early into the storm.

- Given the extreme negative impact on the customer experience, "call choking" is not an effective means of managing call volumes and will not be used in the future.

8. Summary of Storm Impacts:

Safety:	**Description**
Employee safety: # of serious injuries Any fatalities	None None
Public injuries or fatalities	None
Impact to the System:	
Generation assets	There were no major impacts to generation assets, downstream stakeholders or dam safety. Therefore, generation emergency plans were not activated.

# of damaged transmission circuits	7, including three that were out for longer than 22 hours.
# of damaged distr. circuits	88
Impact to the Customers:	
Communities Impacted	Vancouver Island/Lower Mainland: Fraser Valley East, Courtney, Nanaimo, Parksville. Hardest hit were Fraser Valley West, Vancouver, Burnaby, Vancouver's North Shore, Sunshine Coast, Tri-Cities.
At the peak # of customers out	120,399
# of customers out after 24 hours	24,224
# of customers out after 48 hours	6,306 (Only 266 out at the end of the day.)
# of customers out for more than three days	21
Communities from which customers were out for three to six days or more	None
Call Centre Response:	
# of calls received	241,000 calls with the peak on Jan. 9 at 100,000 calls
# of calls answered (either through call agents or IVR)	133,000 calls with the peak on Jan. 9 at 44,000 calls
# of busy signals	108,000 with the peak on Jan. 9 at 56,000
	These statistics do not include customers that could not even get through the phone lines.

9. Storm Cost Analysis

The table below summarizes the storm expenditures:

$ thousands

	Expenditures	Loadings	Totals	Adj		Revised
Internal Costs:						
Labour	1,444.4	(530.2)	914.2	(42.1)	[1]	872.1
Construction Services	97.9		97.9			97.9
Travel	32.0		32.0			32.0
Vehicles	246.7	(50.1)	196.6			196.6
Stores Materials	251.7	(44.2)	207.5			207.5
Total Internal Costs	2,072.7	(624.5)	1,448.2	(42.1)		1,406.1
External Costs:						
Contractors	3,917.9	(356.9)	3,561.0	(328.6)	[1]	3,232.4
ABSU	46.0		46.0			46.0
Other	15.0		15.0			15.0
Total External Costs	3,978.9	(356.9)	3,622.0	(328.6)		3,293.4
TOTAL	6,051.6	(981.4)	5,070.2	(370.7)		4,699.5

[1] Adjustments required as not qualified storm expenditures.

- A review of the expenditures for this particular storm was conducted. The scope of this review included extracting information from the financial systems and reviewing specific elements against contracts, standards, past practice or external resources for comparability, given the circumstances of the storm. The data collected and analyzed included time charged to the storm by all affiliations, internal charges received from Construction Services, internal vehicle usage charges, Materials Management (Stores) issues and external contractor invoices greater than $10,000.

- The timing of expenditures needed to be considered in the context of the following definitions: Restoration is being defined as any labour or expenditure charged from Jan 6 through Jan 11. Permanent repair of damage that was temporarily fixed during the storm is defined as any labour or expenditure charged after Jan. 11.

- Expenditures of $4.7 million charged to this storm were confirmed. Total adjustments deducted from this storm amounted to $370,700. $42,100 related to regular time charged to this storm by some Management and Professional (M&P) and COPE employees. These charges were not considered to be eligible unless the employees' regular positions were being backfilled by temporary staff in order for them to work on the storm. It was unclear whether those positions were backfilled, therefore the amount was deducted from the storm costs. In addition, $328,600 of vegetation costs related to

work done during the repair period. It is reasonable to expect some vegetation work done after the response period to clean up any damaged trees caused by the storm. However, it was unclear whether the work done related to those trees or newly identified hazard trees, therefore it was more prudent to deduct that amount from the storm costs.

- The expenditures are further described by category below.

Labour

- Total internal labour costs amounted to $872,000. Of this total, we reviewed and analyze $751,000 in hours and dollars and noted the following:

    - 445 employees were involved in this storm with Power Line Technicians (PLTs) being the largest group at 165 qualified individuals and 43 apprentices with an average of 37 hours. Average hours by PLTs over the 6 day storm response were 30 hours. $175,000 in labour was charged for storm preparation costs. The various categories of employees all played a role in the storm response and repair.

    - Details of the various employee categories are:

				Regular		Overtime	
Job Title	Employees	Hours	Dollars	Avg hours/ employee	Avg Rate ($/hr)	Avg hours/ employee	Avg Rate ($/hr)
Power Line Technicians	165	6,103.0	428,331	20.4	65.1	18.6	76.1
Apprentices	43	1,687.0	86,312	20.9	46.5	20.7	56.2
Manager	35	618.0	63,963	7.3	90.7	16.6	105.6
Other Trades	9	553.3	30,636	33.7	49.4	35.5	61.0
Field Services Administrator	24	629.0	27,918	18.9	39.0	15.5	49.4
Design	70	408.2	22,795	4.2	49.1	6.7	64.4
Coop Student/Youth Hires	22	779.3	22,390	18.3	17.2	23.8	34.4
Storekeepers / Material Handlers	12	271.0	14,203	13.2	44.5	16.0	55.7
Meter & Instrument Technicians	14	226.0	14,043	10.8	57.5	14.9	71.5
Electricians	7	142.0	9,539	9.6	60.0	12.5	73.6
Vehicle Tradesmen	10	112.5	7,080	4.6	53.9	10.6	65.9
Veg Coordinator	7	197.3	10,257	22.8	48.1	10.1	60.8
Maintenance Coordinator	2	41.0	3,011	18.5	48.1	11.3	94.3
Front Line Employees	**420**	**11,767.5**	**740,478**	**16.7**	**56.8**	**17.6**	**68.9**
Admin	5	72.0	3,556	7.9	42.2	20.3	55.0
ESC	11	69.3	3,000	4.1	41.3	7.9	47.3
Inspector	5	42.0	2,287	4.0	44.0	9.5	55.6
Other	1	15.5	1,557			15.5	100.4
Drafter	3	11.5	456	4.0	36.8	3.5	46.4
Support Employees	**25**	**210.25**	**10,856**	**4.9**	**41.3**	**11.0**	**59.2**
Total	**445**	**11,977.7**	**751,335**	**16.1**	**56.5**	**17.4**	**68.7**
Adjustments			120,791				
Total Labour Charged			**872,126**				

    - The number of overtime hours is 6,108 or 51% of the total hours charged to the storm. The restoration period did not stretch over the

weekend, which is paid on overtime for the full day, therefore resulting in a lower overtime ratio than other storms.

- 83% of the labour was for restoration and 17% for repair.

Construction Services

- Total charges from construction services amounted to $97,900.

- Details of the internal charges from Construction Services indicated that the bulk of the staff were PLTs (9) and driver/helpers (4). 826 hours were charged at a blended regular/overtime rate of $65/hour, well below the outside contractor community blended rate.

Vehicles

- Total charges for vehicles amounted to $197,000. Of this total, BC Hydro reviewed charges totalling $182,300. The difference mainly related to year end adjustment to loadings.

- 188 separate vehicles were charged to the storm. Using the number of employees who worked on the storm and the expected number of employees per vehicle, the vehicle count appears consistent with the breakdown of labour resources above, (i.e. the number of two- and three-person PLT crews, vegetation coordinators conducting physical inspections) which is approximately 420 front line employees. In addition, crews may use different vehicles for different shifts. Therefore, a more appropriate analysis is vehicle hours charged.

- Total hours charged to those vehicles amounted to 6,160 hours, which is consistent with the number of front line employees and the hours they've worked.

Contractors

- Total contractor costs amounted to $3.2 million. The list of contractors with billings greater than $50,000 includes:

Contractor Name	Billings
Allteck Line Contractors Inc.	485,632
Valley Power	320,143
Asplundh Canada ULC	289,899
Interior Power	277,803
Fortis	263,956
Arctic Power Systems B.C. Ltd.	254,857
Pacific Electrical Install. Ltd	180,778
Midway Power Line Services Ltd	152,611
HD Tree Service Ltd.	150,621
RS Line Construction, Inc.	94,878
Davey Tree Expert Co. of Canada, Ltd.	84,389
Galbraith Powerline Contr. Ltd.	79,736
Aerial Contractors Ltd.	79,289
Island Traffic Services Ltd.	66,457
Plowe Power Systems Ltd.	66,226
Central Island Powerline Ltd.	62,097
Riteway Tree Service Ltd.	55,704
Other less than $50,000	267,298
Total Contractors	**3,232,376**

- A breakdown of contractors by type is below:

Contractor Type	$ Amount	%
Line Contractor	2,818,699	87.2%
Vegetation	187,217	5.8%
Other	134,431	4.2%
Flagging	50,555	1.6%
Transportation	20,419	0.6%
Helicopter	10,600	0.3%
Excavation	7,508	0.2%
Equipment Rental	2,946	0.1%
Grand Total	**3,232,376**	

- Contractor invoices were collected for review where the invoice amount was greater than $10,000. This amounted to 55 of the 374 contractor invoices charged to this storm. For each invoice, the dollars and hours charged, the dates worked, regular vs. overtime billing and support costs were collected and reviewed.

- Of the $2.8 million for line contractors, BC Hydro reviewed $349,000 of invoices. Of this total, 27% was realized during regular hours whereas 73% was billed for overtime hours. This overtime ratio is higher than internal PLT labour hour allocations between regular and overtime (54/46).

    - Average PLT contractor regular hour billing rate was $92/hour and the overtime billing rate was $139/hour, both in alignment with rates prescribed in the emergency line agreement.

- For vegetation contractors, 94% of the hours billed were at a regular rate compared to 6% at overtime rates. This is a consistent result given that vegetation response is not typically performed in non-daylight hours, which tend to be billed at overtime rates.

- None of the vendors had expenditures greater than $1 million, which is the delegated contract/commitment approval level for the General Manager, Distribution.

Materials

- Material expenditures for this storm totalled $207,000. The bulk of the material costs were for replacement of damaged distribution assets, including poles, conductors, cable ducts, etc.

- A large amount of exempt material (nuts and bolts, etc) of $34,000 was charged to this storm. It is expected that this is due to the replenishment of the truck supplies from the first few storms or to ensure no lack of small parts/materials on the trucks when responding to this storm. Exempt materials expenditures varied by storm with some being as low as 6% of material costs up to 35% of material costs.

- Due to a lack of supply (i.e. cross arms), $36,000 in materials were procured by the Materials Management Business Unit (MMBU) but were delivered directly to the various sites as required without being received at MMBU. This was done to expedite the restoration efforts.