Revenue Requirement Application

2004/05 and 2005/06

BC hydro

Volume 1

Chapter 11.

Capital Expenditures

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1 Introduction

1.1 Purpose and Overview

This chapter summarizes BC Hydro's capital spending since its last revenue requirement application and identifies its capital spending plans in the test periods.

Table 11-1 identifies the consolidated capital additions, retirements, depreciation, and unfinished construction for the period F1994 to F2003.

Table 11-1. Capital Assets, F1994 to F2003

	$ millions
CAPITAL ASSETS IN SERVICE	
Balance at beginning of F1994	$11,726
Assets in Service	3902
Retirements	(688)
Balance at end of F2003	**$14,940**
ACCUMULATED DEPRECIATION	
Balance at beginning of F1994	3,246
Depreciation	3,184
Retirements	(614)
Balance at end of F2003	**$5,816**
NET BOOK VALUE	**$9,124**
UNFINISHED CONSTRUCTION	
Balance at beginning of F1994	411
Additions	4,333
Amortization	(119)
Write-offs	(54)
Transfer to assets in service	(3,902)
Balance at end of F2003	**$669**
NET BOOK VALUE AND UNFINISHED CONSTRUCTION	**$9,794**

Notes:
1. Balances for F1994 were reclassified to conform with presentation in F2003.

Future capital spending requirements are identified within the operating plans presented in chapters 3 to 9. Table 11-2 identifies the forecast capital additions by expenditure category for F2004 to F2006.

Table 11-2. Capital Expenditure Forecast, F2004 to F2006

Expenditure Category ($ millions)	F2004			F2005			F2006			
	S	G	Total	S	G	Total	S	G	Total	
Generation Hydro	$95	$22	$117	$96	$13	$109	$123	$12	$135	
Generation Thermal	6	33	39	3	58	61	3	193	196	
Transmission - Lines	71	16	87	41	9	50	44	12	56	
Substations	34	37	71	45	80	125	53	150	203	
Distribution	75	118	193	84	123	207	86	130	216	
Computers	65	2	67	60	4	64	50	4	54	
Land & Buildings	10	0	10	8	0	8	6	0	6	
Surveys & Investigations (incl Aboriginal Negotiations)	9	0	9	10	0	10	5	0	5	C_2
Vehicles	21	0	21	17	0	17	19	0	19	
Power Smart	0	116	116	0	105	105	0	94	94	
Other	27	0	27	18	0	18	5	0	5	C_2
BCTC *(Note 2)*	12	0	12	47	0	47	0	0	0	
Gross Expenditures	$425	$344	$769	$429	$392	$821	$394	$595	$989	
CIA - Specific	0	-8	-8	0	-8	-8	0	-9	-9	
CIA - Recurring	-3	-37	-39	-4	-38	-42	-4	-41	-45	
Net Expenditures incl BCTC *(Note 3)*	$422	$299	$722	$425	$346	$771	$390	$545	$935	

Notes:
1. S = Sustaining Capital Expenditures; G = Growth Capital Expenditures
2. Includes expenditures on BCTC-owned assets only.
3. BCTC Capital Expenditures are consolidated for F2004 and F2005 only (see section 3.10, page 2-21).
4. Some columns do not total due to rounding.

This remainder of this chapter includes lists of historical (since F1994), in-progress, or planned capital projects, by line of business or service organization, with capital cost greater than $2 million. Descriptions are provided for projects with capital cost greater than $5 million.

As discussed in chapter 6, BCTC has responsibility for planning and justifying capital projects relating to BC Hydro's transmission assets. As a result, historical, in-progress, and planned capital expenditures relating to transmission assets are identified in chapter 6.

2 BC Hydro Generation

2.1 In-service and Substantially Completed Projects

Table 11-3 summarizes capital projects in BC Hydro Generation with actual or forecast costs exceeding $2 million, and that:

- have been placed in service during the period F1995 to F2003, or
- are forecast to be placed in service during F2004.

Table 11-3. Historical and Substantially Complete Projects, BC Hydro Generation

Project Name ($ millions)	Project Completion Date *(Note 1)*	Primary Business Driver *(Note 2)*	Spending to March 31, 2003 *(Note 3)*	Est. Cost at Completion *(Note 4)*	Section Ref. *(Note 5)*
GM Shrum Drainage Tunnel Rehabilitation	1995	Risk Mgmt	4.4		
Kootenay Canal Generator Transformer	1996	Reliability	2.1		
Wahleach Spillway Rehabilitation	1997	Risk Mgmt	3.5		
Coursier Lake Dam Safety Improvements	1997	Risk Mgmt	3.5		
Renovate Central Control Building	1998	Cost Efficiency	4.3		
GM Shrum G5 Rewind	1998	Reliability	4.2		
Kootenay Canal Generating Station Turbine Upgrade	1999	Externally Driven Growth	18.2		2.1.1
South Taylor Land Acquisition	1999	Consent to Operate	7.4		2.1.2
Revelstoke Generating Station Unit 5	1999	Externally Driven Growth	6.1		2.1.3
GM Shrum Governor Replacements	1999	Reliability	3.7		
GM Shrum G8 Rewind	1999	Reliability	2.8		
GM Shrum GS BFD Relays	1999	Reliability	2.6		
Revelstoke Dam Deadman Creek Diversion	1999	Risk Mgmt	2.4		
Stave Falls Power Plant Replacement	2000	Externally Driven Growth	139.4		2.1.4
Fort Nelson Generation	2000	Externally Driven Growth	43.6		2.1.5

Project Name ($ millions)	Project Completion Date (Note 1)	Primary Business Driver (Note 2)	Spending to March 31, 2003 (Note 3)	Est. Cost at Completion (Note 4)	Section Ref. (Note 5)
WAC Bennett Dam Drainage Improvements	2000	Risk Mgmt	4.3		
Aberfeldie Dam Stability Improvements	2000	Risk Mgmt	2.7		
Business Transition Program	2002	Cost Efficiency	40.5		2.1.6
Burrard Generating Station Unit 1 Generator Rehabilitation	2002	Reliability	14.8		2.1.7
Stave Falls Visitor Centre	2002	Consent to Operate	7.7		2.1.8
Stave Falls Rockfill Alternative	2002	Risk Mgmt	4.6		
Kootenay Canal 230KV & 60KV Interconnection with WKP	2002	Cost Efficiency	4.0		
HLK U/S Navigation Lock Gate Crane PLC	2002	Reliability	2.1		
Burrard Generating Station Unit 2 Emergency Rehabilitation	2003	Reliability	3.0		
ESSO Steam Project	2003	Profitable Growth	2.5		
Peace Canyon GS Tailrace Improvements	2003	Externally Driven Growth	2.3		
Burrard Generating Station Upgrade	2004	Reliability/ Consent to Operate	182.8	199.3	2.1.9
Seven Mile Generating Station Unit 4	2004	Externally Driven Growth	80.6	88.9	2.1.10
Bridge River Turbine Runner Upgrade Units 1 to 6	2004	Externally Driven Growth	13.1	15.1	2.1.11
WAC Bennett Dam Deficiency Investigation	2004	Risk Mgmt	9.9	9.9	2.1.12
Coquitlam Dam Deficiency Investigation	2004	Risk Mgmt	4.5	5.5	
Fort Nelson GS Integration into Thermal Generation	2004	Cost Efficiency	2.7	3.9	
Ruskin Dam Deficiency Investigation	2004	Risk Mgmt	2.5	3.1	
Hugh Keenleyside Dam Deficiency Investigation	2004	Risk Mgmt	4.0	4.1	
Fall Protection Program	2004	Employee Safety	9.2	10.6	2.1.13

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Project Name ($ millions)	Project Completion Date (Note 1)	Primary Business Driver (Note 2)	Spending to March 31, 2003 (Note 3)	Est. Cost at Completion (Note 4)	Section Ref. (Note 5)
John Hart – T2, T4 & T6 Replacement	2004	Reliability	0.2	2.6	
Kootenay Canal T4 Unit Transformer Replacement	2004	Reliability	0.1	2.2	

Notes for all tables identifying In-service and Substantially Complete capital projects:

1. Project Completion Date = the fiscal year in which the project was substantially completed and placed in service.
2. Primary Business Driver = the primary reason why the project was undertaken. Drivers used vary between lines of business/service organizations.
3. Spending to March 31, 2003 = Total project spending during the period F1995 to F2003. Costs prior to April 1, 1994 are excluded.
4. Est. Cost of Completion = Forecast of total project cost for projects scheduled for completion during F2004. This value is not provided for projects completed prior to F2004, as the actual cost will be identical to that identified in the previous column.
5. Section Ref. = Section number of descriptions of projects with capital cost greater than $5 million.

2.1.1 Kootenay Canal Generating Station Turbine Upgrade

The four turbines at Kootenay Canal Generating Station were upgraded to obtain additional energy and capacity from the existing plant. The turbine project was developed in two stages. In stage 1, a design competition between two independent contractors was held to build two models to be tested in an independent laboratory. In stage 2, the successful contractor was directed to supply and install turbines at Kootenay Canal.

The project was completed in February 1999. Average efficiency gains of 3.85% were achieved resulting in an increase in annual average energy of 131 GWh/year and 22 MW increase in turbine output power.

2.1.2 South Taylor Land Acquisition

Following discussions with local residents, the Peace River Regional District and Ministry of Environment representatives, BC Hydro initiated a voluntary program of property purchase and floodproofing measures in South Taylor. Property there is at risk of occasional flooding when the Peace River freezes near Taylor. These properties are in the 200-year flood plain and are subject to flooding from ice events.

BC Hydro considered changing its operation of the upstream Peace River facilities (GM Shrum and Peace Canyon) to mitigate flooding of these properties. However, the

operational changes required would reduce electricity generation from these large facilities resulting in considerable loss of revenue. Initiating a voluntary property purchase and floodproofing program reduced the impacts of flooding and maintained operational flexibility.

2.1.3 Revelstoke Generating Station Unit 5

The Revelstoke installation consists of large concrete gravity and earthfill embankment dams, a gated spillway, penstocks, and powerplant and switchgear buildings. Construction of the installation began in early 1977, and the first of four installed generating units was brought into service in May 1984. The existing generating units have a total nameplate capacity of 1943 MW. The powerplant has two empty unit bays as provisions for the installation of approximately 1,000 MW of added capacity.

Preliminary work for the licensing and design of Unit 5 was completed in 1999. Installation of Unit 5 did not proceed and no provisions for implementing the project are provided in the BC Hydro Generation capital plan based on the current outlook for load/resource balance.

2.1.4 Stave Falls Power Plant Replacement

The original Stave Falls power plant was the oldest in the BC Hydro electric system that had not undergone a major rehabilitation. It was a 5-unit 52.5 MW power plant that generated approximately 260 GWh/year. The first unit was commissioned in 1912.

The generating units were hydraulically inefficient; did not fully comply with current fire, worker safety, environmental and design standards; were difficult to maintain; and were becoming unreliable.

The Stave Falls project involved the construction of a new 2 unit, 90 MW power plant, switchyard and ancillary equipment. The new facility generates 365 GWh/year of energy.

The original power plant was taken out of service after the construction of the new power plant was completed and the old powerhouse was converted into a historic visitor centre (See section 2.1.8).

2.1.5 Fort Nelson Generation

The Fort Nelson Generating Station is a 45 MW generating facility. Fort Nelson and surrounding area is supplied by generation from this station as well as the Alberta integrated electrical system via a 144 kV, 220 km transmission line from Rainbow Lake in Alberta.

The Fort Nelson Generating Station was constructed by TransAlta Energy Corporation and built to address BC Hydro's reliability supply issues with the transmission line from Alberta. The plant went into commercial operation in May 1999 at a capital cost of $43 million. At the time, BC Hydro purchased 100% of the electrical output, and in August 2001, ownership of the plant was transferred to BC Hydro.

2.1.6 Business Transition Program

In 1996, BC Hydro initiated the Business Transition Program to improve asset management practices and the optimization of the generation system. The program included the following four key projects:

- Asset Management, which replaced the outdated Production Facilities Maintenance System with Indus PassPort, and introduced new work management processes for generating facility staff;
- Operational Information, which provided additional real-time and historical information to operating and maintenance staff;
- Commercial Resource Optimization, which developed and improved the modelling tools utilized to manage BC Hydro's reservoirs; and
- Commercial Management, which introduced a new software tool and business processes to improve tracking of operations and to increase the availability of electricity market price information to generating facility staff.

2.1.7 Burrard Generating Station Unit 1 Generator Rehabilitation

The Burrard Generating Station is a six unit, 913 MW, natural gas fired plant initially constructed in the 1960s.

In August 1999 the Burrard Generating Station Unit 1 generator sustained significant damage when a mixture of hydrogen and other gases ignited in the generator enclosure while the unit was being returned to service following a major maintenance outage.

BC Hydro considered three alternatives: replacement, rehabilitation, or abandonment of Unit 1. Analysis of the alternatives indicated rehabilitation of the generator was the most economic option.

2.1.8 Stave Falls Visitor Centre

Water licenses for the 1912 Stave Falls Generating Station were transferred to the new Stave Falls Station constructed in 1999 and the old plant was no longer used for electrical operations. During public consultation, it was identified that the 1912 Station had considerable support among local residents and businesses for use as a museum or tourist facility. It was also recognized that BC Hydro does not have a visitor centre in the Lower Mainland region of British Columbia where the corporation could inform the public about its business and provide access to one of its hydro electric facilities. The Stave Falls Visitor Centre project was approved and construction proceeded in 1999 to build a visitor centre at the 1912 powerhouse. The centre opened in September 2001.

2.1.9 Burrard Generating Station Upgrade

The Burrard Upgrade Project was initiated in 1993 to make capital improvements at the plant to: meet the permitted air emission standards; meet cooling water standards; improve the operational availability of the units; improve the operational safety of the plant; modernize the control systems; improve the thermal efficiency of the units; and evaluate repowering options for the site and other miscellaneous work.

The project was completed in the fall of 2003. Major work items included: the installation of selective catalytic conversion for emissions control on all six units; burner management system on all six units; distributed control system on units 4, 5 and 6; modernization of the sea water intake chlorination/dechlorination system; asbestos removal and other works.

2.1.10 Seven Mile Generating Station Unit 4

The Seven Mile Dam and Power plant came into service in 1979 and consists of a concrete gravity dam, a spillway, and a 4 bay powerhouse. Three generating units with a total nameplate capacity of 607.5 MW were initially installed. The installation of Unit 4 in 2003 completed the project and increased the capacity by approximately 210 MW. Average energy production was increased by 302 GWh per year.

2.1.11 Bridge River Turbine Runner Upgrade Units 1 to 6

Bridge River Generating Station consists of eight generating units, all Pelton type vertical impulse turbines. Units 1 to 4 are identical and installed in powerhouse No.1. Units 5 to 8 are installed in powerhouse No. 2 and are similar to Units 1 to 4 but larger. Units 1 to 6 were installed between 1948 and 1959.

Turbine efficiency tests were carried out on Unit 1, which indicated that the average efficiency of Units 1 to 6 could be increased by at least 3% by replacing the runners. The project was completed in the spring of 2003 and the increase in the annual average energy output is estimated to be 105 GWh/year.

2.1.12 WAC Bennett Dam Deficiency Investigation

In June 1996, the 183 m high WAC Bennett Dam experienced a large sinkhole in the crest of the dam. A sinkhole in an earthfill dam is generally a surface manifestation of a slow erosion process of material removal from deep within the dam.

Extensive investigations were undertaken over a period of 12 months. The results of the investigations provided information for a remediation design and implementation to repair the sinkhole. This project was initiated in 1997 to assess the mechanisms that may have caused the sinkhole and is ongoing with national and international expert advice.

2.1.13 Fall Protection Program

The Fall Protection Program was initiated in 1997 in response to WCB regulations to bring all 36 power facility sites into compliance. A staged approach was developed as follows:

- procurement of customized fall protection equipment for all power facility sites and employees (temporary systems), and

- definition and implementation of permanent engineered systems at all 36 power facilities' sites in locations where it is impossible, impractical, or not suitable to set-up temporary systems.

The project is in the final stages and is scheduled to be complete by the end of F2004, with the exception of some transformer work. The transformer Fall Protection work is outage dependent and will take a further 20 months to complete.

2.2 Future Capital

Table 11-4 summarizes capital projects in BC Hydro Generation that:

- are underway, will be completed during the test periods, and will have total project costs exceeding $2 million; or
- are planned to start during the test periods and are forecast to have costs exceeding $2 million during the test periods.

Table 11-4. Planned and In-progress Projects, BC Hydro Generation

Project Name ($ millions)	Est. Project Completion Date	Sustain/ Growth	Primary Business Driver	To March 31, 2003 *(Note 1)*	F2004 Forecast *(Note 2)*	F2005 Plan *(Note 3)*	F2006 Plan *(Note 3)*	Total Cost *(Note 4)*	Section Ref. *(Note5)*
GM Shrum Exciter Replacement G1 to G8	F2005	Sustaining	Reliability	3.8	8.5	0.8	0.0	13.1	2.2.1
Strathcona T1 Replacement	F2006	Sustaining	Reliability	0.2	1.0	0.4	0.6	2.2	
GM Shrum Turbine Runner Replacement G6 to G8	F2005	Growth	Cost Efficiency	12.9	7.0	7.3	0.0	27.2	2.2.2
GM Shrum Generator Transformers Replacement	F2005	Sustaining	Reliability	17.3	5.2	1.2	0.0	23.7	2.2.3
Elsie Lake Dam Seismic Improvements	F2005	Sustaining	Risk Mgmt	10.8	1.3	5.8	0.0	17.9	2.2.4
Bridge River 2 T5/T6/T7 Transformer Replacement	F2005	Sustaining	Reliability	3.0	2.8	0.4	0.2	6.4	2.2.5
Peace Canyon Powerhouse Crane Upgrade	F2005	Sustaining	Reliability	0.0	4.0	0.0	0.0	4.0	
Revelstoke Slope Stability Improvements	F2005	Sustaining	Risk Mgmt	0.9	0.7	1.3	0.0	2.9	
Cheakamus Units 1 and 2 Governor Replacement	F2005	Sustaining	Reliability	0.0	1.0	1.4	0.0	2.4	
Seven Mile Dam Safety Improvements	F2006	Sustaining	Risk Mgmt	23.2	23.9	24.0	2.3	73.4	2.2.6
Water Use Programs	F2006	Sustaining	Consent to Operate	21.3	4.2	1.3	0.3	27.1	2.2.7
Cheakamus Unit 1 and 2 Upgrade	F2006	Growth	Cost Efficiency	1.1	3.2	3.4	0.6	8.3	2.2.8
Stave Falls (Blind Slough Spillway) Seismic Strengthening	F2006	Sustaining	Risk Mgmt	0.0	0.5	2.0	5.0	7.5	2.2.9
Aberfeldie Woodstave Pipeline Replacement	F2006	Sustaining	Reliability	0.0	0.0	0.1	6.2	6.3	2.2.10
Ruskin Dam Right Abutment Seepage	F2006	Sustaining	Risk Mgmt	0.0	0.1	0.6	4.0	4.7	
Coquitlam Dam Seismic Improvements	F2007	Sustaining	Risk Mgmt	0.0	1.3	3.0	8.8	40.0	2.2.11
Ruskin Dam Strengthening of Concrete Dam	F2007	Sustaining	Risk Mgmt	0.0	0.2	0.7	15.0	30.8	2.2.12
John Hart Penstock 1 Replacement and	F2007	Sustaining	Reliability	0.0	0.0	0.5	13.7	15.1	2.2.13

Project Name ($ millions)	Est. Project Completion Date	Sustain/ Growth	Primary Business Driver	To March 31, 2003 (Note 1)	F2004 Forecast (Note 2)	F2005 Plan (Note 3)	F2006 Plan (Note 3)	Total Cost (Note 4)	Section Ref. (Note5)
PRV									
GM Shrum Unit Transformers and Generators Protection	F2007	Sustaining	Reliability	0.0	0.2	1.1	2.3	8.9	2.2.14
Strathcona Embankment Dam Improvements	F2007	Sustaining	Risk Mgmt	0.0	0.0	0.2	3.0	7.2	2.2.15
LaJoie Dam Safety Improvements	F2007	Sustaining	Risk Mgmt	0.0	0.0	1.8	4.0	6.3	2.2.16
GM Shrum Unit 8 Capacity Increase	F2007	Sustaining	Reliability	0.0	0.0	0.4	2.1	4.3	
Aberfeldie Redevelopment	F2008	Growth	Reliability	0.0	0.1	1.0	1.5	51.6	2.2.17
Mica Unit 4 Stator Replacement	F2008	Sustaining	Reliability	0.0	0.0	0.4	2.7	12.8	2.2.18
Peace Canyon Generator Deficiency Project	F2009	Sustaining	Cost Efficiency	0.0	0.3	0.8	10.6	46.0	2.2.19
First Nations Negotiations	Ongoing	Sustaining	Consent to Operate	23.2	7.2	6.8	3.6	40.8	2.2.20
Burrard Asbestos Program	Ongoing	Sustaining	Safety	3.9	1.1	1.3	1.2	7.5	2.2.21
Fire Risk Reduction Program (F1995 - F2009)	Ongoing	Sustaining	Risk Mgmt	10.3	5.2	4.1	2.6	31.3	2.2.22
Security Measures	Ongoing	Sustaining	Risk Mgmt	0.0	0.0	2.6	1.7	6.1	

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Notes for all tables identifying Planned and In-Progress Projects:

1. To March 31, 2003 = Project spending to the end of F2003, for projects that are underway but will not be completed during F2004.
2. F2004 Forecast = Forecast spending during F2004.
3. F2005 Plan and F2006 Plan = Planned spending during each of F2005 and F2006.
4. Total Cost = Estimated total cost at project completion. Total Cost will be equal to the sum of the previous columns for projects completed prior to the end of F2006. Total Cost is greater than the sum of the previous columns for projects with completion dates after F2006 and includes expenditures after F2006 to completion.
5. Section Ref. = Section number of descriptions of projects with capital cost greater than $5 million.

2.2.1 GM Shrum Exciter Replacement G1 to G8

Eight of ten exciters at GM Shrum have exceeded their expected operating life of 25 years. These eight exciters are experiencing increasing in-service failures and there is a significant and increasing risk of damage to the turbine/generator units due to certain exciter failure modes. The scope of this project is to procure, supply, and install eight new static excitation systems for GM Shrum G1 to G8.

2.2.2 GM Shrum Turbine Runner Replacement G6 to G8

GM Shrum G6 to G8 turbine runners were manufactured by Toshiba and installed in 1971 and 1972. The other 7 turbine runners were manufactured by Mitsubishi (G1 to G5) and Fuji (G9 and G10).

A model test completed by GE Canada, BC Hydro's turbine partner, confirmed that a potential increase in efficiency of about 5% can be achieved by replacing the runners and modifying some water passage components (stay vanes, wicket gates, seals etc.). The efficiency increase from the 3 units has been confirmed at 243 GWh/year based on the prototype field efficiency test of G7, the first unit upgraded in November 2002.

The second runner was completed in November 2003 and the third unit is scheduled for completion in November 2004.

2.2.3 GM Shrum Generator Transformers Replacement

Each of GM Shrum Generating Station's ten generating units is connected to three single-phase generator transformers. A condition assessment report concluded that 13 of the transformers are at or near the end of their useful life and need to be replaced. The transformer replacement project started in February 2001 and is scheduled to be completed by the end of F2005.

2.2.4 Elsie Lake Dam Seismic Improvements

Elsie Dam is located on Vancouver Island's Ash River. The project consists of a main 25 m high earthfill dam and four saddle (secondary earthfill) dams.

The Elsie Dam Safety Deficiency Investigations concluded that the main dam and saddle dam 1 had seismic deficiencies related to imperfections in the original earthfill dam construction. In addition, the low level outlet (LLO) structures were seismically deficient. A capital project was commenced in 2000 to correct these deficiencies.

Improvements to the embankment dams and LLO tower have now been completed. The remaining work, involving structural modifications and improvements to the LLO conduit and valves, is scheduled for completion in F2005.

2.2.5 Bridge River 2 T5/T6/T7 Transformer Replacement

Each of the four generating units at Bridge River Powerhouse 2 is connected to a three-phase generator transformer. A transformer condition assessment concluded that the transformers for generators G5 to G7 are at or nearing the end of their useful lives and need to be replaced.

The project scope is the purchase and installation of three transformers. The project is to be completed by the end of F2005.

2.2.6 Seven Mile Dam Safety Improvements

The Seven Mile Dam and powerplant is located on the Pend d'Oreille River in southeastern B.C. and came into service in 1979. The facility consists of an 80 m high concrete gravity dam, a spillway and a 4 unit powerhouse. While the facility was designed and constructed to the dam safety standards and criteria in effect at that time, the standards and criteria have evolved. As a result, a Dam Safety Deficiency Investigation project, undertaken as part of the Dam Safety Program, identified a number of deficiencies. The Seven Mile Dam Safety Improvements project was initiated in February 2002 to address these deficiencies. The work includes:

- spillway gate seismic improvements;
- dam upgrade work to anchor the dam with post-tensioned anchors drilled through the concrete into the underlying bedrock; and
- site systems seismic upgrades to improve the reliability of the power supply to the facility, common drainage pumps and improved communications and control.

The Seven Mile Dam safety improvements are expected to be completed in F2006.

2.2.7 Water Use Programs

BC Hydro has been, with broad public consultation, reviewing all of its generation and storage operations and preparing Water Use Plans that clarify the operating boundaries for each licensed facility. Water Use Plans reflect a balance of the economic, environmental and social values associated with the water resources at the local, regional, provincial and federal levels. Participants can include government agencies, First Nations, local citizens and other interests to ensure that water uses such as hydroelectric, industrial, recreational, community, flood management, and fish habitat are considered in reviewing facility operations. Each Water Use Plan must be authorized under B.C.'s *Water Act*.

The program consists of two components: program management, which oversees the management and the implementation of BC Hydro's Water Use Program; and watershed project management, which focuses on developing a Water Use Plan for each watershed and its associated facilities.

2.2.8 Cheakamus Unit 1 and 2 Runner Upgrade

Cheakamus powerplant came into service in 1957 as a two unit, 157 MW plant. The project calls for the first unit to be upgraded in the winter of F2004 and the second unit in the winter/spring of F2005 with project completion in October 2005. The upgrade of the two units will generate an additional 46 GWh/year.

2.2.9 Stave Falls (Blind Slough Dam) - Seismic Strengthening

The Stave Falls project is located on the Stave River about 65 km east of Vancouver and is part of the Alouette-Stave-Ruskin hydroelectric development. Stave Falls is the upstream project on the Stave River and was completed in 1925, with the new powerhouse completed in 2000. This project impounds the 30 km long Stave Lake Reservoir.

Blind Slough Dam is a concrete dam that contains the spillway facilities for the Stave Falls project. Previous work has concluded that the Blind Slough spillway piers could fail under the design earthquake.

Capital improvements to the Blind Slough Dam to bring the structure up to current seismic standards include both horizontal and vertical anchoring of the dam. Design work is planned for F2004 and completion of anchoring by the end of F2006.

2.2.10 Aberfeldie Woodstave Pipeline Replacement

The existing woodstave pipeline at Aberfeldie was placed in service in 1970 and is well past its life expectancy of 25 years. The current pipeline leaks excessively and is getting very expensive to maintain. Repairs are no longer feasible due to deteriorating wood staves. If the deterioration is allowed to continue it may lead to a penstock failure. To ensure the continued safe, reliable operation of the generating station the woodstave pipe will be replaced most likely with steel, and will be sized appropriately to take into consideration future expansion of the plant (See section 2.2.17).

2.2.11 Coquitlam Dam Seismic Improvements

The Coquitlam Dam is located near the city of Port Coquitlam and was constructed from 1911 to 1913. Previous investigations have determined that the dam contains loose materials that are expected to liquefy during a moderate to large earthquake, resulting in large deformations of the dam. Interim risk management measures involve operating the reservoir under a restricted maximum operation level of elevation of 149 m, which is 6 m below the maximum level.

The selected upgrade option is to construct a new, seismically stable dam just downstream of the existing dam. Final design and cost estimates for construction are planned for F2004. Construction is targeted to start in June of 2004, and dam construction is scheduled for completion by the end of 2006. The reservoir impounds water used by the Lake Buntzen generating station and by the Greater Vancouver Water District (GVWD). The GVWD are involved with relocation of their pipeline and valve house.

2.2.12 Ruskin Dam Strengthening of Concrete Dam

The Ruskin Dam is located on the Stave River about 50 km east of Vancouver and is part of the Alouette-Stave-Ruskin hydroelectric development. Ruskin Dam, completed in 1930, retains Hayward Lake, which extends 6 km upstream to the tailwater of the Stave Falls project. Hayward Lake has very little storage capacity, and storage and flood control are provided entirely by the upstream Stave Falls plant.

Ruskin Dam is a 58 m high concrete gravity structure founded mostly on rock with the exception of the right abutment. Studies have identified that the spillway piers and road deck, and possibly the dam body, would fail under the updated design earthquake criteria.

The conceptual design for seismic upgrades which include anchoring of the dam and strengthening of the spillway gates has been developed. Construction starts in F2006.

2.2.13 John Hart Penstock 1 Replacement and PRV

The John Hart Dam was commissioned in 1953. The plant is key in ensuring that fish flows for the internationally famous Campbell River fishery are maintained. The plant has reached an age where the cost to maintain and operate it is increasing and reliability of operation and hence fish flows cannot be guaranteed. The first step in the modernization will be to replace one wooden penstock and to add a fishwater bypass valve take off. This will ensure that fishflows are maintained.

2.2.14 GM Shrum Unit Transformers and Generators Protection

The present systems used to protect the GM Shrum generators and unit transformers are over 30 years old, obsolete, and are no longer supported by the original equipment manufacturer. The scope of the project is to purchase and replace the GM Shrum transformer and generator protection, replace control systems and the DC system chargers and associated cabling.

2.2.15 Strathcona Embankment Dam Improvements

The Strathcona Dam is located on the Campbell River on central Vancouver Island, 43 km upstream of the city of Campbell River. The dam is 53 m high and 1,510 m long and is comprised of an upstream sloping till core supported by sand and gravel shells. There are no designed filters separating the core from the shells. A power conduit through the base of the dam connects the power intakes to the powerhouse.

Analyses of the materials used to construct the dam, as well as data from surveillance instruments, suggest that the dam could have experienced some piping during its 45-year life. Preliminary analyses also indicate that the downstream slope of the dam could slump if the dam or power conduit experiences a significant leak.

Investigations are continuing and, if required, remedial options such as constructing a rockfill filter along the downstream slope of the dam and grouting around the conduit penstocks could be implemented to mitigate the dam safety risk.

2.2.16 La Joie Dam Dam Safety Improvements

The La Joie Dam is the upstream project of the Bridge River system, located about 1.5 km upstream of the town of Gold Bridge, B.C. and 56 km upstream of the Terzaghi Dam which impounds Downton Reservoir for power generation at La Joie.

The La Joie dam was constructed to its maximum height of 87 m in two stages, completed in 1951 and 1955, by dumping and sluicing rockfill for the main body. Wood was originally used as the impervious membrane. In 1972, the wood was replaced with a layer of shotcrete, and repairs to this surface have been required periodically since installation due to deterioration as the dam settles resulting in increased leakage.

Previous studies have identified potential deficiencies associated with the seismic performance of the dam (including the shotcrete facing), the intake tower and the north conduit. Conceptual designs are being developed to address these deficiencies. Final design and construction is planned for F2005 with project completion in F2007.

2.2.17 Aberfeldie Redevelopment

The Aberfeldie Generating station was built in 1922 and is currently the oldest generating station in the BC Hydro electric system. It is a 2 unit 5 MW run-of-the-river power plant that generates approximately 34 GWh/year. The powerhouse and core generating equipment are original. Condition assessments have determined that the facility will require extensive investment to bring it up to modern standards to keep it operating.

Resource Smart studies in the early 1990's determined that Aberfeldie has the potential to be upgraded to a 30 MW run-of the-river power plant that could generate approximately 120 GWh/year. The optimal configuration of a new powerhouse is still being studied. The dam was rebuilt in 1953 and was designed with a spare intake to allow for future expansion. The dam was anchored in 1999 and with a proposed new larger pipeline, the major civil works would be in place for a larger power plant.

The station would be more efficient, reliable and less costly to maintain than the existing one.

2.2.18 Mica Units 1 to 4 Stator Replacement

The generators for all four Mica units were supplied by General Electric Canada and are all rated at 435 MW (457 MVA @ 0.95 pf). The generators have experienced problems with core waves over the years (first noticed in 1978) that have resulted in progressive damage to the stator core. Stator core bolt failures in recent years have increased the potential for high voltage faults in the stator windings.

The scope of the project is to purchase and install new stators for each unit over a number of years, beginning with Unit 4.

2.2.19 Peace Canyon Generator Deficiency Project

The Peace Canyon Generators have had a history of operational and maintenance problems since commissioning in 1979/1980. BC Hydro believes these problems to be abnormal for this type of equipment and result from design deficiencies.

In 1999 BC Hydro undertook a design and operational review of the Peace Canyon generators. The review identified safety and operational risks that require modifications and repairs to the Peace Canyon generators in the next 1-3 years. BC Hydro has received a "Proposal for Improvement" from the original equipment manufacturer.

In the opinion of a panel of experts, the proposal was inadequate. While negotiations will proceed in an attempt to reach an acceptable technical and commercial solution with the original equipment manufacturer, BC Hydro is also proceeding with legal action to recover costs.

Because the manufacturer's proposal was inadequate, BC Hydro is proceeding with a Request for Proposal from qualified generator manufacturers. The proposals will be reviewed and it is expected that work on the generators will begin in 2005.

2.2.20 First Nations Negotiations

The negotiations were initiated to manage and mitigate BC Hydro's legal and business risks due to impacts of its Peace and Coastal Regions facilities on B.C. First Nations. BC Hydro is doing this by negotiating agreements on economic and social development cooperation measures, and through relationship-building measures with some bands. The costs

identified in Table 11-4 reflect negotiation costs but do not contain provision for any settlement costs that may result.

2.2.21 Burrard Asbestos Program

Since the mid-1980s asbestos at Burrard Generating Station has been managed through a program of removal and encapsulation. Beginning in the early 1990s the construction associated with the Burrard Upgrade Project necessitated asbestos removal in upgrade work areas.

Annual funding for asbestos work varies depending on the condition of remaining asbestos, planned maintenance, construction work, and the results of the asbestos consultant's site reviews.

2.2.22 Fire Risk Reduction Program (F1995 - F2009)

In 1986, the BC Hydro Board of Directors initiated the Fire Risk Reduction program which invested in fire protection on a planned prioritized basis. The process for implementing any fire upgrade was based on a probabilistic assessment of the risks involved and a subsequent economic analysis of the individual upgrade measures for the specific plant. The upgrades are based on an equivalency to the B.C. Fire Code.

The following Fire Risk Reduction Upgrade projects were carried out.

Station	Total
GM Shrum generating station	$5.6 million
Mica generating station	$3.9 million
Seven Mile generating station	$2.7 million
Revelstoke generating station	$4.2 million

Major Upgrade projects are currently underway at the following sites:

Station	Total
Peace Canyon	$3.3 million
Kootenay Canal	$2.8 million

Fifteen additional fire protection upgrade projects are planned to be completed by F2011.

3 BC Hydro Distribution

3.1 In-service and Substantially Completed Projects

Table 11-5 summarizes capital projects by BC Hydro Distribution with actual or forecast costs exceeding $2 million, and that:

- have been placed in service during the period F1995 to F2003, or
- are forecast to be placed in service during F2004.

Table 11-5. Historical and Substantially Complete Projects, BC Hydro Distribution

Project Name ($ millions)	Project Completion Date	Primary Business Driver	Spending to March 31, 2003	Est. Cost at Completion	Section Ref.
Mobile Generators	F1999	Reliability	2.9		
Call Centres *(Note 1)*	F2000	Enabling	11.0		3.1.1
Customer Account Services Projects *(Note 1)*	F2000	Enabling	3.8		
Outage Management System	F2003	Enabling	3.7		
Sandspit DGS Standby Road Mobile	F2000	Reliability	2.4		
MRMS Renewal Meter Reading System	F2003	Enabling	2.4		
CIS Regatta Servers	F2004	Enabling		2.2	
Northstar CIS Project	F2004	Enabling	27.6	62.8	3.1.2

Note
1. F2000 was the primary in-service date for these projects. Total project spending includes additional upgrades completed in F2002.

The following are descriptions of projects by BC Hydro Distribution with total expenditures (actual or forecast) that exceed $5 million:

3.1.1 Call Centres

Four call centres were put in service in F2000 to improve BC Hydro's ability to respond to customer enquiries in a timely, efficient manner. The main call centre is located at Edmonds and networks with call centres in Vernon, Nanaimo and Prince George. The efficiency and service level of telephone services was improved by eliminating call handling from local offices and implementing four regional integrated call centres. The call centres provided customers with a single point of contact via a 1-800 number, extended service hours for live

agents, and '24x7' service via an Interactive Voice Response system in multiple languages.

3.1.2 Northstar CIS Project

The Northstar CIS Project replaces BC Hydro's legacy billing system which was put in service in 1973. The reasons to replace the existing system are its age, resulting in costly maintenance, and relative inflexibility in dealing with complex rate structures, such as time-of-use and real-time pricing.

The new billing system will be put in service in late December 2003.

3.2 Future Capital

Table 11-6 summarizes capital projects by BC Hydro Distribution that:

- are underway, will be completed during the test periods, and will have total project costs exceeding $2 million; or
- are planned to start during the test periods and are forecast to have costs exceeding $2 million during the test periods.

Table 11-6. Planned and In-progress Projects, BC Hydro Distribution

Project Name ($ millions)	Est. Project Completion Date	Primary Business Driver	To March 31, 2003	F2004 F'cast	F2005 Plan	F2006 Plan	Total Cost	Sec. Ref.
Resource Scheduling Phase II	F2005	Enabling			2.5		2.5	
Northstar CRM and BW	F2007	Enabling				5.0	10.0	3.2.1

The following are descriptions of projects in BC Hydro Distribution with total expenditures that exceed $5 million.

3.2.1 Northstar CRM and BW

This project is to configure and set up the Customer Relationship Management (CRM) and Business Warehouse (BW) features, which are currently available in the Northstar license. The CRM feature simplifies the account/customer relationship management by allowing campaign management. The BW feature enables future data mining capabilities.

4 Field Services

4.1 In-service and Substantially Completed Projects

Table 11-7 summarizes capital projects by Field Services with actual or forecast costs exceeding $2 million, and that:

- have been placed in service during the period F1995 to F2003, or
- are forecast to be placed in service during F2004.

Table 11-7. Historical and Substantially Complete Projects, Field Services

Project Name ($ millions)	Project Completion Date	Primary Business Driver	Spending to March 31, 2003	Est. Cost at Completion	Section Ref.
PCB Solids Destruction Plant	F2004	Growth	6.6		4.1.1

The following are descriptions of projects in Field Services with total expenditures that exceed $5 million.

4.1.1 PCB Solids Destruction Plant

This project includes the development, design, construction, and commissioning of a PCB Solids Destruction Plant to process contaminated fluorescent light ballast potting compound and capacitor windings. Initial funding for this project was approved August 2000 and the Plant was put in service in August 2003. Included in the project was a sodium dispersion manufacturing plant to supply both the PCB Solids Destruction Plant and the existing PCB Liquids Destruction Plant, which decontaminates transformer oil for BC Hydro and other Western Canadian utilities.

4.2 Future Capital

Table 11-8 summarizes capital projects by Field Services that:

- are underway, will be completed during the test periods, and will have total project costs exceeding $2 million; or
- are planned to start during the test periods and are forecast to have costs exceeding $2 million during the test periods.

Table 11-8. Planned and In-progress Projects, Field Services

Project Name ($ millions)	Est. Project Completion Date	Business Driver	To March 31, 2003	F2004 F'cast	F2005 Plan	F2006 Plan	Total Cost	Section Ref.
Scheduling and Resource Optimization	F2006	Cost - effectiveness			1.6	0.7	2.2	

5 Corporate

5.1 In-service and Substantially Completed Projects

Table 11-9 summarizes capital projects with actual or forecast costs exceeding $2 million, and that:

- have been placed in service during the period F1995 to F2003, or
- are forecast to be placed in service during F2004.

Table 11-9. Historical and Substantially Complete Projects, Corporate

Project Name ($ millions)	Project Completion Date	Primary Business Driver	Spending to March 31, 2003	Est. Cost at Completion	Sec. Ref.
Common Desktop System	F1998	Enabling	10.6		5.1.1
S390 Processor and Tape Replacement	F1998	Sustaining	3.2		
Integrated Package PAHR	F1999	Sustaining	11.6		5.1.2
Central Park Place Build Out	F2002		3.3		
Accounts Payable Replacement	F2002	Sustain	3.3		
Enterprise Application Integration	F2003	Enabling	2.1		
Integrated Package Portal (Supply Chain/Work Management)	F2003	Enabling	39.8		5.1.3
Integrated Package Project Finance Business Transformation	F2004	Enabling	45.5	51.1	5.1.4

5.1.1 Common Desktop System

Between 1995 and 1998, BC Hydro replaced its desktop systems, Wide Area Network, and Local Area Network with standardized equipment within a common IT architecture. The project included implementation of common Intel/Windows platforms, desktop applications, e-mail, network, and WAN structure. BC Hydro also moved towards a client-server environment.

This project addressed the conclusion in the Deloitte & Touche Report that the use of multiple technology platforms puts BC Hydro at a "…disadvantage whenever integrated, corporate, wide systems were being contemplated". In addition, the project addressed key business drivers such as cost efficiency, the implementation of best IT practices, and the creation of a standard IT platform.

5.1.2 Integrated Package PAHR

The Pay/PDM (Payroll/Personnel Data Management) system was a legacy computer system that had to be replaced prior to the year 2000. Pay/PDM was over 25 years old and was written using embedded two character date logic that would not operate after January 1, 2000. The replacement system is PeopleSoft PAHR (PAyroll - Human Resources). PAHR is part of the PeopleSoft integrated suite of computer software.

5.1.3 Integrated Package Portal (Supply Chain/Work Management)

Between 1999 and 2003, BC Hydro implemented Indus PassPort supply chain management and work management software as part of the Integrated Package. Portal is integrated with BC Hydro's PeopleSoft financial system to enhance asset maintenance, labour/work management, and supply chain management capabilities.

5.1.4 Integrated Package Project Finance Business Transformation

Between 1998 and 2003, BC Hydro implemented a new Integrated Package to replace its legacy financial systems. This project is known as the Finance Business Transformation, and its goals were to:

- improve the quality and accessibility of business information to support decision making;
- transform the finance function from primarily a transaction based processing organization to a value added business partner of operational management; and
- support a range of future business models.

The project scope included implementing PeopleSoft Financials with the following modules: General Ledger; Budgets; Business Performance Reporting; Billing/Accounts Receivable; Travel & Expense; Project Accounting; Fixed Assets, and Time Capture.

5.2 Future Capital

Table 11-10 summarizes capital projects that:

- are underway, will be completed during the test periods, and will have total project costs exceeding $2 million; or
- are planned to start during the test periods and are forecast to have costs exceeding $2 million during the test periods.

Table 11-10. Planned and In-progress Projects, Corporate

Project Name ($ millions)	Est. In-Service Date	Sustain/ Growth	To March 31, 2003	F2004 F'cast	F2005 Plan	F2006 Plan	Total Cost	Section Ref.
Enterprise Graphical Information System	F2005	Strategic		13.5	2.9		16.4	5.2.1
Knowledge Management	F2005	Enable	0.1	1.5	0.5	0.5	2.6	
Disaster Recovery Program	F2006	Sustain	0.2	1.8	0.3	0.2	2.5	
PassPort Version Upgrade	F2006	Req'd Mtce				2.5	2.5	
PeopleSoft PAHR/TL Migration to Unix	F2005	Sustain			2.0		2.0	
Peoplesoft PAHR Upgrade/Enhancements	F2007	Req'd Mtce		0.2	0.8	3.5	9.6	5.2.2
PeopleSoft Financials Upgrades	F2007	Req'd Mtce		0.2	0.7	3.5	9.3	5.2.3
PassPort Web Procurement	F2007	Enabling				1.5	2.0	

5.2.1 Enterprise Geographical Information System

The Enterprise Geographic Information System (EGIS) is an enabling technology that consolidates several different databases in BCTC, BC Hydro Distribution and Generation, and BC Hydro service organizations, to provide a single multifaceted view of the province based on links to geographical features. This system will replace the current BC Hydro Distribution Geographical Facilities Information System (GFIS), which is now 20 years old and is becoming more difficult and costly to maintain and operate.

EGIS will incorporate information from BC Hydro data systems to provide spatial links for rights of ways, property rights, reservoirs, watershed modeling, aboriginal relations, and other information about BC Hydro plant, property and land occupancy.

5.2.2 PeopleSoft PAHR Upgrades and Enhancements

To ensure continued vendor support it is necessary to upgrade and enhance PeopleSoft PAHR. The following PeopleSoft applications are involved: Time and Labour; Payroll; and Human Resources.

5.2.3 PeopleSoft Financials Upgrades

To ensure continued vendor support it is necessary to upgrade PeopleSoft Financials. The following PeopleSoft applications are involved: GL; Billing; Accounts Receivable; Payables; Contracts; Project Costing; and Asset Management.