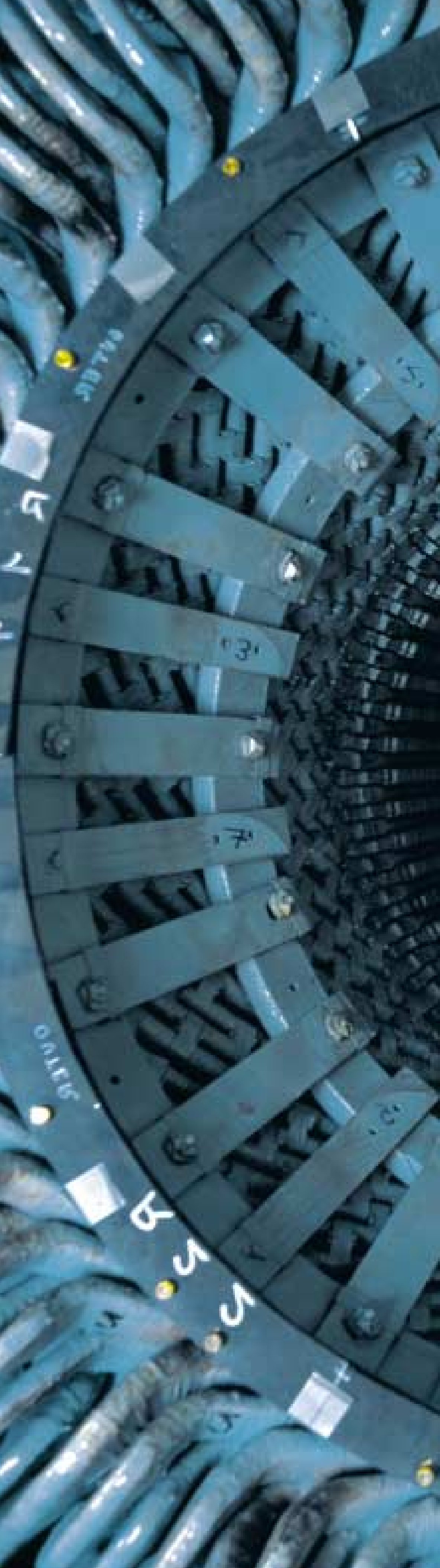
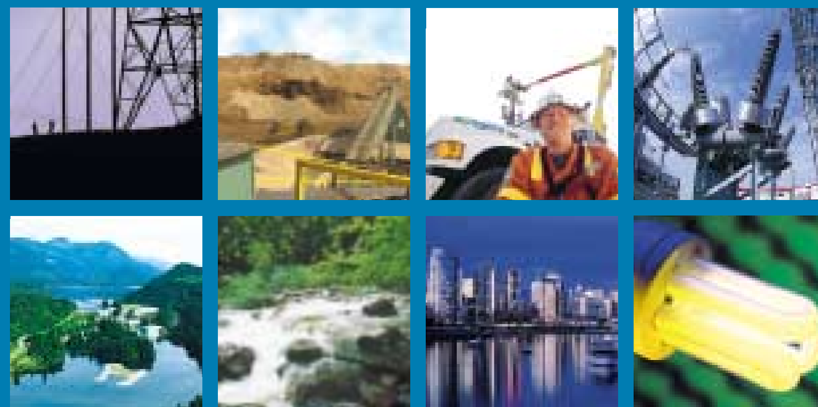


2004
Integrated Electricity Plan



Part 2 Demand-Supply Outlook

BC hydro

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Contents

Executive Summary

The first step in the planning process is to assess the adequacy of supply of energy and dependable capacity to meet customer requirements reliably. BC Hydro has updated its demand-supply outlook, which compares the current forecast of energy and peak demand requirements of BC Hydro's obligation-to-serve customers to the capability of the existing supply. This is for customers connected to the integrated system.

The demand-supply outlook would typically only compare existing and committed supply to the demand forecast and not consider planned resources. However, Figures E.1 and E.2 also show the impact on the demand-supply balance of the programs that BC Hydro currently has underway. These resources include the future contribution from the current 10-year Power Smart Plan, the ongoing Resource Smart program and the Vancouver Island call for tenders (VI CFT). The current Power Smart program is also referred to as Power Smart 2 to distinguish it from BC Hydro's first Power Smart initiative launched in 1989 and from future Power Smart programs evaluated in the IEP.

Figure E.1. Integrated System Capacity Demand/Supply Balance (MW)

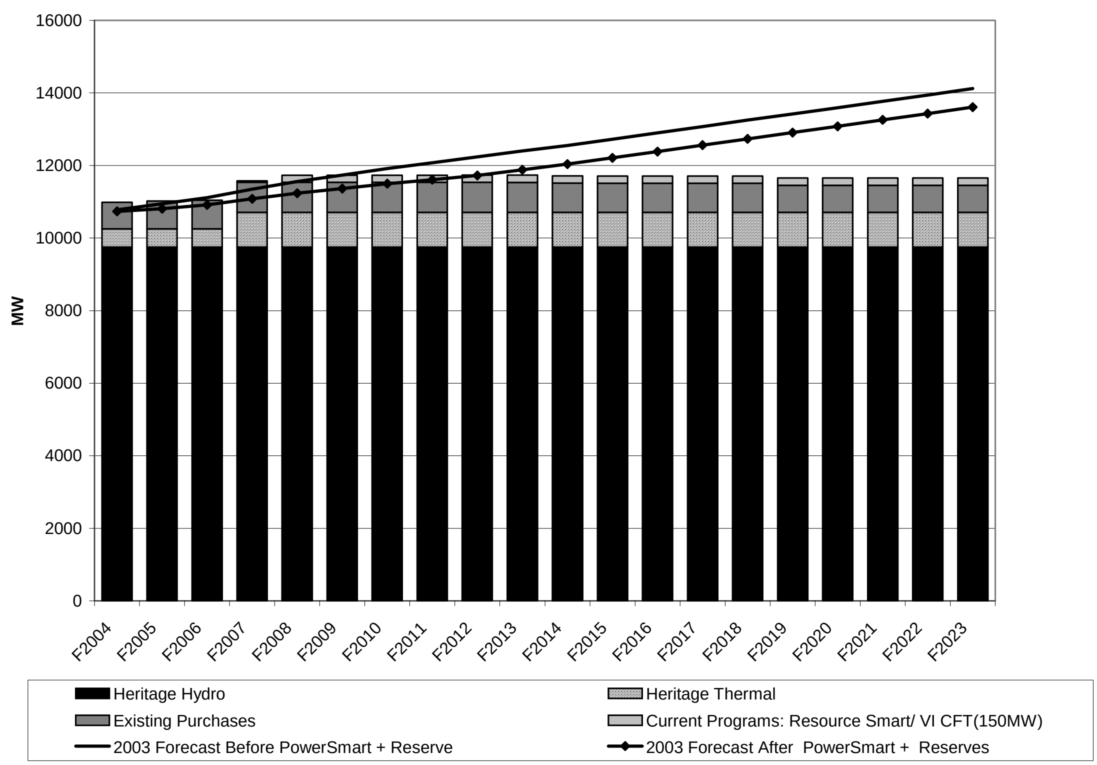
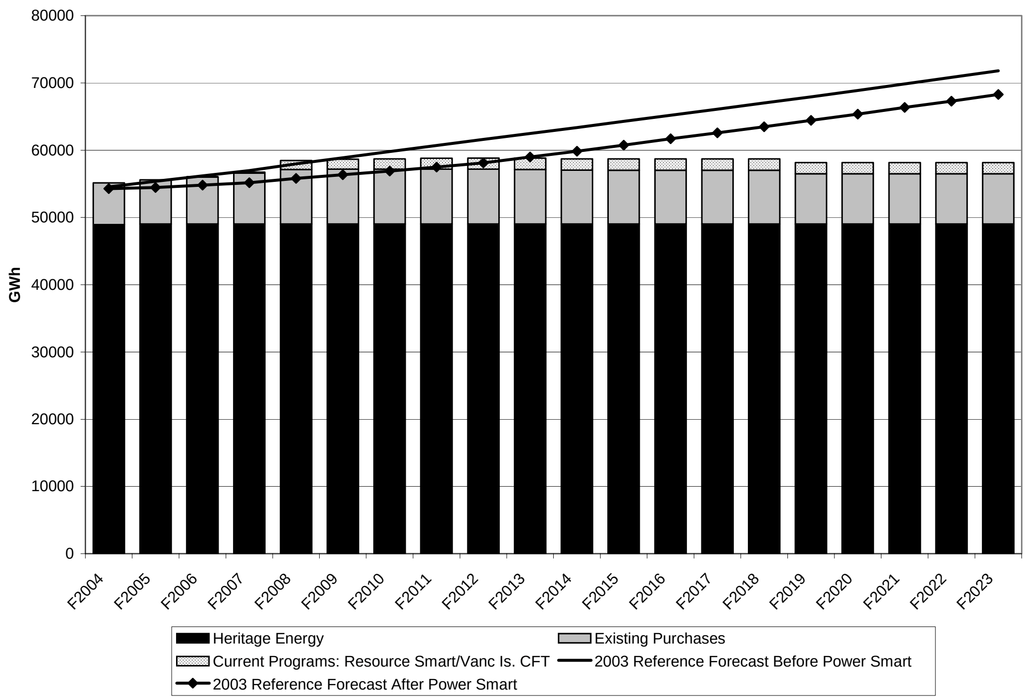


Figure E.2. Integrated System Dependable Energy Demand/Supply Balance (GWh)



Load Forecast

The demand on BC Hydro's system is taken from BC Hydro's October 2003 load forecast. It provides a forecast of the load both before and after the impact of the current Power Smart program. (Power Smart savings are measured at the customer's meter. The difference between the forecast before and after Power Smart includes the avoided system losses attributable to the Power Smart program. Power Smart savings before F2004[1] are included in the forecast before Power Smart.)

The reference forecast before Power Smart 2 indicates that, over the 20-year period starting in F2003, annual energy and peak demand for the integrated system are expected to increase by 18,755 GWh and 4,092 MW, respectively. The reference forecast after Power Smart indicates that, over the same period, annual energy and peak demand for the integrated system are expected to increase by 15,239 GWh and 3,577 MW, respectively. Portfolio analysis will include both forecasts in order to evaluate the merits of continuing with the current Power Smart program. Figures E.3 and E.4 show the energy and peak demand forecasts after Power Smart 2, including the high and low forecasts.

[1] Dates marked with an F refer to BC Hydro's fiscal year ending March 31.

Figure E.3. Integrated System Total Gross Energy Requirements After Power Smart (GWh)

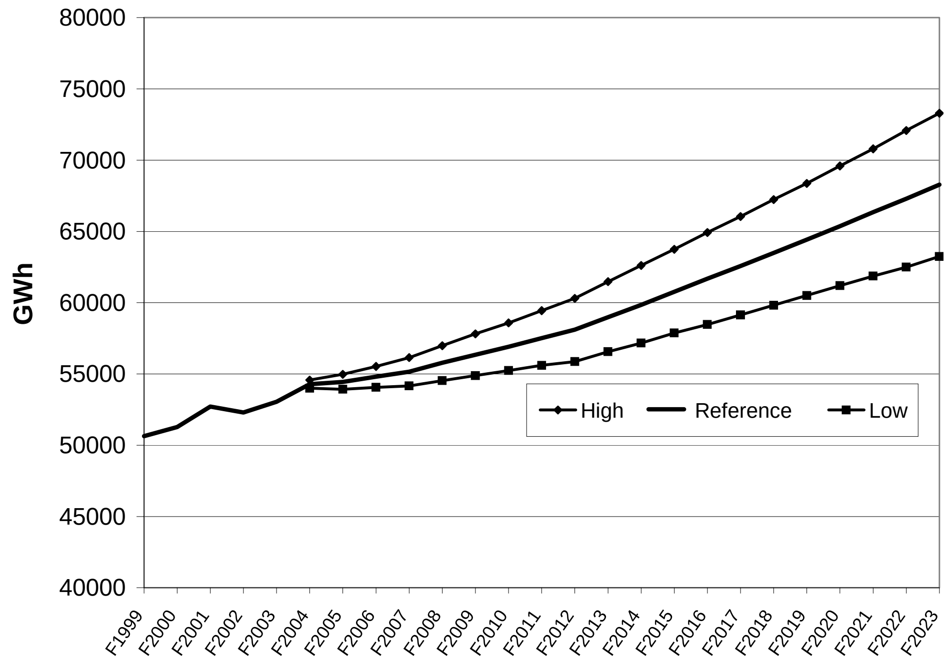
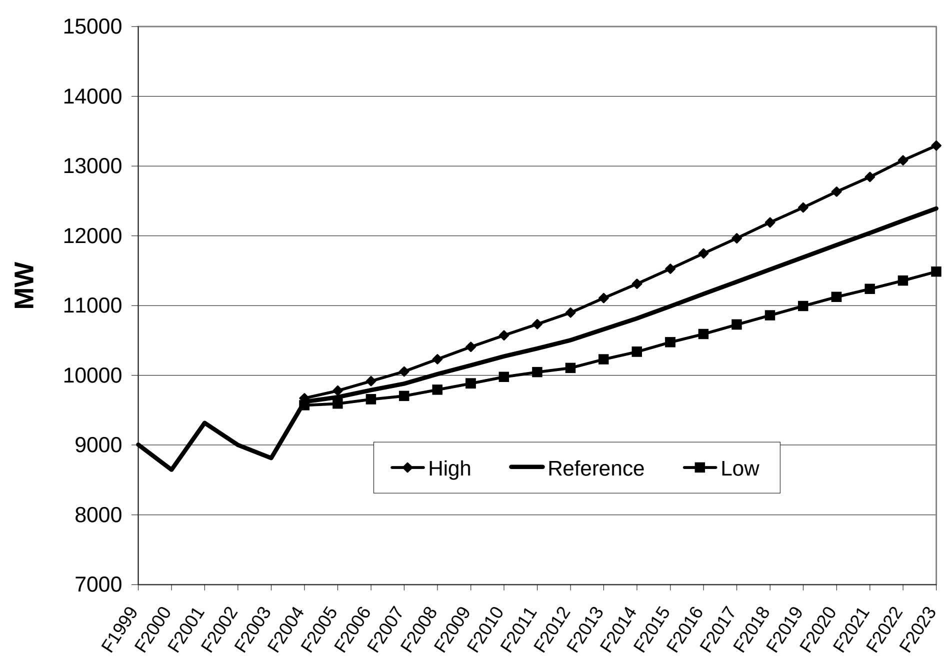


Figure E.4. Integrated System Peak Demand After Power Smart (MW)



Heritage Resources

In November 2003, through the *BC Hydro Public Power Legacy and Heritage Contract Act*, the B.C. government created a "Heritage Contract" to preserve the benefits of the existing hydroelectric and thermal resources for BC Hydro's customers. The Heritage Contract requires BC Hydro Generation to provide 49,000 GWh per year[2] to BC Hydro Distribution. Of this, 48,845 GWh per year will be supplied to the integrated system.[3] The IEP is based on the assumption that no termination notice would be given under the Heritage Contract; thus the contract would continue for at least the full 20-year planning horizon.

The dependable capacity available from the Heritage resources, including six units at Burrard Thermal Generating Station, is 10,708 MW. BC Hydro currently expects to need only three Burrard units for dependable capacity until F2007.

BC Hydro has assumed that, for portfolios where Burrard is phased out, the Heritage Resources could provide approximately 47,000 GWh per year, based on average water conditions. The reliable energy supply under low water conditions from Heritage Resources (without Burrard) would be approximately 43,000 GWh per year.

Existing Purchase Contracts

BC Hydro expects that contracts with independent power producers for projects that are in service or contracted, but not yet in service as of F2007, will provide approximately 8,000 GWh per year of energy and 828 MW of dependable capacity. The contribution of projects not yet in service is adjusted for attrition. Based on experience with previous calls for proposals, BC Hydro expects that some projects will not come into service.

Current Supply Programs and Initiatives

Resource Smart has been an ongoing program since 1987 to invest in improvements at BC Hydro's generating facilities. Resource Smart projects currently underway will add 208 GWh per year of energy by F2006 but no new dependable capacity. Resource Smart is expected to provide an additional 488 GWh and 51 MW of dependable capacity by F2013.

In October 2003, BC Hydro announced a call for tenders for Vancouver Island to address the Island's need for new dependable capacity by F2008. This call is expected to contribute between 150 MW and 300 MW of dependable capacity and 1,200 to 2,100 GWh per year of new energy.

Planning Criteria

BC Hydro plans new capacity resources to ensure that reliable supply is available at least cost consistent with also meeting other planning objectives. In assessing the reliability of supply consistent with Western Electricity Coordinating Council (WECC) guidelines, BC Hydro has adopted a maximum allowable risk of loss of load due to insufficient generating resources of one day in 10 years. Loss-of-load analysis indicates that this is equivalent to maintaining

[2] Less Skagit River Treaty Obligations.

[3] The remaining 155 GWh per year is from Fort Nelson Thermal Generating Station, which is in the non-integrated system.

capacity planning reserves equal to 14 per cent of total dependable capacity. However, BC Hydro is interconnected with other utilities in Alberta and in the United States, and based on experience, the likelihood that capacity supplies on all systems would be in short supply simultaneously is low. Therefore, BC Hydro allows for up to 400 MW of capacity from neighbouring control areas when needed.

BC Hydro's energy planning reliability criterion is intended to ensure that sufficient generation resources are available to satisfy the system's annual energy requirements. BC Hydro uses an energy planning reliability criterion of up to 2,500 GWh per year of non-firm imports. BC Hydro also applies economic planning criteria that examine the merits of advancing resources ahead of when they are needed for reliability. Part 6 of the IEP includes portfolios that confirm the merits of acquiring energy resources with no allowance for non-firm imports; that is, portfolios in which BC Hydro would be energy self-sufficient. The energy demand-supply balance is presented here with no contribution from non-firm imports.

System Demand-Supply Balance

Figures E.1 and E.2 on the previous pages show the system energy and dependable capacity demand-supply balances. Based on the reference forecast before Power Smart 2, the capacity demand-supply balance shows that new dependable capacity is required in F2009. When the contributions from Power Smart 2 and Resource Smart programs are included, and assuming BC Hydro acquires 150 MW from the Vancouver Island call for tenders, the need for new system capacity is deferred to F2013.

The demand-supply balance for energy indicates that demand exceeds supply in F2007. When the contributions from Power Smart 2 and Resource Smart programs are included and assuming BC Hydro acquires 1,200 GWh per year as a result of the Vancouver Island call for tenders, supply exceeds demand until F2013.

Regional Issues

The regional disparity between supply and demand affects the investment in transmission infrastructure needed to ensure system reliability. The key transmission constraints to be addressed in the 2004 IEP are between Vancouver Island and the Lower Mainland and on the 500 kV transmission system between the Lower Mainland and the Interior. When and where new generation is added will influence the need for new transmission. For example, adding new generating capacity in the Southern Interior will require investment in new transmission infrastructure in that region in order to deliver that power to the Lower Mainland/Vancouver Island load centre.

1 Planning for the Future – An Overview

An integrated electricity plan (IEP) presents an electric utility's long-term plan for acquiring electricity resources to meet forecast customer needs. IEPs have been an integral part of BC Hydro's overall business planning process for many years. These plans provide the framework to support prudent investments in demand-side management (DSM), generation facilities and transmission infrastructure. This, in turn, ensures that BC Hydro meets its obligation to supply reliable electricity service to its customers at least cost, consistent with other planning objectives.

Integrated electricity systems are complex and capital-intensive. Most new resources also require significant lead times to build. As a result, electric utilities plan ahead to be sure that the required resources will be in place when needed. IEPs are typically based on load forecasts and resource options that cover 15 to 20 years. Taking this long-term view, however, does not mean that BC Hydro is locked into each of the resource options identified over the planning horizon. In fact, the IEP must be sufficiently flexible to respond to changing market conditions and future uncertainties. In other words, the IEP must meet planning objectives against a range of possible futures as these futures cannot be predicted with certainty.

BC Hydro periodically reviews and updates its IEP. BC Hydro's most recent published IEP was issued in 2000 as an update to the 1995 IEP. A new IEP was to have been completed in 2001. However, the 2001 IEP planning process was put on hold in August 2001, pending the B.C. government's review of provincial energy policy. The B.C. Energy Plan, released in November 2002, enabled BC Hydro to proceed with the development of the 2004 IEP.

The primary purpose of BC Hydro's 2004 IEP is to project the nature and quantity of BC Hydro's resource needs over the next 20 years. This strategic direction guides the management of BC Hydro's owned and contracted energy resources, as well as future acquisition processes.

Specifically, the 2004 IEP:

- Provides the planning foundation for future demand-side management programs (Power Smart), private sector calls for electricity, and other resource acquisitions;
- Demonstrates to First Nations, stakeholders and the B.C. Utilities Commission (BCUC) that BC Hydro has a plan to meet future customer demand for electricity that recognizes key risks and uncertainties;
- Considers and incorporates, where feasible, feedback from the First Nation and stakeholder engagement process;
- Demonstrates how environmental, social and economic considerations are included in electricity planning; and
- Identifies an Action Plan that specifies initiatives to implement the IEP.

BC Hydro's 2004 IEP has nine components:

- Summary
- Part 1. Introduction and Planning Objectives
- Part 2. Demand-Supply Outlook
- Part 3. Resource Options
- Part 4. First Nations and Stakeholder Engagement
- Part 5. Portfolio Evaluation Process
- Part 6. Portfolio Evaluation Results
- Part 7. Action Plan
- Glossary

2 Introduction to the Demand-Supply Outlook

The demand-supply outlook refers to the balance between the demand for electricity on BC Hydro's integrated system and BC Hydro's ability to serve that demand reliably using the existing system and new resources. BC Hydro requires new electricity to ensure reliable supply when the forecast demand exceeds the capability of available resources, taking into consideration planning reserve margins. These margins are based on BC Hydro's capacity and energy reliability planning criteria. The IEP also examines opportunities to advance resources ahead of reliability requirements if it would be economic to do so or to meet other planning objectives.

Some of BC Hydro's customers live in areas too remote to be served by transmission lines. Local generation serves these non-integrated communities. This document does not address the supply planning for those non-integrated areas.

Transmission requirements are also an important planning consideration. This is particularly so for BC Hydro's system, in which most of the electricity demand is in the southwest corner of B.C., while most of the present supply resources are located in the North and South Interior regions of the province. BC Hydro has an extensive system of transmission lines to transmit the electricity from the point of generation to load areas. BC Hydro's transmission system is planned, operated and managed by the British Columbia Transmission Corporation (BCTC). If new resources are interconnected at remote portions of the transmission system, then there will likely be a need for transmission upgrades to transmit the power to the major load centre in the southwest corner of the province. The integrated electricity planning process involves planning resource requirements from both the system and regional perspectives.

The demand-supply outlook is presented in the following four sections:

- Section 3 outlines the current load forecast and Power Smart assumptions.
- Section 4 provides an overview of existing and planned new supply resources within the integrated BC Hydro system.
- Section 5 summarizes BC Hydro's planning criteria.
- Section 6 presents the need for new resources, including system requirements and regional requirements.

3 BC Hydro Electric Load Forecast

3.1. Introduction

BC Hydro produces an electric load forecast annually, published in the fall. The forecast is only for domestic load and firm export obligations. It does not take into account electricity trade opportunities. Forecasts are provided both before and after the impact of BC Hydro's current Power Smart initiative, Power Smart 2. The forecast includes the requirements of customers on the integrated system and those in the non-integrated areas.

The following section summarizes the forecast information used in the IEP. Because the IEP must meet integrated system requirements, it is based on the total gross requirements for the integrated system, including transmission and distribution losses but excluding the non-integrated areas. The IEP considers both the forecast of energy requirements and the forecast of peak demand for the integrated system. Regional peak demand forecasts for the major transmission regions within B.C., such as Vancouver Island, are also used to determine new transmission requirements. Reference energy and peak demand forecasts are provided both before and after Power Smart 2. High and low uncertainty bands around these reference forecasts are provided, based on Monte Carlo probability analysis. As well, sensitivity analysis can be conducted to examine the impact of changes in key factors such as gross domestic product (GDP) and electricity prices (i.e., rates).

3.2. Forecast Drivers

There are a number of key components to the load and sales forecast:

- The residential forecast;
- The commercial forecast (distribution voltage and transmission voltage);
- The industrial forecast (distribution voltage and transmission voltage); and
- The peak forecast.

Table 3.1 provides an overview of the key drivers for the reference forecast. For each forecast segment, this table includes the activity variables, the use rate variables and the summary data sources.

Table 3.1. Key Load Forecast Drivers

	Activity	Use Rate	Data Sources
1. Residential Forecast	Number of residential accounts by housing type, heating type, region	Consumption per account	Current number of accounts as base. Housing starts for short term (first four years). Population forecast for longer term (next 17 years). Appliance saturation rates.
2. Commercial Distribution Forecast	Floor stock by building type and by existing and new buildings	Fuel share Consumption (per square foot)	Floor stock forecasts. End use saturation rates. End use intensities updated from the 2002 Conservation Potential Review.
3. Commercial Transmission Forecast	Number of facilities	Current consumption adjusted for expansions, contractions, closures	Customer billing data for commercial transmission customers (first four years). Consumption trends extrapolated (next 17 years).
4. Industrial Distribution Forecast	GDP (based on regression modelling)	Current consumption	GDP forecast.
5. Industrial Transmission Forecast	Number of facilities for first four years GDP for next 17 years (based on regression modelling)	Current consumption adjusted for expansions, contractions, closures	Industrial billing data for industrial transmission customers (first four years). GDP forecasts (next 17 years).
6. Non-Integrated Forecast	Number of accounts	Consumption per account	Current number of accounts as base. Local conditions for short term (first four years). Population forecast for longer term (next 17 years). Appliance saturation rates.
7. Peak Forecast	Number of accounts by type	Peak for transmission, energy for distribution	Previous year peak by substation, region, system. Weather data for normalization. Customer billing data. Population forecasts. Floor stock forecasts.

3.3. Growth Rates

Table 3.2 provides a summary of assumptions on key growth rates for the reference forecast. Growth rates are shown for population, real GDP, the Consumer Price Index, employment and commercial floor stock. Housing starts are shown in thousands. For GDP, three sources were used (see Table 3.3) to generate a weighted average, which is shown in the table. Actual data is shown for 1998 to 2002 and forecast data is shown for 2003 to 2023. Three features of this data are worth noting:

- First, based on provincial forecasts, modest rates of population growth are assumed for the forecast period, which acts as a constraint on growth of residential and commercial energy consumption.
- Second, although the forecast assumes reasonably smooth future growth in GDP, the B.C. economy has been subject to significant external shocks in recent years that have led to quite uneven growth rates. This is a significant source of uncertainty for the load forecast.
- Third, growth in productivity is approximately equal to growth in output minus growth in employment. The implicit growth in productivity is small, which will tend to limit the increase in energy demand for the forecast period.

Table 3.2. Growth Assumptions

	Population (%)	Real GDP (%)	House Starts (000s)	Employment (%)	Commercial Floor Stock (%)
1998	0.9	1.3	19.9	0.1	2.2
1999	0.8	2.8	16.3	1.9	2.2
2000	0.8	4.3	14.4	2.2	2.1
2001	0.9	-0.2	17.2	-0.3	2.2
2002	1.1	1.8	21.6	1.6	1.9
2003	0.9	1.5	28.1	2.7	2.5
2004	1.1	2.6	30.4	2.2	2.4
2005	1.2	3.0	32.9	2.2	2.4
2006	1.2	2.9	35.5	2.1	2.8
2007	1.2	2.9	38.0	2.1	2.8
2008	1.2	2.7	36.7	2.0	2.9
2009	1.3	2.6	35.5	1.8	2.9
2010	1.3	2.6	34.2	1.7	2.9
2011	1.3	2.4	32.9	1.8	2.6
2012	1.3	2.3	31.7	1.5	2.6
2013	1.2	2.4	29.0	1.8	2.5
2014	1.2	2.4	29.0	1.8	2.5
2015	1.2	2.4	29.0	1.8	2.5
2016	1.2	2.4	29.0	1.8	2.3
2017	1.2	2.4	29.0	1.8	2.3
2018	1.1	2.3	28.0	1.7	2.3
2019	1.1	2.3	28.0	1.7	2.3
2020	1.1	2.3	28.0	1.7	2.3
2021	1.1	2.3	28.0	1.7	2.3
2022	1.1	2.3	28.0	1.7	2.3
2023	1.1	2.3	28.0	1.7	2.3

3.4. Data Sources

Information on the sources and the uses of the growth assumptions is shown in Table 3.3 For each key driving variable, this table shows those applications where the variable is used, the time period(s) for which the variable is used and the detailed data sources.

Table 3.3. Data Sources for Growth Assumptions

Variable	Application	Period	Source
Population	Residential energy forecast	2007-2023	BC Statistics, BC Population Forecast, May 2002
	Commercial non-building energy forecast	2003-2023	BC Statistics, BC Population Forecast, May 2002
	Number of residential accounts for peak	2003-2006	BC Statistics, BC Population Forecast, May 2002
GDP (Gov)	Below	2003-2007	BC Ministry of Finance, First Quarterly Report 2003/04, September 2003
GDP (Malatest)	Below	2003-2023	R.A. Malatest, July 2003
GDP (DOE)	Below	2008-2023	BC share based on Canadian GDP forecast, USA Department of Energy, Annual Energy Outlook 2003
GDP (weighted)	Industrial energy forecast	2003-2023	Weighted average of Malatest and government sources
Housing Starts	Residential energy forecast	2003-2006	R.A. Malatest, July 2003
Employment	Number of general under 35 kW accounts for peak	2003-2023	BC Ministry of Finance, First Quarterly Report 2003/04, September 2003
	Number of general over 35 kW accounts for peak	2003-2023	BC Ministry of Finance, First Quarterly Report 2003/04, September 2003
Commercial Floor Space	Commercial building use energy forecast	2003-2005	R.A. Malatest, July 2003 (adjusted for first three years using short-term population and GDP forecasts)
	Commercial building use energy forecast	2006-2023	R.A. Malatest, July 2003

3.5. Reference Forecast

Appendix A, Tables A1 and A2, provide details on the reference forecast before and after Power Smart 2. Tables 6.1 and 6.2 provide the reference, high and low energy and peak demand forecasts for the integrated system before and after Power Smart 2. Power Smart savings are measured at the customer's meter. The difference between the forecast before and after Power Smart 2 includes the avoided system losses attributable to the Power Smart program.

Appendix A, Tables A1 and A2, provide historical information from F1999 to F2003. The impact of Power Smart savings achieved prior to F2004 is reflected in the forecast before Power Smart 2. The forecast after Power Smart reflects the expected future savings resulting from Power Smart. It is important to note that the forecast for F2004 onward is weather-normalized, whereas the actual demand for F1999 to F2003 is not weather-normalized.

BC Hydro's total sales include residential, commercial and industrial sales for the BC Hydro service area; sales to New Westminster and Aquila Networks, and firm export obligations, such as supply to Seattle City Light under the Skagit River Treaty. Total sales also include BC Hydro service to small border communities, such as Hyder, Alaska.

BC Hydro's total gross requirements include transmission and distribution system losses and therefore represent the amount of generation resource BC Hydro needs to have available to meet customers' requirements. Tables A1 and A2 provide the forecasts of BC Hydro's total obligation in terms of total gross requirements (GWh) and peak demand (MW) for all of BC Hydro's customers. They also provide the forecasts of total gross requirements and peak demand for the integrated system. The IEP is BC Hydro's plan to meet the integrated system requirements.

Based on the reference forecast before Power Smart 2, total gross requirements for the integrated system are expected to grow from 53,050 GWh in F2003 to 71,805 GWh in F2023, which corresponds to the peak demand increasing from 8,816 MW (F2003 actual) to 12,908 MW in F2023. Based on the reference forecast after Power Smart 2, total gross requirements for the integrated system are expected to grow from 53,050 GWh in F2003 to 68,289 GWh in F2023, which corresponds to the peak demand increasing from 8,816 MW to 12,393 MW in F2023.

Table 3.4 provides percentage growth rates for energy and peak demand. This table compares historical growth rates based on F1999 to F2003 as well as five-year, 11-year and 21-year forecast growth rates starting from F2003 to F2024. The IEP portfolio analysis used the 20-year forecast information for the period of study (F2003 to F2023).

Table 3.4 Historical and Forecast Energy and Peak Growth Rates

	Energy Before Power Smart (%)	Weather-Adjusted * Peak Before Power Smart (%)	Energy After Power Smart (%)	Weather-Adjusted Peak After Power Smart (%)
5 years: F1998-F2003	2.0	1.4	2.0	1.4
5 years: F2003-F2008	1.8	2.8	1.0	2.2
11 years: F2003- F2014	1.6	2.1	1.1	1.7
21 years: F2003-F2024	1.5	1.8	1.3	1.6

* Forecast peak demand is weather-adjusted; i.e., based on design temperature. To calculate growth rates in Table 3.4, actual historical peak demands were weather-adjusted. These weather adjusted peak demands were 8,772 MW in F1999, 8,835 MW in F2000, 8,986 MW in F2001, 9,016 MW in F2002 and 9,005 MW in F2003. Tables in Appendix A include the actual peak demands for those historical years.

There are three main observations to note about these growth rates.

- First, energy before Power Smart 2 tracks the key economic drivers real GDP and employment fairly closely. This largely reflects the importance of real GDP and employment as forecast drivers and their strong historical relationships to energy consumption.
- Second, applying the full Power Smart 2 targets reduces energy growth substantially for the first 11 years, but has less impact over the full forecast period. This reflects the absence of new Power Smart activity after the current 10-year Power Smart Plan.
- Third, peak is growing more quickly than energy. This is due to two main factors: increase in the relative share of residential energy compared to industrial energy; and increase in the relative share of commercial energy compared to industrial energy.

3.6. Load Forecast Uncertainty

There are two major components of uncertainty in the long-term load forecast:

- Uncertainty in the future levels of causal factors within the forecast and their effect on future electricity consumption levels; and
- Uncertainty about how the relationships between the major causal factors and electricity consumption may change over time.

To reflect the overall uncertainties implicit in the load forecast, BC Hydro used five major causal factors to analyze the sensitivity of the forecast:

- The long-term economic growth rate (reflected by GDP);
- The electricity rate paid by the customer;
- The effective energy reduction achieved by demand-side management (DSM) programs;
- The change in quantity of electricity demanded in response to electricity price changes (price elasticity); and
- Electricity use intensity.

Probability distributions were assigned to each of the causal factors. Three values (low, probable, and high) were established to reflect possible future levels of each of the five causal factors, with a probability assigned to each.

An uncertainty model employing Monte Carlo simulation methods (using random combinations of variables in multiple runs) was used to quantify and combine the probability distributions, reflecting the relationships between the five causal factors and electricity consumption. A probability distribution was thus obtained, which showed the likelihood of various load levels resulting from the combined effect of the five factors. For the low scenario, there is a 10 per cent chance the outcome will be below this value. For the high scenario, there is a 10 per cent chance that the outcome will exceed this value.

Results are presented for the energy and peak demand forecasts before and after Power Smart 2 are presented in Figures 3.1 through 3.4. Tables 6.1 and 6.2 provide the reference, high and low energy and peak demand forecasts before and after Power Smart 2. Tables A3 and A4 in Appendix A provide the details of the high forecasts before and after Power Smart 2. Tables A5 and A6 provide the details of the low forecasts before and after Power Smart 2.

Figure 3.1. Integrated System Total Gross Energy Requirements Before Power Smart (GWh)

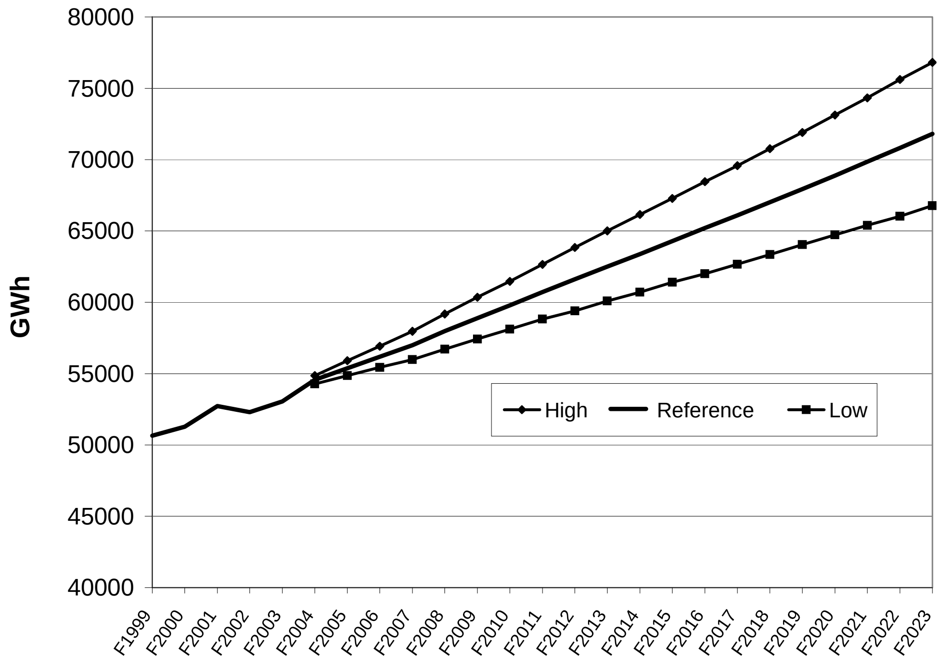


Figure 3.2. Integrated System Total Gross Energy Requirements After Power Smart (GWh)

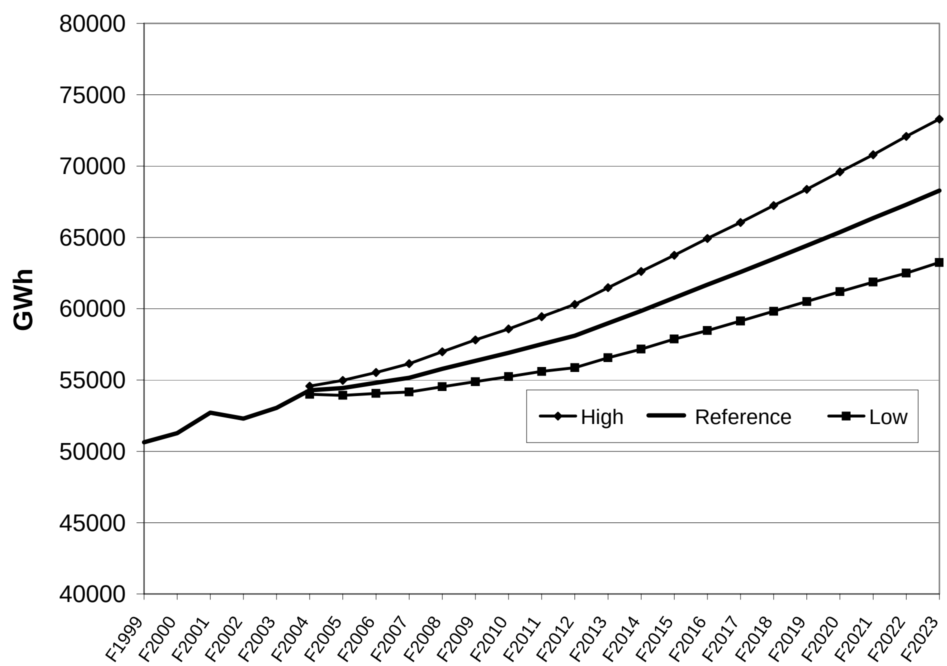


Figure 3.3. Integrated System Peak Demand Before Power Smart (MW)

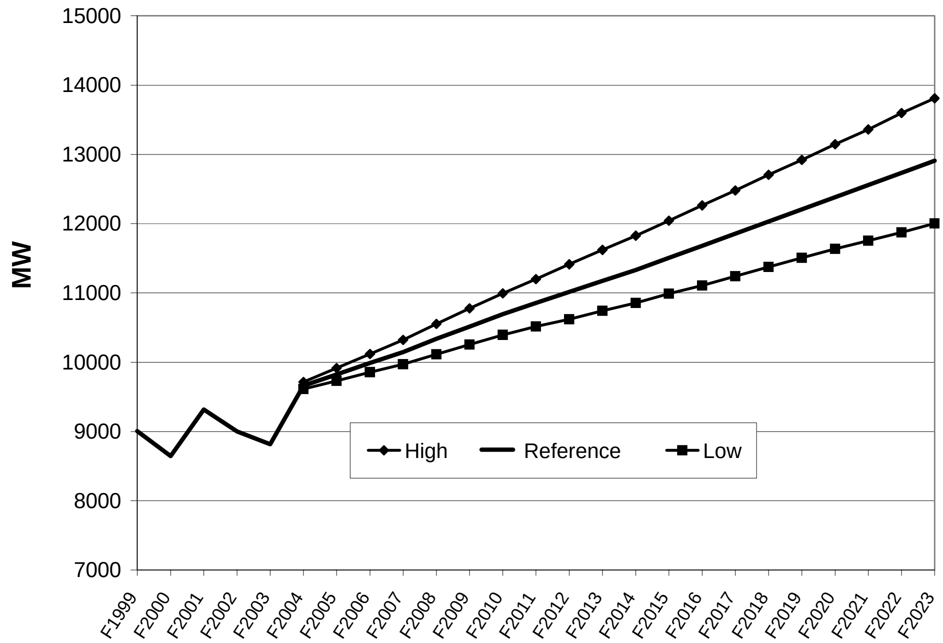
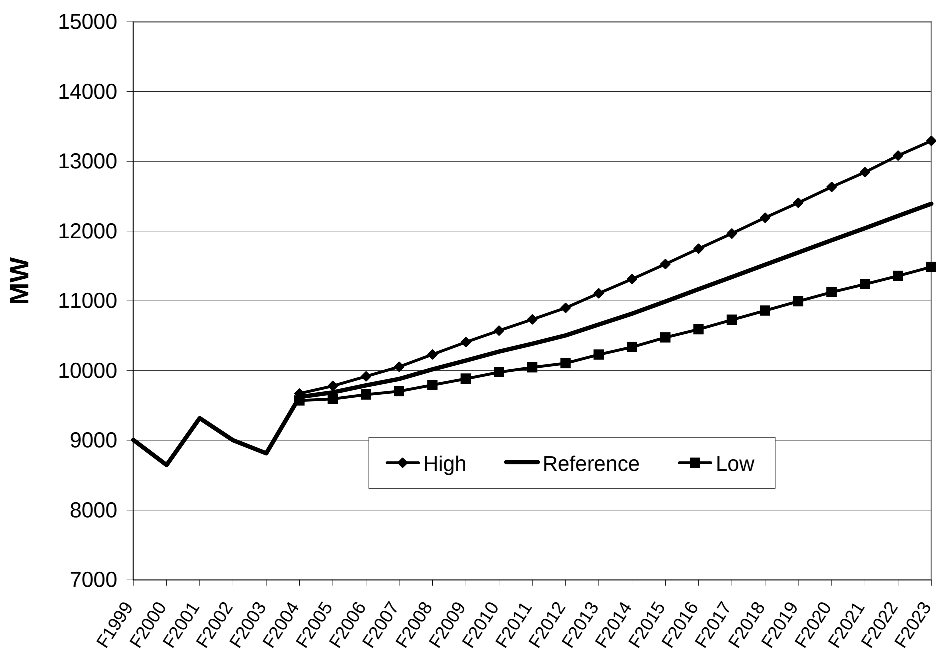


Figure 3.4. Integrated System Peak Demand After Power Smart (MW)



3.6.1. Sensitivity Analysis

BC Hydro's 2003 load forecast describes the methodologies developed to analyze the sensitivity of the load forecast to the key assumptions of GDP growth and electricity prices. This analysis is based on a range of demand elasticities associated with these factors. This is a scenario approach to examining load forecast uncertainty, in contrast to the probability distributions based on Monte Carlo analysis discussed above. Either approach can be applied to examining the implications of load forecast uncertainty in the IEP.

For example, varying the GDP growth rate assumptions (provided in Table 3.2) by plus or minus 50 per cent resulted in a plus or minus 6,148 GWh difference in the reference forecast by F2024. This was based on an elasticity of 0.42, which was estimated from econometric analysis of weather-adjusted energy consumption over the period 1993 to 2004. By comparison, the Monte Carlo analysis indicated a range of plus or minus 5,300 GWh between the high and low forecasts by F2024.

3.6.2. Potential New Large Industry

Several new large industries have been proposed in B.C., which adds load forecast uncertainty. These proposals require individual, site-specific assessment to determine the resources required (generation and transmission) to serve each large new load. Since these proposed new large industries remain uncertain from BC Hydro's perspective until service is requested, they are not included in the reference load forecast.

3.7. Comparison with 2002 Electric Load Forecast

The load forecast used for the 2003 IEP differs in some ways from the 2002 forecast. Figures 3.5 and 3.6 compare the 2003 load and peak forecasts used in the IEP with the 2002 load and peak forecasts.

Figure 3.5. 2002 Load Forecast vs. 2003 Load Forecast (GWh)

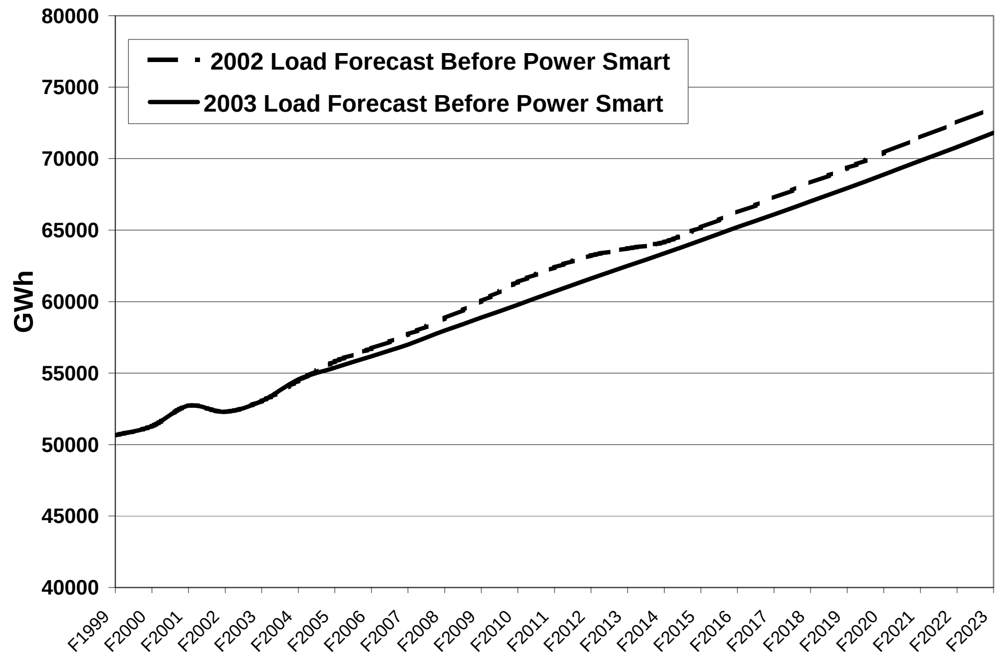
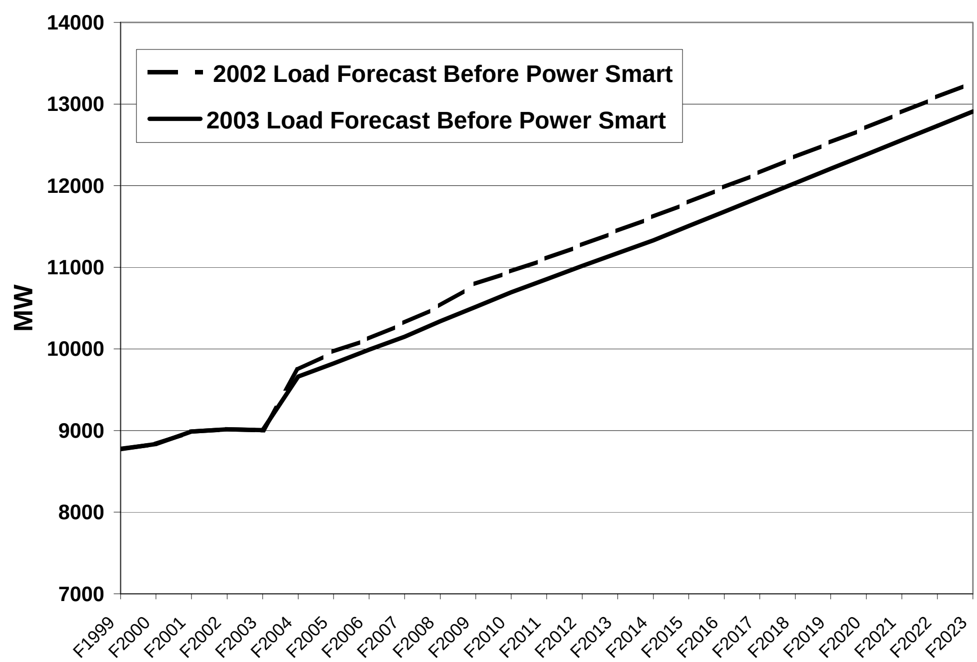


Figure 3.6. 2002 Peak Forecast vs. 2003 Peak Forecast (MW)



For all years except F2004, the 2003 forecast is lower than the 2002 forecast.

Residential sales are higher in the 2003 forecast for most of the forecast period but only until F2020. The main reason for the increase is that the residential use rate has been increasing due to the increased saturation of secondary appliances, as demonstrated by billing data analysis. A second factor driving growth is the increase in the forecast number of residential accounts due to forecasts of strong housing starts for the first four years. Beyond this period, account growth levels off, and is less strong than was assumed in the 2002 forecast as a result of lower population forecast growth, bringing down forecast residential sales in the later forecast years.

For commercial sales, the 2003 forecast is below the 2002 forecast by 200 GWh for F2004 and below the 2002 forecast by 1,670 GWh in F2023. A number of factors contribute to these changes:

- Slower than expected economic recovery;
- Increased Power Smart forecast (575 GWh of additional Power Smart savings have been allocated to the commercial sector by F2013); and
- Poorer future economic performance (Over the medium and long terms, declining growth rates for several of the macroeconomic indicators, including employment and GDP, have contributed to lower long-term growth rates for the commercial sector.).

For industrial sales, the 2003 forecast is above the 2002 forecast by 390 GWh for F2004 and above the 2002 forecast by 681 GWh in F2023. For F2004, the 2003 forecast is higher than the 2002 forecast for two reasons, mainly the fact that 2003 has been reanchored to the results from 2002, which were 634 GWh above the 2002 forecast.

It should be noted that the 2003 forecast uses a new methodology for forecasting industrial transmission account loads, which reduces bias in forecasting specific accounts and provides greater transparency to the forecast. The 2002 forecast used estimates of individual transmission accounts for the first half of the forecast period, with these implied growth rates projected for the second half of the forecast period. The 2003 forecast uses estimates of individual transmission accounts for only the first four years of the forecast with an econometric model based on GDP used for the remaining 17 years.

This change acknowledges that the value of specific account information and key account market intelligence diminishes over time in terms of providing relevant information about account growth. For example, while key account information and other market intelligence provides reasonable information on anticipated plant closures, information on new plants is often kept confidential for business reasons. This creates a bias in the use of individual account information for long periods. Compared to the 2002 forecast, the 2003 peak forecast is reduced in the short term to reflect economic conditions and is pushed out more than one year in the longer term. The following points are worth noting with respect to the peak forecast:

- The residential and commercial peak forecasts were revised downward for F2004 to reflect changes in the 2003 population and employment forecasts compared to 2002. A gradual recovery is projected to occur over the next five years, resulting in higher growth over the longer term, using F2003 as a base year.

- The industrial peak forecast has been updated to reflect restructuring occurring among B.C.'s resource-based industries. The forecast also includes the closing of a large copper mine in F2008.
- The reference peak forecast does not include any rate impacts from potential rate increases. Rate impacts are explored in sensitivity analyses or scenarios.
- The forecast is based on design temperatures of –6.8 degrees C. at Vancouver airport for the system and –4.4 degrees C. at Victoria airport for Vancouver Island. A review of the design temperatures is underway.

3.8. Regional Summary

Electricity demand in B.C. depends very much on the health of the economy, traditionally based on the extraction and processing of natural resources such as pulp and paper, minerals, forest products and fish. Service-based industries such as tourism, high tech and government services, however, have been contributing more to the economy in recent years. The southwestern portion of the province (Lower Mainland and Southern Vancouver Island) is the centre of this service-based economy, while the rest of the province depends more heavily on resource-based industries. The discussion that follows describes the primary drivers of electricity demand in BC Hydro's four planning regions.

The Lower Mainland includes Greater Vancouver, the Fraser Valley, the Sunshine Coast and Whistler. This part of the province has the most diverse economy and typically experiences more stable population and employment growth than the rest of the province. Because of the region's diversity, it is better able to endure the economic swings that affect the rest of the province during times of soft commodity prices.

A mix of resource- and service-based industries drives Vancouver Island's economy. As the provincial capital, Victoria, has a significant service sector. The central and northern part of the Island mainly depends on the forestry sector, with some mining, fishing and a growing aquaculture industry. The demand for electricity on Vancouver Island has been affected by ongoing weaknesses in the forestry industry and restructuring by the provincial government. The slight growth seen on Vancouver Island is driven by limited growth in sales to residential and general customers. Sales to large industrial and commercial customers are forecast to decline over the medium term.

The South Interior contains three transmission planning areas: Kelly/Nicola, East Kootenay and Selkirk. Although resource industries continue to dominate the economy of the region, a growing number of tourism and recreation facilities and an increasing population in the Okanagan are providing some diversity. The forecast for the South Interior is dominated by the anticipated closure of the Highland Valley Copper mine and smelter (in Kelly/Nicola) early in the next decade and continued weak sales to other resource industries.

The Northern Region is also divided into three transmission planning areas: North Coast, Peace Region and Central Interior. This part of B.C. is almost exclusively dependent on natural resources such as fish, lumber, pulp and paper, and, in the eastern part of the region, oil and gas. A forecast for strong sales to large industrial customers in the North is the main reason for the stronger sales growth rates to the region.

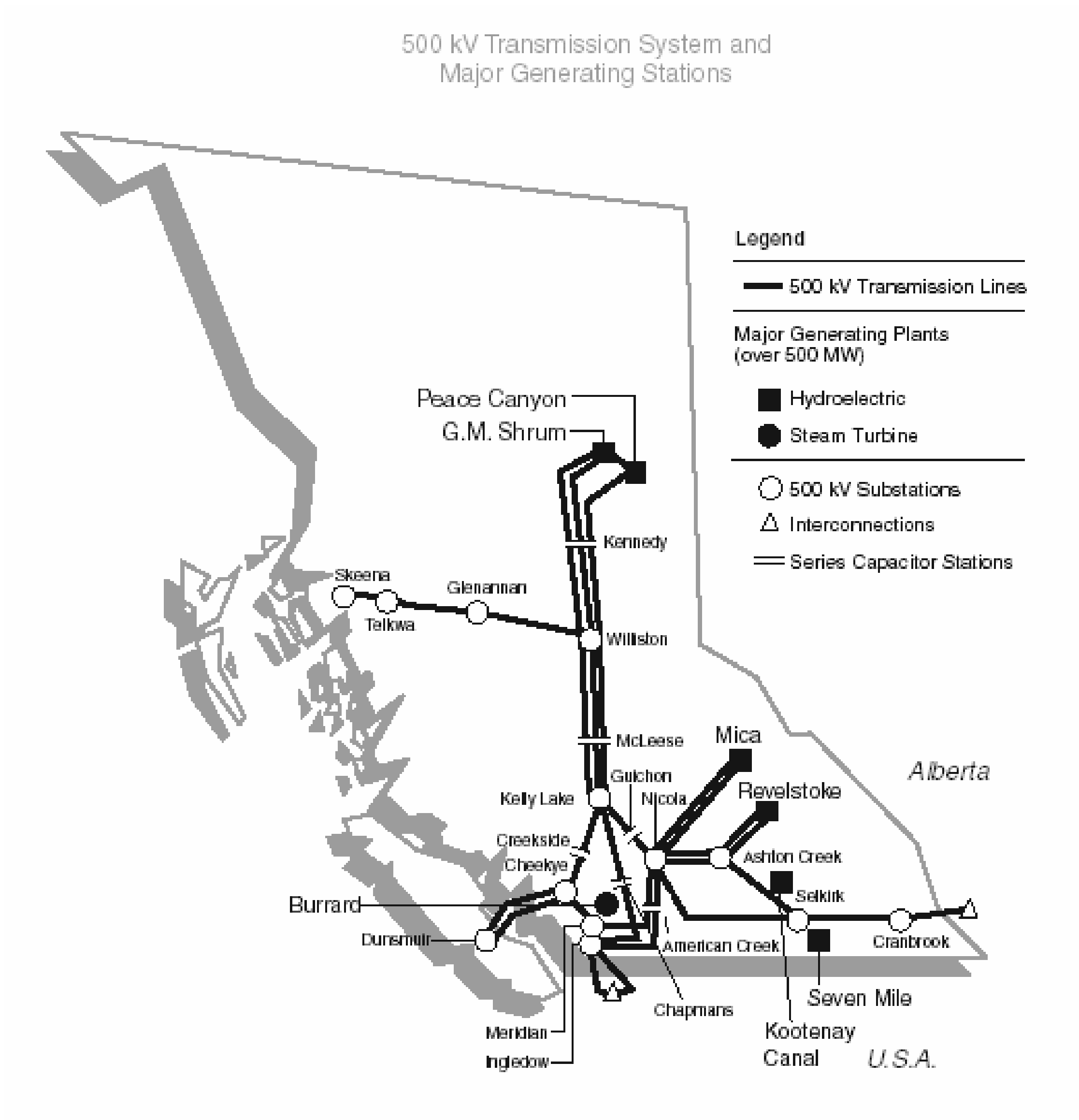
4 Existing Supply

BC Hydro delivers electricity mainly through an interconnected or integrated system of more than 74,000 kilometres of transmission and distribution lines. Figure 4.1 shows BC Hydro's major generating stations, major substations and the major transmission system.

Subsequent to the B.C. Energy Plan, generation resources are grouped into two broad categories:

- BC Hydro's Heritage resources; and
- Electricity purchase agreements with independent power producers (IPPs) and others.

Figure 4.1. BC Hydro System – Main Generating Plants & Transmission System



4.1. BC Hydro Heritage Resources

In November 2003, the B.C. government created a "Heritage Contract" through the *BC Hydro Public Power Legacy and Heritage Contract Act*. The purpose is to preserve the benefits of the existing hydroelectric and thermal resources for BC Hydro's customers.

The Heritage resources include the major hydroelectric stations on the Columbia and Peace rivers, which have multi-year storage reservoirs, and a number of small hydroelectric installations, which have limited or no storage capability. BC Hydro has 30 hydroelectric generation stations, 29 of which are in the integrated system. The Heritage resources also include three natural gas-fired thermal generating stations. The largest of these is the Burrard Thermal Generating Station in the Lower Mainland, comprising six natural gas-fired conventional steam units. Between 1995 and 2000, BC Hydro installed selective catalytic reduction equipment at Burrard to reduce nitrogen oxide emissions.

The Heritage thermal resources also include two smaller combustion turbine generating stations: Prince Rupert Generating Station, which uses natural gas as a primary fuel and diesel as a backup; and Fort Nelson Generating Station, which runs on natural gas. The Fort Nelson station is integrated with the northern Alberta grid but is not part of BC Hydro's integrated system.

4.1.1. Energy Capability of the Heritage Resources

Prior to the introduction of the Heritage Contract, BC Hydro assessed the reliability of energy supply based on the firm energy capability of available resources. The Heritage Contract has quantified the reliable supply from the heritage resources. Table 4.1 summarizes the reliable or "firm" energy capability of the generation resources owned by BC Hydro that are connected to the integrated system. The firm capability of the hydroelectric resources is the energy that is reliably available (i.e., equalled or exceeded) at any time during the historical analysis period. The firm energy capability of the BC Hydro hydroelectric system is currently estimated at 42,700 GWh.

Thermal resources include the Burrard (913 MW[4]) and the gas turbine generating station at Prince Rupert (46 MW). The energy capability of thermal resources is based on their installed capacity and the number of hours they are available to operate during the year, which considers fuel availability and the requirements for maintenance and forced outages. As a result, the firm energy capability of Burrard and Prince Rupert is estimated at 6,280 GWh per year. The total firm energy capability of BC Hydro's hydroelectric and thermal resources is estimated at 48,980 GWh per year, as shown in Table 4.1.

The Heritage Contract requires BC Hydro Generation to provide 49,000 GWh per year[5] to BC Hydro Distribution. Of this, 48,845 GWh per year will be supplied to the integrated system.[6] This is shown in Table 4.1 in the column titled "Reliable Supply."

[4] Net of its own energy requirements to run pumps.

[5] Less Skagit River Treaty Obligations.

[6] The remaining 155 GWh per year is from Fort Nelson Thermal Generating Station, which is in the non-integrated system.

The IEP is based on the assumption that no termination notice would be given under the Heritage Contract; thus the Heritage Contract would continue for at least the full 20-year planning horizon.

BC Hydro has assumed for portfolios where Burrard is phased out, the Heritage Resources could provide approximately 47,000 GWh per year, based on average water conditions. The reliable energy supply under low water conditions from Heritage Resources (without Burrard) would be 42,880 GWh per year, based on the firm energy capability of the Heritage hydro (42,700 GWh per year) and the firm energy capability of the remaining Heritage resource on the integrated system, Prince Rupert Thermal Generating Station (180 GWh per year).

Table 4.1. Average and Firm Energy Capability of the BC Hydro System

	Firm Energy (GWh per year)	Reliable Supply (GWh per year)
Hydroelectric	42,700	N/A
Thermal	6,280	N/A
Subtotal	48,980	N/A
Heritage Contract	N/A	49,000 GWh 48,845 GWh on integrated system

4.1.2. Dependable Capacity Contribution of the Heritage Resources

A key measure of the adequacy of supply is dependable capacity. Dependable capacity, measured in megawatts, is the amount that resources are capable of supplying to meet the instantaneous peak demand for electricity with a high level of confidence. Factors that may limit a plant's dependable capacity are external to the plant and may include streamflow conditions and reservoir elevations (which may restrict hydro capability), air temperature (which impacts thermal plant ratings), gas supply constraints or emission permits. The dependable capacity rating of a plant assumes that all units are in service. Therefore, it does not consider forced or planned outage rates, which affect plant availability. Outage rates are considered in loss-of-load analysis studies, which assess the system capacity reserve requirements.

BC Hydro's customers have first priority use of the dependable capacity associated with the Heritage resources. The dependable capacity of the BC Hydro hydroelectric system is 9,749 MW.

The dependable capacity of the Heritage thermal resources is 913 MW at Burrard, based on six units, and 46 MW at Prince Rupert. In December 1998, BC Hydro made an agreement with Terasen Gas Inc. (formerly BC Gas Utility Ltd.) for firm gas transportation to Burrard from the Sumas Hub on the Duke Energy pipeline (formerly Westcoast Energy). This allows BC Hydro to rely on Burrard as a supply of dependable capacity to meet system peak winter loads.

Because not all units at Burrard are expected to be needed over the near term for energy or for dependable capacity, only three units are currently available for generation. The current outlook is that BC Hydro will not require all six units until F2007. The government's decision on the Burrard MLA Review currently underway may also affect the future contribution of the plant.

4.1.3. Resource Smart

Since 1987, BC Hydro has had an ongoing program of investment at existing facilities to improve their output. Energy gains since the start of the program total 1,100 GWh per year. These gains are reflected in the calculation of the Heritage energy and the dependable capacity of the Heritage hydro resources discussed above. BC Hydro currently has two committed Resource Smart projects underway that will provide an additional 208 GWh of energy capability by F2006 but no new dependable capacity. These are at the G.M. Shrum and Cheakamus generating stations.

4.2. Electricity Purchase Agreements

BC Hydro's existing contracts with independent power producers (IPPs) represent approximately 8,000 GWh of energy per year and 800 MW of dependable capacity. These include existing IPP projects that are in service, some of which date as far back as the 1989 request for proposals and include natural gas cogeneration, biomass and small hydro projects. This total also includes Green[7] and customer-based generation projects for which BC Hydro has signed energy purchase agreements (EPAs) between 2000 and 2003. Some of these IPP projects are in service and some are under development. The estimated contribution from projects that are still under development includes an adjustment for attrition, based on experience with previous calls.

For planning purposes, BC Hydro uses the annual energy specified in the EPA for these projects as their firm or assured annual energy contribution. The dependable capacity estimated for these projects depends on the type of project. For thermal projects such as biomass or gas, dependable capacity is based on installed capacity. For small hydro projects that have been in service for a number of years, dependable capacity is based on operating experience. For newer small hydro projects, which are predominantly run-of-river projects with no water storage, the estimate of their dependable capacity is based on an estimate of their output capability during adverse streamflow conditions at the time of winter peak demand.

To date, most EPAs with IPP projects have been for projects in which BC Hydro pays for the contracted energy but does not control how much energy is generated at any particular time. These projects are referred to as non-dispatchable. Currently, the one exception is the Island Cogeneration Project (ICP). Within limits that ensure that the project meets its obligations to the cogeneration steam host, BC Hydro can dispatch ICP to meet system energy and capacity needs. For planning purposes, ICP's energy capability is 1,900 GWh per year but its expected annual dispatch may be less.

BC Hydro also purchases electricity from Alcan under the terms of the Long Term Energy Purchase Agreement (LTEPA) and from the Arrow Lakes hydro

[7] The term "Green" refers to energy resources that meet BC Hydro's definition of energy that is renewable, environmentally and socially responsible and licensable.

project. For long-term planning purposes, Alcan provides 140 average MW from its Kemano I hydroelectric project. This equates to 1,225 GWh of energy per year and 147 MW of dependable capacity (based on a 95 per cent capacity factor). The operation of the Arrow Lakes hydro project is determined by the requirements of the Columbia River Treaty. Therefore, BC Hydro and the project owners (Arrow Lakes Power Development Corporation) have established an entitlement agreement in which BC Hydro takes delivery of the output of the plant and the owners receive an annual energy entitlement. For long-term planning purposes, BC Hydro includes the energy capability of the Arrow Lakes project on the basis of the entitlement energy, 772 GWh per year. Arrow Lakes contributes an estimated 120 MW of dependable capacity.

Tables 6.1 and 6.2 provide further details. For the purposes of the IEP, BC Hydro assumes that these projects will continue to supply electricity upon the expiry of their current contracts, given that the projects are expected to be available and producing energy. The exception is woodwaste projects, which are not included in existing supply beyond the end of their contract because their fuel supply is uncertain.

4.3. Planned New Resources Based on Current Programs

BC Hydro has three programs underway that are expected to contribute new resources to the BC Hydro demand-supply outlook over the next 10 years. These are the current Power Smart 2, additional planned Resource Smart, and the Vancouver Island call for tenders. These are discussed here and included in the demand-supply outlook, and are evaluated in Part 6.

4.3.1. Power Smart

BC Hydro’s current Power Smart Program, Power Smart 2 was initiated in 2001, with a goal of reducing customer annual energy demand by 3,500 GWh per year over a 10-year period. Power Smart reduces customer requirements for energy, which also reduces peak demand. The load forecast, discussed in Section 3, is presented before and after the impact of the expected savings associated with Power Smart 2. When comparing the forecast before Power Smart 2 to the forecast after Power Smart 2, the difference in gross system energy requirements for the integrated system is the reduction in energy savings at the customer’s meter plus avoided transmission and distribution system losses. As shown in Table 6.1, the comparison of the forecast before and after Power Smart 2 indicates that gross system energy requirements are reduced by 3,516 GWh per year as of F2012. This is the incremental contribution from Power Smart 2 from F2004 onward. Power Smart 2 savings before F2004 are reflected in the 2003 forecast before Power Smart 2.

BC Hydro has also estimated the reduction in peak demand attributable to Power Smart energy savings and incorporated it into the peak demand forecast after Power Smart 2. A comparison of the 2003 peak demand forecast before and after Power Smart 2 indicates a peak demand reduction of 514 MW as of F2012. Part 3 of the IEP provides further details on Power Smart 2.

4.3.2. Resource Smart

BC Hydro is currently planning to pursue additional Resource Smart projects that would contribute an additional 488 GWh per year by F2013. These projects would provide additional energy capability and are discussed in Part 3 of the IEP, Resource Options.

Along with their incremental energy contributions, some Resource Smart projects will increase the dependable capacity at existing hydroelectric generating plants, which adds 51 MW by F2012. This includes 13 MW on Vancouver Island by F2007.

4.3.3. Vancouver Island Call for Tenders

In October 2003, BC Hydro announced a call for tenders for between 150 MW and 300 MW of new dependable capacity on Vancouver Island, to be in service by the fall of 2007. This call is to address the shortfall in dependable supply to Vancouver Island expected by that year. This call is expected to result in 1,200 to 2,100 GWh per year of additional system energy.

5 Planning Criteria

BC Hydro plans its system to ensure the reliable supply of electricity to its customers at least cost, applying four considerations:

- A generation capacity reliability planning criterion;
- A generation energy reliability planning criterion;
- Economic advancement; and
- Transmission planning criteria.

The first two criteria are used to evaluate when generation resources are required to maintain the reliable supply of electricity. In applying its reliability criteria, BC Hydro considers both the peak demand and the annual energy demand on its electrical system. The generation capacity reliability planning criterion ensures that sufficient resources are acquired to provide a high reliability of serving the annual peak demand. The energy reliability planning criterion ensures that sufficient resources are available to satisfy the annual energy requirements of the system. Both criteria aim to ensure that the resources available to BC Hydro are adequate to meet customer demand.

Electricity plans may also identify opportunities to advance acquisitions of new resources ahead of reliability requirements to take advantage of economic benefits. The economic criteria consider the merits of advancing resources ahead of need.

BCTC applies the transmission planning criteria to the planning of the transmission system. These criteria aim to ensure that the transmission system is secure and adequate to serve customer demand.

5.1. Generation Capacity Reliability Planning Criterion

The capacity planning criterion is intended to ensure there is adequate dependable generation capacity to meet peak demand. It is based on the reliability planning guidelines of the Western Electricity Coordinating Council (WECC), which recommends that utilities carry sufficient dependable capacity reserves to allow them to withstand temporary outages of individual generating units. BC Hydro, like most other North American utilities, has adopted the *loss-of-load probability* criterion. This criterion assesses the probability of simultaneous outages of generating units creating a shortfall of supply capacity to meet demand in any hour over the year. BC Hydro has applied this criterion by adopting a one-day-in-ten-years allowable risk of not serving its entire load.

For the BC Hydro system as a whole, this criterion requires dependable capacity supply to exceed peak demand by about 14 per cent. This criterion was derived from detailed loss-of-load studies of the existing BC Hydro system, taking into consideration the forced outage rates and planned maintenance schedules for generation on the system, including IPP generation. The analysis considers the age, type and size of generating units. However, BC Hydro is interconnected with other utilities in Alberta and in the U.S., and the likelihood that capacity supplies on all systems would be in short supply simultaneously is low. Therefore, BC Hydro considers that up to 400 MW of its capacity planning reserves could be obtained reliably from neighbouring control areas when needed.

5.2. Generation Energy Reliability Planning Criterion

The energy reliability planning criterion is a physical criterion intended to ensure that sufficient generation resources are available to satisfy BC Hydro's annual energy requirements. This criterion is used to determine when new firm energy resources must be added. It is applied by comparing the reference energy demand forecast to the firm energy capability of BC Hydro's owned and contracted resources plus 2,500 GWh per year of non-firm imports. BC Hydro could rely on up to this amount of non-firm imports with a high degree of confidence during periods of low water conditions on the BC Hydro system.

In 1984, BC Hydro started relying on imports by including an additional block of "other" energy on a probabilistic basis from non-firm energy sources such as energy purchases from Alcan, TransAlta and the U.S. Though these resources were considered non-firm, BC Hydro assumed that in low water conditions there was a high probability that they could provide a firm energy equivalent of 1,500 GWh per year. In 1985, a probabilistic analysis indicated that in low water conditions BC Hydro could expect a greater availability of non-firm resources. BC Hydro accordingly increased its reliance on non-firm energy resources to 2,200 GWh per year. The 1995 IEP used a value of 2,500 GWh per year to reflect various new factors, including increased liquidity in the electricity markets in neighbouring jurisdictions. Although the liquidity of the electricity markets has continued to increase since 1995, there are a number of uncertainties about the extent to which BC Hydro can access that energy:

- Transmission constraints in neighbouring jurisdictions may limit the delivery of energy to the BC border, particularly during heavy load hours;
- Additional users of the BC interties with Alberta and the U.S. may limit BC Hydro access to those interties; and
- Minimum generation constraints on the BC Hydro system affect the ability to import, particularly during light load periods.

For these reasons, relying on non-firm imports beyond 2,500 GWh per year needs further study. However, the 2,500 GWh per year limit on non-firm imports does not affect the IEP portfolio evaluation because of the economic benefits associated with advancing resources, as explained below.

5.3. Economic Advancement

BC Hydro assesses the merits of acquiring resources in advance of reliability requirements if it is economic to do so. Acquiring new resources with lower capital, fixed and variable costs than the fixed and variable costs of existing resources will generally lower the net present value (NPV) of the portfolio costs.

A set of portfolios is included in Part 6 that compares the NPV of portfolios with different levels of reliance on market energy. The results indicate that energy self-sufficiency can provide a least cost schedule of new resources. Self-sufficiency means that BC Hydro can reliably meet its customer demand (domestic load and firm imports) under low water conditions without relying on energy purchases from neighbouring jurisdictions.

Scheduling resources for self-sufficiency also enhances BC Hydro's ability to manage its financial risk during periods of adverse water conditions. The annual energy capability of the BC Hydro system varies significantly from year to year due to water conditions. As well, water conditions in B.C. and the Pacific North-west impact the market price of electricity. Therefore, even though the flexibility in the reservoir system can be used to minimize required purchases during high-price periods, BC Hydro needs to limit its reliance on market purchases during periods of adverse water conditions, in order to manage the financial risks associated with market price volatility. As a result, the remaining portfolios in Part 6 are scheduled on the basis of achieving energy self-sufficiency.

5.4. Transmission Planning Criteria

The British Columbia Transmission Corporation (BCTC) is responsible for planning the transmission system. The need for future reinforcements of the bulk transmission system and the nature of these reinforcements are primarily driven by the following factors:

- Power transfer capability requirements (amount of power that can be reliably transferred over a particular section of a transmission system);
- Location and size of new generation resources;
- Expected retirement of existing transmission elements;
- Demand for wholesale transmission access; and
- Economic benefits of reducing transmission losses (for both capacity and energy).

The electrical system is planned and operated to meet certain steady state and dynamic performance standards under various single or multiple failures, such as the loss of a major system component. In particular, the transmission system is planned and operated in accordance with the industry-wide standards defined by the North American Electric Reliability Council (NERC) and the WECC. One of the key requirements is that the system should be able to withstand a severe short circuit and outage of any single element (such as a transmission line, cable circuit, generator or transformer) under any system condition. There should be no loss of customer load or cascading outages of other system elements. Furthermore, any resultant variation in voltage or frequency must be within acceptable limits. This reliability standard governs the planning and operations of the integrated system.

Generally, in planning the transmission system, this reliability standard is met by applying the “single-contingency planning criterion”, under which firm supply must serve demand with the largest element out of service. This provides good long-term system performance as long as the remaining elements have a high level of availability.[8]

[8] Certain areas where providing redundancy would be extremely costly do not reach this level of reliability. These areas are evaluated on a case-by-case basis taking into consideration the actual system performance in that area. For example, the North Coast area is served by a single 500 kV line, which would be extremely costly to duplicate.

6 The Need for New Resources

The need for new resources is examined from both the system perspective and the regional perspective. Section 6.1 discusses the system demand-supply balance. Section 6.2 discusses regional requirements.

6.1. System Requirements

Figure 6.1 depicts the integrated system energy demand-supply balance. The 2003 forecasts before and after Power Smart 2 are included. Energy supplies include:

- The Heritage energy (48,845 GWh per year) plus the additional 208 GWh per year from Resource Smart projects that are currently underway;
- Existing purchase contracts, which include all projects for which BC Hydro has an EPA (approximately 8,000 GWh per year); and
- The energy contribution from the current programs (488 GWh per year from Resource Smart and 1,200 GWh per year from the Vancouver Island call for tenders).

Based on the reference forecast before Power Smart 2, demand exceeds firm energy capability by F2007. Based on the reference forecast after Power Smart 2 and including the contribution of planned new resources, demand exceeds supply in F2013. Details of the energy demand-supply balance, including high and low forecasts, are also provided in Table 6.1.

Figure 6.2 depicts the integrated system dependable capacity demand-supply balance. The 2003 forecasts before and after Power Smart 2 are included. For ease of presentation, planning reserves[9] are added to the peak demand forecast. Dependable capacity supplies include:

- The dependable capacity available from Heritage hydroelectric resources (9,749 MW);
- The dependable capacity available from Heritage thermal resources (including three units at Burrard until F2006 and six units thereafter, and also including 46 MW from Prince Rupert Generating Station);
- Existing EPAs (estimated at 828 MW by F2007); and
- Planned additions from current programs and initiatives (additional Resource Smart and the Vancouver Island call for tenders at 51 MW and 150 MW, respectively).

Based on the reference forecast before Power Smart 2, peak demand exceeds dependable capacity supply in F2006 if only three units are available at Burrard. If the other three units at Burrard are available, supply would exceed demand until F2009. Based on the reference forecast after Power Smart 2, and including the contribution of current supply programs, demand exceeds supply in F2013. The details, including high and low forecasts, are provided in Table 6.2.

[9] Based on BC Hydro's capacity reliability criterion, planning reserves have been calculated as 14 per cent of dependable capacity supply, excluding the 147 MW from Alcan, less the 400 MW allowance for reliance on the market at the time of need. The supply from Alcan includes reserves.

Figure 6.1. BC Hydro Integrated System Energy Demand/Supply Balance (GWh)

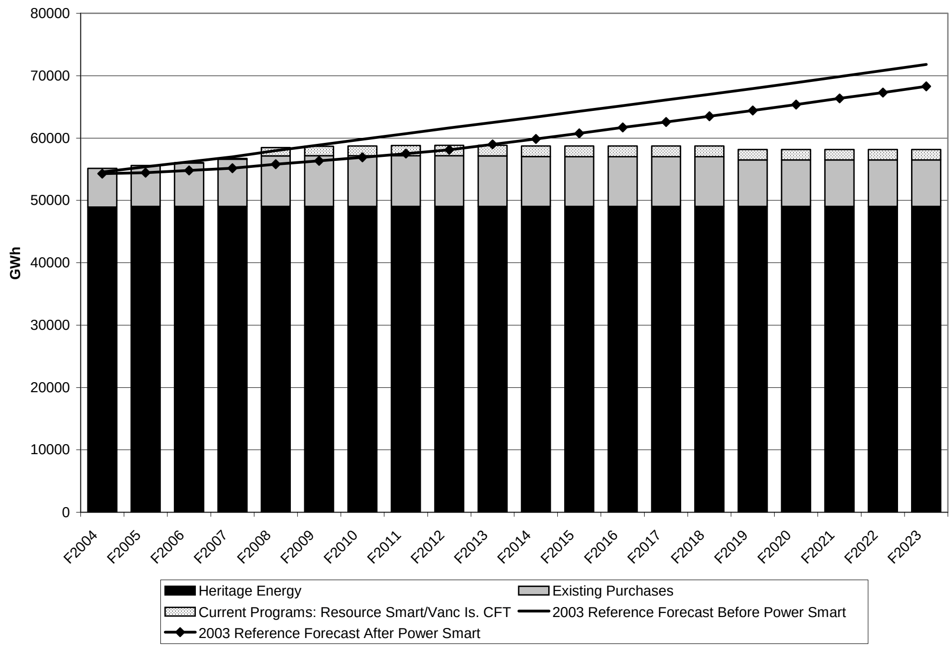
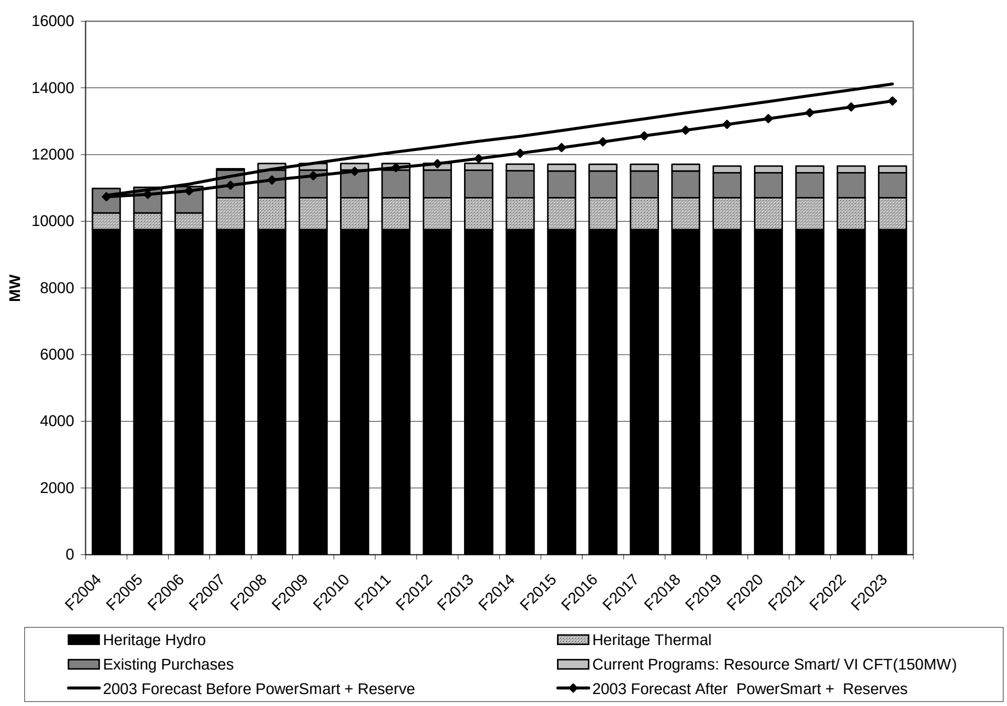


Figure 6.2. BC Hydro Integrated System Dependable Capacity Demand/Supply Balance (MW)



6.2. Regional Transmission Issues

B.C. has a regional imbalance between the location of generation supply and the location of customer demand. Because of large hydroelectric developments along the Peace and Columbia rivers, most of the generation supply in the BC Hydro system is located in the Southern Interior and Northern regions while the greatest load occurs in the Lower Mainland and on Vancouver Island.

The regional disparity between supply and demand has implications for the transmission infrastructure needed to maintain a working system. As the load increases and the transmission system equipment ages, BCTC must continue to ensure reliable supply. Existing or emerging constraints on the transmission system need to be considered in the 2004 IEP. These include constraints on Vancouver Island, the North Coast (Central Interior to the North Coast), the Southern Interior (if new generation is added in that region) and in supplying the Lower Mainland from the Interior.

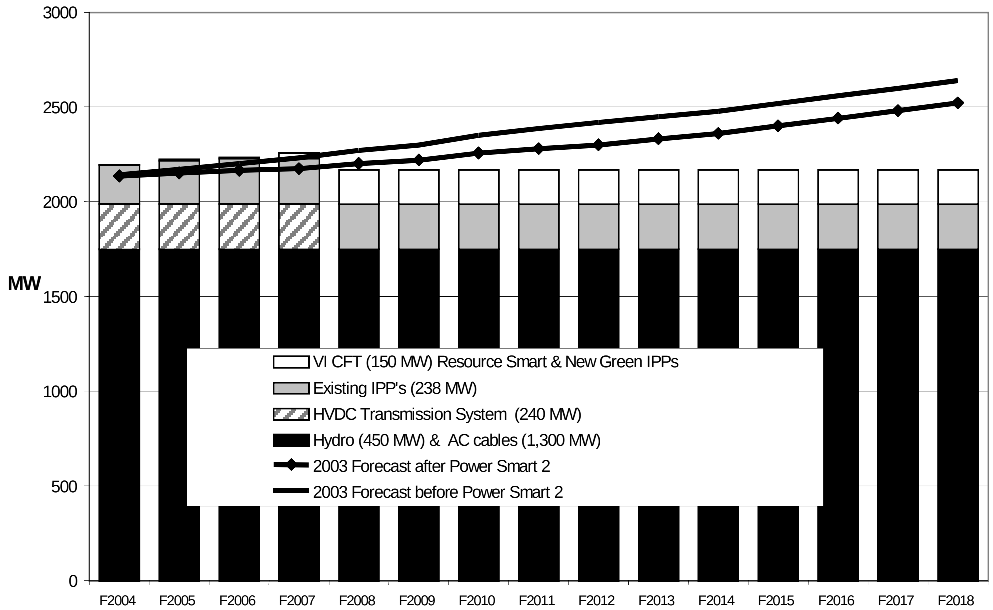
6.2.1. Vancouver Island Requirements

Most of Vancouver Island's electricity needs are served by submarine transmission interconnections from the Mainland. Future supply requirements are driven by regional load growth and the planned retirement of the high voltage direct current (HVDC) transmission interconnection to the Island which is nearing the end of its service life. For planning purposes the HVDC system is expected to be retired as of F2008 (fall of 2007). As of that date the HVDC system's dependable capacity will be zero, reducing dependable supply to the Island by 240 MW.

Vancouver Island regional supply is planned in accordance with the single-contingency criterion under which dependable supply must serve demand with the largest element out of service. For Vancouver Island, the largest element is one of the two 500 kV submarine transmission circuits. Figure 6.3 provides the Vancouver Island dependable capacity balance based on the demand forecast. New capacity supply is required as of F2008 to ensure Vancouver Island supply is reliable.

BC Hydro is pursuing the Vancouver Island call for tenders to acquire at least 150 MW of new dependable capacity supply on the Island by F2008 to address this capacity shortfall. Figure 6.3 includes 150 MW from the call for tenders, 13 MW from Resource Smart and an estimated 18 MW from existing IPPs. On this basis, and including the impact of Power Smart, there would still be approximately a 30 MW shortfall in F2008.

Figure 6.3. Vancouver Island Dependable Capacity Demand-Supply Balance (MW)



6.2.2. North Coast Requirements (Central Interior to North Coast)

The North Coast region is served by a highly reliable single 500 kV transmission line and some local generation, including purchases from Alcan under the Long Term Energy Purchase Agreement (LTEPA). This region does not meet the single-contingency reliability criterion, since providing redundant transmission supply would be very costly. BC Hydro continues to assess the reliability of supply to the North Coast and opportunities to improve it.

6.2.3. Lower Mainland Requirements (Southern Interior to Kelly/Nicola to Lower Mainland)

Strong demand growth in the Lower Mainland and Vancouver Island and the development of new generation in the Interior has pushed the Interior-to-Lower Mainland 500 kV transmission lines toward their limits. In the short term, terminal equipment and series capacitor banks can be upgraded to increase the limits. Over the long term, new 500 kV lines will be needed if generation is added in the Interior to meet growing load in the Lower Mainland and the Island. Part 6 of the IEP examines alternatives such as building generation close to the Vancouver Island/Lower Mainland load centre or building generation in the Interior and reinforcing the Interior-to-Lower Mainland transmission system.

6.2.4. Southern Interior Requirements (Selkirk Area to Kelly/Nicola)

Resource additions in the Southern Interior may require transmission reinforcements in the Selkirk (near Trail) to Kelly (near Clinton)/Nicola (near Kamloops) area, depending on the specific location of the generation. The IEP portfolios that include new generation in the Southern Interior also include these incremental transmission requirements.

Table 6.1. Integrated System: Energy Demand/Supply Balance (GWh)

(GWh)	F2003	F2004	F2005	F2006	F2007	F2008	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	F2019	F2020	F2021	F2022	F2023
Demand-Supply Outlook based on Forecast Before Power Smart 2:																					
2003 ReferenceLoad Forecast before Power Smart2	**53,050 (actual)**	54,563	55,375	56,180	56,990	57,977	58,884	59,783	60,716	61,620	62,504	63,372	64,284	65,210	66,095	67,010	67,932	68,878	69,861	70,813	71,805
High Forecast Before Power Smart 2		54,856	55,904	56,912	57,967	59,178	60,357	61,462	62,657	63,835	65,007	66,147	67,282	68,458	69,572	70,762	71,899	73,129	74,322	75,613	76,819
Low Forecast Before Power Smart 2		54,278	54,859	55,442	55,987	56,720	57,426	58,118	58,825	59,399	60,089	60,705	61,402	61,998	62,666	63,347	64,039	64,730	65,392	66,029	66,768
Heritage Resources		48,845	48,845	48,845	48,845	48,845	48,845	48,845	48,845	48,845	48,845	48,845	48,845	48,845	48,845	48,845	48,845	48,845	48,845	48,845	48,845
Committed New Resource Smart		81	185	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208
Purchases:																					
Pre-2000 Energy Purchase Agreements		5,783	5,631	5,914	5,912	5,912	6,012	6,012	6,012	6,012	5,990	5,923	5,923	5,923	5,923	5,923	5,378	5,378	5,378	5,378	5,378
2000 Expressions of Interest for Green Energy		33	149	149	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
2001 Green Energy Call		197	510	588	600	606	606	606	606	606	606	606	606	606	606	606	606	606	606	606	606
2002 Customer Based Generation		195	264	266	303	329	265	265	265	265	265	223	201	201	201	201	201	201	201	201	201
2002 Green Power Generation			14	53	580	1,096	1,096	1,096	1,096	1,096	1,096	1,096	1,096	1,096	1,096	1,096	1,096	1,096	1,096	1,096	1,096
Total Purchases		6,209	6,569	6,971	7,533	8,081	8,117	8,117	8,117	8,117	8,095	7,986	7,965	7,965	7,965	7,965	7,420	7,420	7,420	7,420	7,420
Total Existing &Committed Supply		55,135	55,599	56,024	56,586	57,134	57,170	57,170	57,170	57,170	57,148	57,039	57,018	57,018	57,018	57,018	56,473	56,473	56,473	56,473	56,473
Supply minus Reference Forecast Before Power Smart 2		**573**	**224**	**-157**	**-404**	**-843**	**-1,713**	**-2,613**	**-3,546**	**-4,450**	**-5,356**	**-6,333**	**-7,266**	**-8,192**	**-9,078**	**-9,992**	**-11,459**	**-12,405**	**-13,388**	**-14,340**	**-15,333**
Supply minus High Forecast Before Power Smart 2		279	-305	-888	-1,381	-2,044	-3,186	-4,292	-5,487	-6,665	-7,859	-9,108	-10,265	-11,440	-12,554	-13,745	-15,426	-16,656	-17,849	-19,140	-20,346
Supply minus Low Forecast Before Power Smart 2		857	740	581	599	414	-256	-948	-1,654	-2,229	-2,941	-3,666	-4,384	-4,981	-5,648	-6,329	-7,566	-8,258	-8,919	-9,556	-10,296
Demand Supply Outlook Based on Forecast After Power Smart 2 and Planned Contribution from Current Programs:																					
2003 Load Forecast after Power Smart 2		54,282	54,447	54,805	55,170	55,787	56,350	56,911	57,508	58,105	58,988	59,855	60,768	61,694	62,580	63,494	64,415	65,361	66,345	67,297	68,289
High Forecast after Power Smart 2		54,574	54,975	55,534	56,145	56,984	57,816	58,582	59,440	60,307	61,480	62,618	63,754	64,928	66,043	67,235	68,371	69,599	70,793	72,084	73,291
Low Forecast after Power Smart 2		53,997	53,929	54,065	54,166	54,527	54,886	55,237	55,607	55,871	56,562	57,175	57,873	58,469	59,137	59,820	60,510	61,201	61,863	62,498	63,241
Reduction in energy requirements due to Power Smart 2 (difference between forecast before and after Power Smart)		280	928	1,375	1,820	2,190	2,534	2,872	3,208	3,515	3,517	3,517	3,516	3,516	3,516	3,516	3,517	3,517	3,516	3,516	3,516
Vancouver Island Call For Tender (minimum 1200 GWh)						1,100	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Resource Smart				8	147	229	293	345	417	463	488	488	488	488	488	488	488	488	488	488	488
Planned New Supply from current progams:				8	147	1,329	1,493	1,545	1,617	1,663	1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688
Total Supply (Existing + Planned)		55,135	55,599	56,032	56,733	58,463	58,663	58,715	58,787	58,833	58,836	58,727	58,706	58,706	58,706	58,706	58,161	58,161	58,161	58,161	58,161
Total Supply minus Forecast After Power Smart 2		**853**	**1,152**	**1,226**	**1,563**	**2,676**	**2,314**	**1,804**	**1,279**	**729**	**-151**	**-1,128**	**-2,062**	**-2,988**	**-3,874**	**-4,788**	**-6,255**	**-7,200**	**-8,184**	**-9,136**	**-10,128**
Total Supply minus High Forecast After Power Smart 2		561	624	497	588	1,479	847	134	-653	-1,473	-2,644	-3,891	-5,048	-6,222	-7,337	-8,529	-10,211	-11,439	-12,632	-13,924	-15,130
Total Supply minus Low Forecast After Power Smart 2		1138	1670	1967	2567	3936	3778	3479	3180	2962	2274	1552	832	237	-431	-1114	-2350	-3041	-3702	-4338	-5080

Notes:

Table is based on resource energy capabilities for long-term resource planning purposes and therefore does not reflect the detailed operating plans developed to F2006, which is the basis of the Revenue Requirement Application.

Energy load forecast is total integrated system gross requirement, which includes losses but excludes load in the non-integrated areas.

Energy savings achieved by Power Smart 2 prior to F2004 are included in the Forecast Before Power Smart 2.

The volumes in this table are slightly less than shown in Table 4-11 of the Revenue Requirements Application because BC Hydro purchases small amounts of energy (approximately 20 to 25 GWh per year from neighbouring utilties to serve BC Hydro customers in areas lacking direct connections to BC Hydro facilities. These amounts are reflected in Table 4-11, but not in Table 4-4 of the Revenue Requirements Application.

For the 2000, 2001Green calls and 2002 Customer-Based Generation call, some are in-service and some are under development; all have signed Energy Purchase Agreements.

For the 2002 Green Power Generation program, all have signed Energy Purchase Agreements. Contribution reflects expected attrition.

For planning purposes, the contribution from IPP contracts is extended beyond their contact end date since the projects will continue to exist, except for woodwaste IPP projects, which may have fuel supply uncertainties.

VI CFT initiated Fall 2003.

Some columns may not add due to rounding error.

Table 6.2. Integrated System: Dependable Capacity Demand/Supply Balance (MW)

	F2003	F2004	F2005	F2006	F2007	F2008	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	F2019	F2020	F2021	F2022	F2023
Demand-Supply Outlook based on Forecast Before Power Smart:																					
2003 Reference Load Forecast before Power Smart 2	**8,816 (actual)**	9,662	9,823	9,989	10,148	10,338	10,514	10,693	10,853	11,016	11,175	11330	11506	11681	11856	12031	12207	12382	12557	12732	12908
High Forecast		9,714	9,917	10,119	10,322	10,552	10,777	10,994	11,200	11,412	11,622	11,827	12,042	12,263	12,480	12,705	12,919	13,146	13,359	13,595	13,809
Low Forecast		9,611	9,731	9,858	9,970	10,114	10,254	10,395	10,515	10,619	10,743	10,854	10,990	11,106	11,241	11,374	11,507	11,636	11,754	11,872	12,002
SUPPLY																					
Heritage Resources (a)		10252	10252	10252	10708	10708	10708	10708	10708	10708	10708	10708	10708	10708	10708	10708	10708	10708	10708	10708	10708
Purchases:																					
Pre-2000 Energy Purchase Agreements		676	696	711	711	711	711	711	711	711	709	702	702	702	702	702	647	647	647	647	647
2000 Expressions of Interest for Green Energy		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2001 Green Energy Call		14	23	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
2002 Customer Based Generation		41	41	41	42	42	42	42	42	42	42	29	23	23	23	23	23	23	23	23	23
2002 Green Power Generation			2	9	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
Total Existing Purchases: (b)		733	765	788	828	828	828	828	828	828	825	806	800	800	800	800	745	745	745	745	745
Total Existing Supply (a) + (b)		10985	11017	11040	11536	11536	11536	11536	11536	11536	11533	11514	11508	11508	11508	11508	11453	11453	11453	11453	11453
Planning Reserves (see note)		1117	1122	1125	1194	1194	1194	1194	1194	1194	1194	1191	1191	1191	1191	1191	1183	1183	1183	1183	1183
Total Existing Supply Less Planning Reserves		9868	9895	9915	10341	10341	10341	10341	10341	10341	10339	10322	10318	10318	10318	10318	10270	10270	10270	10270	10270
Capacity Balance Based on Reference Forecast before Power Smart 2		**206**	**72**	**-74**	**193**	**3**	**-173**	**-352**	**-512**	**-675**	**-835**	**-1008**	**-1188**	**-1363**	**-1538**	**-1714**	**-1936**	**-2111**	**-2287**	**-2462**	**-2637**
Capacity Balance based on High Forecast		**154**	**-22**	**-204**	**19**	**-211**	**-436**	**-652**	**-859**	**-1071**	**-1283**	**-1504**	**-1725**	**-1945**	**-2162**	**-2387**	**-2649**	**-2876**	**-3088**	**-3325**	**-3538**
Capacity Balance based on Low Forecast		**256**	**164**	**57**	**372**	**227**	**87**	**-54**	**-174**	**-278**	**-403**	**-531**	**-672**	**-788**	**-923**	**-1056**	**-1236**	**-1366**	**-1483**	**-1602**	**-1732**
Demand-Supply Outlook Based on Forecast After Power Smart 2 and currently planned programs:																					
2003 Reference Load Forecast After Power Smart 2		9,620	9,687	9,787	9,881	10,017	10,144	10,274	10,385	10,502	10,660	10816	10991	11166	11342	11517	11692	11867	12043	12218	12393
High Forecast After Power Smart 2		9,672	9,781	9,917	10,055	10,232	10,407	10,574	10,732	10,898	11,108	11312	11528	11748	11965	12191	12405	12632	12844	13081	13294
Low Forecast After Power Smart 2		9,570	9,595	9,656	9,702	9,793	9,884	9,976	10,046	10,105	10,228	10339	10475	10591	10726	10859	10992	11122	11239	11358	11488
Power Smart 2 Peak Reductions (difference between Forecast Before and Forecast After PS)		41	136	202	267	321	371	420	469	514	514	514	514	514	514	514	514	514	514	514	514
Vancouver Island Call for Tender (minimum)						150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Resource Smart					39	43	43	43	47	51	51	51	51	51	51	51	51	51	51	51	51
New Supply Less 14% Planning Reserves					34	166	166	166	169	173	173	173	173	173	173	173	173	173	173	173	173
Total Supply Less Planning Reserves:		9868	9895	9915	10375	10507	10507	10507	10511	10514	10512	10495	10491	10491	10491	10491	10443	10443	10443	10443	10443
Capacity Balance Based on Reference Forecast After PS2		**247**	**208**	**128**	**494**	**490**	**363**	**234**	**126**	**12**	**-148**	**-321**	**-501**	**-676**	**-851**	**-1026**	**-1249**	**-1424**	**-1599**	**-1775**	**-1950**
Capacity Balance based on High Forecast After PS2		**195**	**114**	**-2**	**320**	**276**	**100**	**-66**	**-221**	**-384**	**-595**	**-817**	**-1037**	**-1258**	**-1475**	**-1700**	**-1962**	**-2188**	**-2401**	**-2638**	**-2851**
Capacity Balance based on Low Forecast After PS2		**298**	**300**	**259**	**673**	**714**	**624**	**532**	**464**	**409**	**284**	**156**	**15**	**-101**	**-236**	**-369**	**-549**	**-679**	**-796**	**-914**	**-1044**

Notes

Dependable Capacity: MW available to meet peak demand with high level of confidence

Planning Reseves: 14% of total dependable capacity(excluding Alcan 147MW) less 400MW from market. (Alcan 147MW contract includes reserves)

Capacity Balance = Total Dependable capacity supply less planning reserves minus forecast demand.

Peak Demand forecast is total integrated system gross requirement which includes losses but excluded load in the non-integrated areas

Peak Demand reductuions due to Power Smart 2 prior to F2004 are included in the Forecast Before Power Smart 2

For the 2000, 2001 Green calls and 2002 Customer Based Generation Call, some are in-service and some are under development.; all have signed Energy Purchase Agreements.

For the 2002 Green Power Generation program, all have signed Energy Purchase Agreements. Contribution reflects expected attrition.

For planning purposes the contribution from IPP contracts is extended beyond their contact end date since the projects will continue to exist; except for woodwaste IPP projects which may have fuel supply uncertainties.

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