Appendix B – Demand-Side Management

B.1 Project and Program Database – Table of Contents

B.2 Power Smart

Demand-side management (DSM) options will be incorporated into future portfolio modelling by subtracting a specified amount of energy or capacity requirement from the load forecast. A new load forecast would then be used in the portfolio evaluation that included DSM options.

The Power Smart programs at BC Hydro were described for the resource option database by their expected period of implementation. They represent increasing levels of cost and challenge to achieve. They are:

- Power Smart 2 – 2002/03 to 2011/12;
- Power Smart 3 – 2011/12 to 2016/17;
- Power Smart 4 – 2009/10 to 2023/24; and
- Power Smart 5 – 2007/08 to 2023/24.

Energy values quoted for Power Smart 2 to 5 in this text are *acquired energy* numbers. *Acquired energy* represents the amount of energy (GWh) actually saved within the year in question. Acquired energy numbers are used in the Load Forecast, and are presented in the information sheets for Power Smart in this Appendix.

The Conservation Potential Review (CPR, see Appendix H) and Ten-Year Power Smart Plan, quote *run rate* energy numbers representing the rate of savings (GWh per year) at the end of the year in question. Run rate may differ from the acquired energy stated in the Resource Options.

B.2.1 Power Smart 2 Current and Future Role

A new conservation potential review was completed in 2002 to identify primary energy savings opportunities (known as "achievable potential"). Drawing upon the market intelligence contained in the CPR, plus other opportunities that were identified but not included in the CPR, a 10-Year DSM Plan was developed. The Power Smart 2 program represents the implementation of this 10-Year Plan.

The total energy savings target for Power Smart 2 is approximately 3,977 GWh per year by 2011/12. It requires an investment of $692.5 million and yields levelized

utility costs of $17/MWh and total resource cost of $35/MWh. Total resource cost is the total cost of doing the program, including customer costs and BC Hydro costs.

The Power Smart Total Resource unit energy cost and Utility unit energy cost numbers used in this Integrated Electricity Plan differ from the numbers in the *BC Hydro Revenue Requirements 2004/05 and 2005/06 Application, December 2003* because, subsequent to the December 2003 filing, a standardisation of methodologies was done resulting in this change. In the Revenue Requirements, the calculation of total resource cost (TRC) and utility cost (UC) used a real discount rate of 8% for discounting energy savings. In the IEP this was changed to 6% real to agree with the rest of the IEP and the new corporate policy. In the Revenue Requirements, the Power Smart 10 Year Plan includes losses to the regional level as this has been the usual practice when building a business case. In the IEP, losses are included at the full system level to agree with the practice in the Load Forecast. These changes resulted in a decrease of approximately $10/MWh in total resource costs.

The plan includes savings from residential, commercial, institutional and industrial sectors over a wide variety of technologies. Load displacement (customer self-generation reducing demand) makes up approximately 20 per cent of the predicted energy savings in Power Smart 2. Lighting and industrial process are key areas from which savings are achieved. More information on technologies is available in the CPR, but Power Smart 2 will:

- Reduce residential heating, lighting, water heating and appliance electricity use;
- Reduce commercial/institutional lighting, water heating, space heating and cooling electricity use; and
- Reduce industrial process, lighting, water heating and refrigeration electricity use.

The 10-Year DSM plan will be regularly monitored and modified as circumstances change over time to account for unforeseeable opportunities and/or setbacks.

B.2.2 Power Smart 3

The CPR identifies potential savings beyond those that have been committed in Power Smart 2. Power Smart 3 makes up the Likely Achievable scenario and by the year 2015/16 targets.

Power Smart 3 continues after Power Smart 2 over the period from 2012/13 to 2017/18. Power Smart 3 is expected to achieve its target energy savings of 2,600 GWh per year by 2017/18.

Technologies employed in Power Smart 3 are similar to those in Power Smart 2, but with updates and additions, as newer and better energy-efficient technologies become available. Power Smart 3 will use programs that are very similar to Power Smart 2, with the main addition being more advanced technologies.

B.2.3 Power Smart 4

The CPR, in its Upper Achievable scenario, identifies additional potential savings beyond Power Smart 2 and 3. The Upper Achievable scenario is based on a more aggressive Power Smart program, and includes additional government actions that mandate energy efficiency through regulation and legislation. It also includes aggressive promotion of new technologies and efforts to advance the availability of

these technologies. Beginning in 2009/10 and ending in 2023/24, Power Smart 4 is expected to achieve additional savings.

It has been assumed that Power Smart 4 will start in 2009/10; however, it could begin as early as 2006/07 if additional Power Smart savings were required. An early start of Power Smart 4 would likely result in increased unit energy costs. In the near term, Power Smart 4 is very aggressive, but towards the end of the IEP study period it becomes quite conservative since there are nine additional years following the CPR study period to actually achieve the targeted savings.

B.2.4 Power Smart 5

The 2002 CPR identifies additional economic savings beyond Power Smart 2, 3 and 4. Power Smart 5 is based on an aggressive scenario that captures half of the savings identified in the CPR between the Upper Achievable (Power Smart 4) and the Economic.

Power Smart 5 uses aggressive incentives, promotion and education to accelerate the adoption of new technologies. Government regulation and legislation to ensure these changes are permanent would then support this promotion. Power Smart 5 is expected to achieve savings of 2,185 GWh per year by 2023/24.

For the purposes of the integrated electricity plan, Power Smart 5 is assumed to start in 2007/08 and continue to 2023/24. In the near term, Power Smart 5 is very aggressive but it becomes less so towards the end of the IEP study. This aggressive approach would require increased program costs and it is anticipated that Power Smart 5 would have a total resource cost $15/MWh higher than Power Smart 3, for a total resource cost of $60/MWh.

B.2.5 Power Smart Summary

The following tables B.1 and B.2 show the project annual energy and high load hour equivalent dependable capacity for the Power Smart programs 2 to 5, over the 2004 IEP study period.

Table B.1. Annual Energy Savings with Losses Power Smart 2 to 5

Annual Energy Savings (GWh with Losses)					
Year	PS2	PS3	PS4	PS5	TOTAL GWh
2002-03	293	n/a	n/a	n/a	293
2003-04	574	n/a	n/a	n/a	574
2004-05	1221	n/a	n/a	n/a	1221
2005-06	1669	n/a	n/a	n/a	1669
2006-07	2115	n/a	n/a	n/a	2115
2007-08	2484	n/a	n/a	60	2544
2008-09	2828	n/a	n/a	193	3020
2009-10	3167	n/a	80	325	3572
2010-11	3812	n/a	257	458	4217
2011-12	3977	n/a	434	591	4836
2012-13	3977	234	611	724	5546
2013-14	3977	754	788	857	6376
2014-15	3977	1274	965	989	7206
2015-16	3977	1795	1142	1122	8036
2016-17	3977	2315	1319	1255	8867

2017-18	3977	2600	1496	1388	9461
2018-19	3977	2600	1674	1521	9771
2019-20	3977	2600	1851	1654	10,082
2020-21	3977	2600	2028	1787	10,392
2021-22	3977	2600	2205	1920	10,702
2022-23	3977	2600	2382	2052	11,012
2023-24	3977	2600	2560	2185	11,322

Savings above are at the customer meter including supply-side generation, distribution and transmission losses for additional savings of approximately 10 per cent.

Table B.2. Annual High Load Hour Equivalent Dependable Capacity with Losses Power Smart 2 to 5

High Load Hour Equivalent Dependable Capacity Savings (MW with Losses)					
Year	PS2	PS3	PS4	PS5	TOTAL MW
2002-03	41	n/a	n/a	n/a	41
2003-04	80	n/a	n/a	n/a	80
2004-05	169	n/a	n/a	n/a	169
2005-06	231	n/a	n/a	n/a	231
2006-07	293	n/a	n/a	n/a	293
2007-08	344	n/a	n/a	8	352
2008-09	391	n/a	n/a	27	418
2009-10	438	n/a	11	45	494
2010-11	484	n/a	36	64	584
2011-12	527	n/a	60	82	670
2012-13	550	33	85	101	769
2013-14	550	105	110	119	885
2014-15	550	178	135	138	1000
2015-16	550	250	159	156	1116
2016-17	550	323	184	175	1232
2017-18	550	363	209	194	1315
2018-19	550	363	233	212	1359
2019-20	550	363	258	231	1402
2020-21	550	363	283	249	1445
2021-22	550	363	308	268	1489
2022-23	550	363	333	286	1532
2023-24	550	363	357	302	1575

B.2.6 Common Power Smart Assumptions

The previous sections have outlined basic Power Smart financial assumptions. A unique aspect of Power Smart financial analysis is the separation of utility cost and customer cost. For most Power Smart efficiency gains, there is a cost to BC Hydro (utility cost) that involves creating and managing a program, providing incentives and/or providing new materials or technology to customers. There is also often a cost born by the consumer (customer cost) that may involve purchasing a new technology (e.g., low wattage compact fluorescent light bulbs) or larger industrial

equipment purchases. Power Smart costs are expressed in both the utility costs and total resource costs that reflect this portioning of expenses for efficiency advances.

Power Smart savings are considered “firm” and the average energy savings in the database are also input as “firm energy”. Projects receive a technical review prior to commitment and a site inspection when complete. Subsequent to that, a measurement and verification process is carried out. In addition, each program is evaluated with the evaluation study being signed off by an Evaluation Oversight Team that includes members from various areas of the BC Hydro organization. Each step in the process can result in a change to the numbers so that the reported numbers are adjusted to be correct. While there are some measures that are not considered permanent, these are dropped out of the reported numbers at the end of their life.

An example where a major portion of savings is achieved is in the conversion of fluorescent lighting fixtures from T12 lamps with magnetic ballasts to T8 lamps with electronic ballasts. Once the new technology is installed, they will never go back to the old. At replacement time, these will be replaced with the same or perhaps a better technology which may become available at that time.

B.2.6.1 Industrial Sector

The following initiatives encourage energy savings in the industrial sector:

- **Load displacement.** Condensing turbines, which capture low-pressure steam from heat-recovery projects and produce electricity, are installed to improve the overall performance, efficiency and competitiveness of a facility.
- **Motor system optimization.** Premium motors, variable speed drives, synchronous belts, efficient equipment, and control and design improvement increase the overall efficiency of the systems while reducing operating costs and extending the life of the equipment.
- **Process improvement.** Re-design improves the overall performance and efficiency of mechanical pulping systems and other processes. The primary focus is on thermal mechanical pulping (TMP), metal ore grinding and other manufacturing processes.
- **Industrial lighting.** New equipment and controls are used to improve the overall efficiency of lighting systems while reducing operating costs and extending the life of the installation.
- **Other end-use systems.** This includes materials handing, indoor air quality and refrigeration/cooling.

B.2.6.2 Commercial/Institutional Sector

Lighting and new facility design represent about 80 per cent of the DSM savings potential for the commercial/institutional sector. Lighting technologies include compact fluorescent lamps (CFLs), T8 and T5 linear fluorescent lamps, more efficient ballasts, light emitting diode (LED) exit lights and pulsed start metal halide lamps. Savings also arise from improvements in design.

The following initiatives aim to realize energy savings in the commercial/institutional sector:

- **Power Smart Partners (PSP).** PSP encourages customers to integrate energy efficiency into their on-going business practices by using incentives, education, funding and recognition.
- **SUCH.** This is a PSP-type program that targets schools, universities, colleges and hospitals. BC Hydro fully funds energy savings opportunity studies, unlike the partially funded PSP.
- **Traffic Light Program.** BC Hydro provides 100 per cent of the up-front capital costs to municipalities and the Ministry of Transportation for the purchase of LED traffic control lamps, which consume 90 per cent less energy compared to current incandescent traffic lights. BC Hydro recovers 50 per cent of the LED costs over a five-year period.
- **Power Smart Product Incentive Program.** BC Hydro offers rebates to encourage small and medium commercial customers to identify and implement energy-efficient products.
- **New Construction.** This program uses education and incentives to advance the adoption of whole building/integrated design as a standard practice for commercial buildings within the B.C. design and construction industries.
- **Lighting Redesign Program.** This program increases lighting design expertise and offers incentives for re-designing lighting systems for greater efficiency.
- **Small Business Coupon Program.** Coupons and educational materials are distributed to small business customers to encourage the adoption of compact fluorescent lights.
- **Demonstration/New Technology Program.** BC Hydro sponsors and participates in selected energy technologies or procedures that are commercially proven, but not used in B.C. or are new to the industry or sector.

B.2.6.3 Residential Sector

The residential sector accounts for about 21 per cent of the total BC Hydro achievable potential. The most effective areas to target in this sector are lighting, appliances and weatherization.

The following programs aim to realize energy savings in the residential sector:

- **Compact Fluorescent Lighting Program.** This program distributes vouchers, discount coupons and educational materials to encourage the adoption of energy-efficient compact fluorescent lights.
- **Compact Fluorescent Lighting Multi-family Program.** This program offers discount coupons to motivate owners and property managers of multi-family residential buildings to use compact fluorescent lights in hallway lighting.
- **Seasonal Lighting LED Program.** Discount coupons, educational materials and mass advertising will be used to educate and encourage customers to purchase LED light strings, which provide electricity savings of 90 to 95 per cent.
- **Refrigerator Buy-back Program.** This program encourages customers to turn in second operating fridges by offering rebates and a free pick-up service.
- **New Home Program.** This market transformation program is designed to protect existing insulation legislation of electrically heated homes, and further improve the energy efficiency of new homes being built in B.C.

- **Home Energy Upgrade Program.** Customer incentives and partnerships with trade allies will be used to increase the use of low-e, argon-filled windows and basement/crawlspace insulation in the B.C. renovation market place.
- **Variable-Speed Furnace Motor Program.** BC Hydro will partner with a manufacturer or another third party to offer rebates for the purchase of a variable-speed motors, which are 60 per cent more efficient than the traditional single or two-speed blower motors. The second step is to pursue a strategy to lobby federal bodies and establish an Energy Star label for furnace fans or the entire furnace.
- **Fuel Switching Program.** This program will target existing homeowners to switch from electrically heated appliances to gas-heated ones, and will provide incentives to developers of new homes to encourage the installation of gas-fuelled appliances.
- **Solar Water Heaters.** This is not likely to be a significant portion of Power Smart in the near future. B.C.'s climate combined with the fact that the majority of water heaters use natural gas results in limited power saving potential. However, this may be pursued in areas of the province that enjoy sunnier weather but it is not expected to have a large overall impact.

PROJECT: **Power Smart 2**

Resource Category: Demand Side Management - Power Smart Level of Study: In progress Region: All

PROJECT DESCRIPTION

Power Smart is a program that was launched by BC Hydro in 1989/90 with the primary aim of achieving significant energy savings from existing and new customers, thus deferring the need for new generation supply. Power Smart 2 is a new Demand Side Management (DSM) Plan for the ten-year period 2002/03 to 2011/12.

The energy savings target for all of Power Smart 2 approximately 3,980 GWh/yr (run rate) by 2011/12. Power Smart 2 investments yield levelized utility and total resource costs of $17/MWh and $35/MWh, respectively. These unit costs are for illustrative purposes only, as Power Smart programs are modelled using an annual discounted cashflow with most of the capital expenditures being in the early years of the program.

Power Smart includes savings from residential, commercial, institutional, and industrial sectors over a wide variety of technologies. Lighting and industrial process are key areas from which savings are achieved. A description of the technologies and programs that make up Power Smart are provided in the Resource Option Report.

Energy, capacity and cost estimates are based on Power Smart analysis Version 6.7.

FINANCIAL INFORMATION

Utility Capital Cost ($1000s of 2003$)	$603,400
Fixed Operating And Maintenance Cost ($1000s/year)	$0
Variable Operating And Maintenance Cost ($/MWh)	$0
Project Life (Years)	10
Project Lead Time (Years)	11
Utility Energy Cost ($/MWh)	$17
Customer Energy Cost ($/MWh)	$18
Total Resource Cost ($/MWh)	$35

Power Smart energy savings are considered to continue indefinitely since the program involve replacement of inefficient technologies. Project life for Power Smart represents the total number of years over which the utility investment would be paid. Project lead time represents the number of years from project intiation to achievement of projected maximum savings.

The unit energy cost for this project is estimated to range from $31/MWh to $42/MWh, based on the price uncertainty ranking.

In the Revenue Requirements (Power Smart 10 Year Plan), the calculation of Total Resource Cost and Utility Cost used a real discount rate of 8% for discounting energy savings. In the IEP this was changed to 6% real to agree with the rest of the IEP and the new corporate policy. In the Revenue Requirements, the Power Smart 10 Year Plan includes losses to the regional level as this has been the usual practice when building a business case. In the IEP, losses are included at the full system level to agree with the practice in the Load Forecast.

PROJECT: **Power Smart 2**

Resource Category: Demand Side Management - Power Smart Level of Study: In progress Region: All

TECHNICAL INFORMATION

Equivalent Dependable Capacity (MW)	550
Projected Annual Energy Savings (GWh)	3977

Equivalent Dependable Capacity and Annual Energy values for Power Smart represent the total target savings for entire program. Equivalent dependable capacity was estimated using high-load-hour energy savings and the methodology outlined in the Conservation Potential Review Sections included in the Resource Option Report appendices. The capacity and energy values include avoided transmission losses and are acquired values versus run rate. Acquired energy represents the amount of energy (GWh) actually saved within the year in question. Where as Run rate values represent savings (GWh/yr) at the end of the year in question. Acquired energy numbers are used when Power Smart values are subtracted from the Load Forecast in the 2004 IEP Portfolio Evaluation.

The difference between the 2003 Load Forecast Before Power Smart and the 2003 Load Forecast After Power Smart (provided in IEP Chapter 2 Supply/Demand Outlook) reflects the incremental impact of the Power Smart 2 program including avoided losses.

The Power Smart 2 program period is 2002/03 to 2011/12, however the energy and equivalent capacity savings are assumed to be persistent to the end of the 2004 IEP Study.

SOCIAL AND ENVIRONMENTAL INFORMATION

Meets BC Hydro Clean Criteria	No
Greenhouse Gas Emission Factor (Tonnes CO2 equivalent/GWh)	0

Atmospheric Emissions (Metric Tonnes/GWh)	SOx	NOx	CO	VOC	PM 10	PM 2.5	Hg
	0	0	0	0	0	0	0

Project Footprint (Hectares)	0

Note: Some footprint aspects have not been estimated specifically.

There are no significant environmental impacts associated with Power Smart programs. Impacts from disposal or treatment of waste that may be associated with specific demand side management programs appear to be small. In addition, demand side management does not have land use impacts or direct social/community implications.

Power Smart 2 includes minor amounts of savings from fuel switching from electricity to natural gas. However, this amount of natural gas used to displace the electricity use is less than that which would be used to generate the electricity therefore emissions are assumed to be zero for this application.

Job Creation

Construction Jobs Created (Person-years)	15700
Permanent Jobs Created (Full time equivalents)	900

It is estimated that Power Smart 2 will create roughly 15,700 person years of construction work and 900 full time permanent jobs over the duration of the 2004 IEP Study period.

Job data was derived from the "Economic and Employment Impacts of Power Smart and Provincial Energy Standards, March 1996", by G.E. Bridges & Associates Inc. It was assumed that total jobs created was 59.02 person-years of employment per million dollars of BC Hydro spending and:
Construction Jobs Created: 44% of the total jobs created.
Permanent Jobs Created: 56% of the total jobs created.

Demand side management employment is generated through:
- Investments employment (construction jobs), which includes direct expenditures on the program (i.e., material and labour associated with the implementation of the initatives) and;
- Respending employment (permanent jobs): bill savings/respending effects (employment generated as a result of program induced customer bill savings).

PRIVATE SECTOR INVOLVEMENT

Estimated Level of Private Sector Involvement	Primary: 50% to 99%

UNCERTAINTY

Development Uncertainty	Low

Power Smart 2 technologies are currently being integrated into residential, commercial and industrial sectors. To date the development progess has met estimated targets.

Price Uncertainty	Low

The total resource cost of Power Smart 2 projects has been in line with previous estimates.

REFERENCES

BC Hydro, Power Smart 10 Year Plan, 2003.

BC Hydro, Conservation Potential Review, Residential Sector Report (Base Year: Fiscal 2000/01), 2002.

BC Hydro, Conservation Potential Review, Industrial Sector Report (Base Year: Fiscal 2000/01), 2002.

BC Hydro, Conservation Potential Review, Commercial Sector Report (Base Year: Fiscal 2000/01), 2002.

BC Hydro 1995 Integrated Electricity Plan, Appendix E, ISSN 1180-2561, October 1995.

Bond, M., Internal BC Hydro Power Smart Forecast Data (version 6.7), January 7, 2004.

PROJECT: **Power Smart 3**

Resource Category: Demand Side Management - Power Smart Level of Study: Feasibility Region: All

PROJECT DESCRIPTION

The Conservation Potential Review 2002 (CPR), in its Likely Achievable Scenario, identifies potential savings beyond those that have been committed in Power Smart 2. Power Smart 3 is derived from the Likely Achievable scenario and is based on a continuation of Power Smart 2 over the 5-year period 2012/13 to 2016/17. With the additional year beyond the CPR study period, Power Smart 3 is expected to achieve annual savings of approximately 2600 GWh by 2016/17. These savings are in addition to Power Smart 2 savings.

Technologies employed in Power Smart 3 are similar to those in Power Smart 2, but with updates and additions, as newer energy efficient technologies become available (see Resource Option Report).

The percentage of the total GWh energy resource (savings) was based on the Conservation Potential Review Likely Achievable total. This data was split between the sectors Residential, Commercial and Industrial sectors as follows: Residential (17.7%), Commercial (26.5%) and Industrial (55.8%) based on the ratio determined from the Power Smart 2 data over all the years provided.

Energy, capacity and cost estimates are based on Power Smart analysis Version 6.7.

FINANCIAL INFORMATION

Utility Capital Cost ($1000s of 2003$)	$215,000
Fixed Operating And Maintenance Cost ($1000s/year)	$0
Variable Operating And Maintenance Cost ($/MWh)	$0
Project Life (Years)	5
Project Lead Time (Years)	6
Utility Energy Cost ($/MWh)	$17
Customer Energy Cost ($/MWh)	$18
Total Resource Cost ($/MWh)	$35

Power Smart energy savings are considered to continue indefinitely since the program involve replacement of inefficient technologies. Project life for Power Smart represents the total number of years over which the utility investment would be paid. Project lead time represents the number of years from project intiation to achievement of projected maximum savings.

The unit energy cost for this project is estimated to range from $31/MWh to $42/MWh, based on the price uncertainty ranking.

TECHNICAL INFORMATION

Equivalent Dependable Capacity (MW)	363
Projected Annual Energy Savings (GWh)	2600

Equivalent Dependable Capacity and Annual Energy values for Power Smart represent the total target savings for entire program. Equivalent dependable capacity was estimated using high-load-hour energy savings and the methodology outlined in the Conservation Potential Review Sections included in the Resource Option Report appendices. The capacity and energy values include avoided transmission losses and are acquired values versus run rate. Acquired energy represents the amount of energy (GWh) actually saved within the year in question. Where as Run rate values represent savings (GWh/yr) at the end of the year in question. Acquired energy numbers are used when Power Smart values are subtracted from the Load Forecast in the 2004 IEP Portfolio Evaluation.

The difference between the 2003 Load Forecast Before Power Smart and the 2003 Load Forecast After Power Smart (provided in IEP Chapter 2 Supply/Demand Outlook) reflects the incremental impact of the Power Smart 2 program including avoided losses.

The Power Smart 3 program period assumed for the 2004 Integrated Electricity Plan is 2012/13 to 2016/17, however the energy and equivalent capacity savings are assumed to be persistent to the end of the 2004 IEP Study.

PROJECT: **Power Smart 3**

Resource Category: Demand Side Management - Power Smart Level of Study: Feasibility Region: All

SOCIAL AND ENVIRONMENTAL INFORMATION

Meets BC Hydro Clean Criteria	No
Greenhouse Gas Emission Factor (Tonnes CO2 equivalent/GWh)	0

Atmospheric Emissions (Metric Tonnes/GWh)	SOx	NOx	CO	VOC	PM 10	PM 2.5	Hg
	0	0	0	0	0	0	0

Project Footprint (Hectares)	0

Note: Some footprint aspects have not been estimated specifically.

There are no significant environmental impacts associated with Power Smart programs. Impacts from disposal or treatment of waste that may be associated with specific demand side management programs appear to be small. In addition, demand side management does not have land use impacts or direct social/community implications.

Job Creation

Construction Jobs Created (Person-years)	5600
Permanent Jobs Created (Full time equivalents)	600

It is estimated that Power Smart 3 will create roughly 5,600 person years of construction work and 600 full time permanent jobs over the duration of the 2004 IEP Study period.

Job data was derived from the "Economic and Employment Impacts of Power Smart and Provincial Energy Standards, March 1996", by G.E. Bridges & Associates Inc. It was assumed that total jobs created was 59.02 person-years of employment per million dollars of BC Hydro spending and:
Construction Jobs Created: 44% of the total jobs created.
Permanent Jobs Created: 56% of the total jobs created.

Demand side management employment is generated through:
- Investments employment (construction jobs), which includes direct expenditures on the program (i.e., material and labour associated with the implementation of the initatives) and;
- Respending employment (permanent jobs): bill savings/respending effects (employment generated as a result of program induced customer bill savings).

PRIVATE SECTOR INVOLVEMENT

Estimated Level of Private Sector Involvement	Primary: 50% to 99%

UNCERTAINTY

Development Uncertainty	Low

Power Smart 3 is an extension of Power Smart 2 using technologies that are currently available or well developed. Its savings only reach the "Likely Achievable" from the Conservation Potential Review (CPR).

Price Uncertainty	Low

As an extension of Power Smart 2 using similar technologies, the costs are well known.

REFERENCES

BC Hydro, Power Smart 10 Year Plan, 2003.

BC Hydro, Conservation Potential Review, Industrial Sector Report (Base Year: Fiscal 2000/01), 2002.

BC Hydro, Conservation Potential Review, Commercial Sector Report (Base Year: Fiscal 2000/01), 2002.

Bond, M., Internal BC Hydro Power Smart Forecast Data (version 6.7), January 7, 2004.

BC Hydro, Conservation Potential Review, Residential Sector Report (Base Year: Fiscal 2000/01), 2002.

BC Hydro 1995 Integrated Electricity Plan, Appendix E, ISSN 1180-2561, October 1995.

PROJECT: **Power Smart 4**

Resource Category: Demand Side Management - Power Smart Level of Study: Pre-feasibility Region: All

PROJECT DESCRIPTION

The Conservation Potential Review 2002 (CPR), in its Upper Achievable scenario, identifies additional savings beyond Power Smart 2 & 3. Power Smart 4 is derived from the Upper Achievable scenario and is based on an even more aggressive Power Smart program, including additional government actions that mandate energy efficiency through regulation and legislation. It also includes aggressive promotion of new technologies and efforts to advance the availability of these technologies. Beginning in 2009/10 and ending in 2023/24, Power Smart 4 is expected to achieve annual energy savings of approximately 2560 GWh.

Although for the purposes of the 2004 IEP study it is assumed that Power Smart 4 will be started in 2009/10, however it could begin as early as 2006/07 if additional Power Smart savings are required. It should be noted that intiating Power Smart 4 as early as 2006/07 could result in increased unit costs. In the near term, Power Smart 4 is very aggressive, but towards the end of the 2004 IEP study period it becomes quite conservative since there are nine additional years following the CPR study period to actually achieve the targeted savings.

The total GWh energy resource (savings) is based on the Conservation Potential Review Likely Achievable total. This data was split between the sectors Residential, Commercial and Industrial sectors as follows: Residential (17.7%), Commercial (26.5%) and Industrial (55.8%) based on the ratio determined from the Power Smart 2 data over all the years provided.

Energy, capacity and cost estimates are based on Power Smart analysis Version 6.7.

FINANCIAL INFORMATION

Utility Capital Cost ($1000s of 2003$)	$225,000
Fixed Operating And Maintenance Cost ($1000s/year)	$0
Variable Operating And Maintenance Cost ($/MWh)	$0
Project Life (Years)	15
Project Lead Time (Years)	15
Utility Energy Cost ($/MWh)	$19
Customer Energy Cost ($/MWh)	$21
Total Resource Cost ($/MWh)	$40

In the analysis, it has been assumed that the total resource cost for Power Smart 4 is $5/MWh higher than Power Smart 2 & 3.

Power Smart energy savings are considered to continue indefinitely since the program involve replacement of inefficient technologies. Project life for Power Smart represents the total number of years over which the utility investment would be paid. Project lead time represents the number of years from project intiation to achievement of projected maximum savings.

The unit energy cost for this project is estimated to range from $36/MWh to $56/MWh, based on the price uncertainty ranking.

PROJECT: **Power Smart 4**

Resource Category: Demand Side Management - Power Smart Level of Study: Pre-feasibility Region: All

TECHNICAL INFORMATION

Equivalent Dependable Capacity (MW)	357
Projected Annual Energy Savings (GWh)	2560

Equivalent Dependable Capacity and Annual Energy values for Power Smart represent the total target savings for entire program. Equivalent dependable capacity was estimated using high-load-hour energy savings and the methodology outlined in the Conservation Potential Review Sections included in the Resource Option Report appendices. The capacity and energy values include avoided transmission losses and are acquired values versus run rate. Acquired energy represents the amount of energy (GWh) actually saved within the year in question. Where as Run rate values represent savings (GWh/yr) at the end of the year in question. Acquired energy numbers are used when Power Smart values are subtracted from the Load Forecast in the 2004 IEP Portfolio Evaluation.

The difference between the 2003 Load Forecast Before Power Smart and the 2003 Load Forecast After Power Smart (provided in IEP Chapter 2 Supply/Demand Outlook) reflects the incremental impact of the Power Smart 2 program including avoided losses.

The Power Smart 4 program period assumed for the 2004 Integrated Electricity Plan is 2009/10 to 2023/24.

SOCIAL AND ENVIRONMENTAL INFORMATION

Meets BC Hydro Clean Criteria	No
Greenhouse Gas Emission Factor (Tonnes CO2 equivalent/GWh)	0

Atmospheric Emissions (Metric Tonnes/GWh)	SOx	NOx	CO	VOC	PM 10	PM 2.5	Hg
	0	0	0	0	0	0	0

Project Footprint (Hectares)	0

Note: Some footprint aspects have not been estimated specifically.

There are no significant environmental impacts associated with Power Smart programs. Impacts from disposal or treatment of waste that may be associated with specific demand side management programs appear to be small. In addition, demand side management does not have land use impacts or direct social/community implications.

Job Creation

Construction Jobs Created (Person-years)	5800
Permanent Jobs Created (Full time equivalents)	500

It is estimated that Power Smart 4 will create roughly 5,800 person years of construction work and 500 full time permanent jobs over the duration of the 2004 IEP Study period.

Job data was derived from the "Economic and Employment Impacts of Power Smart and Provincial Energy Standards, March 1996", by G.E. Bridges & Associates Inc. It was assumed that total jobs created was 59.02 person-years of employment per million dollars of BC Hydro spending and:
Construction Jobs Created: 44% of the total jobs created.
Permanent Jobs Created: 56% of the total jobs created.

PRIVATE SECTOR INVOLVEMENT

Estimated Level of Private Sector Involvement	Primary: 50% to 99%

UNCERTAINTY

Development Uncertainty	Medium

Power Smart 4 is an extended version of Power Smart 2 and 3. It reaches the "Upper Achievable" savings from the Conservation Potential Review (CPR) but nine years later. It relies on actions by the government as well as by BC Hydro.

Price Uncertainty	Medium

The Total Resource Cost from Power Smart 2 have been scaled up to provide a rough estimate of the costs of Power Smart 4.

REFERENCES

BC Hydro, Conservation Potential Review, Commercial Sector Report (Base Year: Fiscal 2000/01), 2002.

BC Hydro, Conservation Potential Review, Industrial Sector Report (Base Year: Fiscal 2000/01), 2002.

Bond, M., Internal BC Hydro Power Smart Forecast Data (version 6.7), January 7, 2004.

BC Hydro, Power Smart 10 Year Plan, 2003.

BC Hydro, Conservation Potential Review, Residential Sector Report (Base Year: Fiscal 2000/01), 2002.

BC Hydro 1995 Integrated Electricity Plan, Appendix E, ISSN 1180-2561, October 1995.

PROJECT: **Power Smart 5**

Resource Category: Demand Side Management - Power Smart Level of Study: Conceptual Region: All

PROJECT DESCRIPTION

The Conservation Potential Review 2002 (CPR), identifies additional economic savings beyond Power Smart 2, 3 & 4. Power Smart 5 is based on an very aggressive scenario which captures half of the savings identified in the CPR between the Upper Achievable (Power Smart 4) and the Economic Scenario. While the CPR identifies these savings as being economic in 2014/16, Power Smart 5 would more likely capture them by 2024/25. Power Smart 5 uses aggressive incentives, promotion, and education to accelerate the adoption of new technologies. This is followed by government regulation and legislation to ensure these changes are permanent. Power Smart 5 is expected to achieve annual savings of approximately 2185 GWh by 2023/24.

For the purposes of the 2004 IEP study, Power Smart 5 is assumed to start in 2007/08 and continues until the end of the study period. In the near term Power Smart 5 is very aggressive but it becomes less so towards the end of the 2004 IEP study.

The total GWh energy resource (savings) is based on the Conservation Potential Review Likely Achievable total. This data was split between the sectors Residential, Commercial and Industrial sectors as follows: Residential (17.7%), Commercial (26.5%) and Industrial (55.8%) based on the ratio determined from the Power Smart 2 data over all the years provided.

Energy, capacity and cost estimates are based on Power Smart analysis Version 6.7.

FINANCIAL INFORMATION

Utility Capital Cost ($1000s of 2003$)	$205,000
Fixed Operating And Maintenance Cost ($1000s/year)	$0
Variable Operating And Maintenance Cost ($/MWh)	$0
Project Life (Years)	17
Project Lead Time (Years)	17
Utility Energy Cost ($/MWh)	$24
Customer Energy Cost ($/MWh)	$26
Total Resource Cost ($/MWh)	$50

This aggressive approach would require increased program costs and it is anticipated that Power Smart 5 would have a total resource cost $15/MWh higher than Power Smart 2 & 3.

Power Smart energy savings are considered to continue indefinitely since the program involve replacement of inefficient technologies. Project life for Power Smart represents the total number of years over which the utility investment would be paid. Project lead time represents the number of years from project intiation to achievement of projected maximum savings.

The unit energy cost for this project is estimated to range from $45/MWh to $80/MWh, based on the price uncertainty ranking.

PROJECT: **Power Smart 5**

Resource Category: Demand Side Management - Power Smart Level of Study: Conceptual Region: All

TECHNICAL INFORMATION

Equivalent Dependable Capacity (MW)	305
Projected Annual Energy Savings (GWh)	2185

Equivalent Dependable Capacity and Annual Energy values for Power Smart represent the total target savings for entire program. Equivalent dependable capacity was estimated using high-load-hour energy savings and the methodology outlined in the Conservation Potential Review Sections included in the Resource Option Report appendices. The capacity and energy values include avoided transmission losses and are acquired values versus run rate. Acquired energy represents the amount of energy (GWh) actually saved within the year in question. Where as Run rate values represent savings (GWh/yr) at the end of the year in question. Acquired energy numbers are used when Power Smart values are subtracted from the Load Forecast in the 2004 IEP Portfolio Evaluation.

The difference between the 2003 Load Forecast Before Power Smart and the 2003 Load Forecast After Power Smart (provided in IEP Chapter 2 Supply/Demand Outlook) reflects the incremental impact of the Power Smart 2 program including avoided losses.

The Power Smart 5 program period assumed for the 2004 Integrated Electricity Plan is 2007/08 to 2023/24.

SOCIAL AND ENVIRONMENTAL INFORMATION

Meets BC Hydro Clean Criteria	No
Greenhouse Gas Emission Factor (Tonnes CO2 equivalent/GWh)	0

Atmospheric Emissions (Metric Tonnes/GWh)	SOx	NOx	CO	VOC	PM 10	PM 2.5	Hg
	0	0	0	0	0	0	0

Project Footprint (Hectares)	0

Note: Some footprint aspects have not been estimated specifically.

There are no significant environmental impacts associated with Power Smart programs. Impacts from disposal or treatment of waste that may be associated with specific demand side management programs appear to be small. In addition, demand side management does not have land use impacts or direct social/community implications.

Job Creation

Construction Jobs Created (Person-years)	5300
Permanent Jobs Created (Full time equivalents)	400

It is estimated that Power Smart 5 will create roughly 5,300 person years of construction work and 400 full time permanent jobs over the duration of the 2004 IEP Study period.

Job data was derived from the "Economic and Employment Impacts of Power Smart and Provincial Energy Standards, March 1996", by G.E. Bridges & Associates Inc. It was assumed that total jobs created was 59.02 person-years of employment per million dollars of BC Hydro spending and:
Construction Jobs Created: 44% of the total jobs created.
Permanent Jobs Created: 56% of the total jobs created.

PRIVATE SECTOR INVOLVEMENT

Estimated Level of Private Sector Involvement	Primary: 50% to 99%

PROJECT: **Power Smart 5**

Resource Category: Demand Side Management - Power Smart Level of Study: Conceptual Region: All

UNCERTAINTY

Development Uncertainty	High

Power Smart 5 is an aggressive program which achieves savings half way between Power Smart 4 and the CPR "Economic" savings, but nine years later. Power Smart 5 takes a very aggressive approach to the introduction of new technologies.

Price Uncertainty	High

The Total Resource Cost from Power Smart 2 have been scaled up to provide a rough estimate of the costs of Power Smart 5. The specific program costs are undetermined resulting in a high price uncertainty.

REFERENCES

Bond, M., Internal BC Hydro Power Smart Forecast Data (version 6.7), January 7, 2004.

BC Hydro, Power Smart 10 Year Plan, 2003.

BC Hydro, Conservation Potential Review, Industrial Sector Report (Base Year: Fiscal 2000/01), 2002.

BC Hydro, Conservation Potential Review, Residential Sector Report (Base Year: Fiscal 2000/01), 2002.

BC Hydro, Conservation Potential Review, Commercial Sector Report (Base Year: Fiscal 2000/01), 2002.

BC Hydro 1995 Integrated Electricity Plan, Appendix E, ISSN 1180-2561, October 1995.

PROJECT: **Demand Management - NorskeCanada Energy Project**

Resource Category: Demand Side Management - Power Smart Level of Study: Pre-feasibility Region: Vancouver Island

PROJECT DESCRIPTION

On March 12, 2003 the Vancouver Island Energy Corporation (VIEC), a wholly-owned subsidiary of BC Hydro applied for a Certificate of Public Convenience and Necessity (CPCN) for the Vancouver Island Generation Project (VIGP) to the British Columbia Utility Commission (BCUC). During the Public Hearing process for the CPCN, NorskeCanada put forward a proposal for a suite of energy projects at their Vancouver Island facilities that could provide a total winter power capacity of approximately 364 MW.

As part of the NorkseCanada Energy Project (NCEP), NorskeCanada proposes to install new electric power cogeneration facilities and power demand reduction projects at three of their pulp and paper mills on Vancouver Island:
- Crofton Pulp and Paper Mill located near Duncan.
- Port Alberni Paper Mill located in Port Alberni.
- Elk Falls Pulp and Paper Mill located north of Campbell River.

This data sheet summarizes the power demand reduction projects for all three mills. There are two general categories: load shifting which would involve moving the process electrical load to off-peak portions of the day, and peak-shaving where purchased supply of electricity is reduced at peak times through new sources of internal generation or reduced demand. Total reduction in energy consuption is estimated to be 80 MW.

There are a couple of dependencies in the NCEP that are important to note. Before the NCEP Demand Management 80 MW can be implemented, the Elk Falls TMP project (28 MW) must be completed. Furthermore, before the TMP project can be implemented, the Elk Falls steam turbine (12 MW within the 104 MW) must be installed. Norske has indicated that the steam turbine would be done along with the first 46 MW gas turbine at Elk Falls.

The material presented here is taken directly from NorkseCanada's evidence as filed with the British Columbia Utilities Commission on May 26th, 2003. The data has been included in the 2004 Integrated Energy Plan but would need to be confirmed and refined as the project develops.

FINANCIAL INFORMATION

Utility Capital Cost ($1000s of 2003$)	$14,000
Fixed Operating And Maintenance Cost ($1000s/year)	$0
Variable Operating And Maintenance Cost ($/MWh)	$0
Project Life (Years)	Unknown
Project Lead Time (Years)	2
Utility Energy Cost ($/MWh)	Unknown
Customer Energy Cost ($/MWh)	Unknown
Total Resource Cost ($/MWh)	Unknown

Costs include contingencies and development costs but not capitalized interest during construction. The $14 million cost for this portion of the NCEP does not include the cost of the thermomechanical pulp (TMP) facility at Elk Falls, which is required for this project to be completed. It was assumed that O&M costs were small for this type of project, and may be included in the existing mill maintainence costs.

The more relevant cost comparison for this project is the cost of the dependable capacity, which based on available information is approximately $175/MW.

PROJECT: **Demand Management - NorskeCanada Energy Project**

Resource Category: Demand Side Management - Power Smart Level of Study: Pre-feasibility Region: Vancouver Island

TECHNICAL INFORMATION

Equivalent Dependable Capacity (MW)	80
Projected Annual Energy Savings (GWh)	2.4

The NCEP Demand Management project describes options available on the electrical side to reduce demand for electricity, and they fall within two general
categories:

-load-shifting, where there is no change in total net energy consumption but the process electrical load is shifted from a peak to an off-peak portion of the day,
-peak-shaving, where the purchased supply of electricity is reduced during peak periods of the day, either through new sources of internal generation or reduced demand, which is not made up during an off-peak period.

Load shifting and peak shaving will be used to provide solutions for electricity grid constraints saving a maximum of 80 MW. This can be accomplished in the following ways:

Load shifting through existing TMP Facilities - currently existing at Elk Falls TMP plant, up to 20 MW can be shifted to off-peak hours.

Coordination of Vancouver Island Mills - currently each mill is operated independently from an electrical demand perspective. Pulp and paper production in the mills could be coordinated to ensure that the three mills did not peak coincidentally. An estimated 20 MW could be shaved from the combined peak total.

Load shifting through the new TMP component of the NorskeCanada suite - the new TMP capacity at Elk Falls allows for greater level of load shifting. A combination of old an new refining capacity will allow higher operating rate in off-peak hours resulting in a 60 MW redution in demand.

Paper Machine interruption - an 80 MW reduction in demand is the result when a paper machine is taken off line. Reduction in paper production corresponds with lowered TMP demand. This solution viewed as a last resort as lost time on the paper machine cannot be made up and would result in a loss of profit.

NorskeCanada provides a detailed discussion of options, how each may be used both today or in future following implementation of NCEP, the potential volumes available, the category as described above, and other relevant information in their proposal

Annual energy savings were estimated based on using this peak capacity for three hours for 2 consecutive weeks of weekdays only.

SOCIAL AND ENVIRONMENTAL INFORMATION

Meets BC Hydro Clean Criteria	Yes
Greenhouse Gas Emission Factor (Tonnes CO2 equivalent/GWh)	0

Atmospheric Emissions (Metric Tonnes/GWh)	SOx	NOx	CO	VOC	PM 10	PM 2.5	Hg
	0	0	0	0	0	0	0

Project Footprint (Hectares)	0

Note: Some footprint aspects have not been estimated specifically.

The installation of the cogeneration facilities at the Crofton, Elk Falls and Port Alberni mills will result in some increased air emissions, however it is not expected that the demand management project would. Emissions have been assumed to be zero for this portion of the NCEP.

It is expected that there would be no net increase in footprint for this project because it would be located at an existing industrial site with direct access to transmission lines.

The NCEP is considered to be 58% (165 MW) BC Clean by the BCUC.

Job Creation

Construction Jobs Created (Person-years)	Unknown
Permanent Jobs Created (Full time equivalents)	Unknown

The complete NCEP suite will generate 500 person-years worth of on-site labour.

PRIVATE SECTOR INVOLVEMENT

Estimated Level of Private Sector Involvement	100%: Private sector ownership

UNCERTAINTY

Development Uncertainty	Medium

Uncertainties are difficult to assess as the data provided was limited, and not initially computed for the purposes the 2004 IEP study.

Price Uncertainty	Medium

Cost information provided by project proponent, and not initially computed for the purposes the 2004 IEP study.

REFERENCES

AMEC and VECO Canada Ltd., NorskeCanada Energy Project, Project Suite Technical Report and Cost Estimate, May 2003.

Norske Skog Canada Ltd., Evidence of Norske Skog Canada Ltd. submitted to British Columbia Utilities Commission, May 2003.

British Columbia Utilities Commission, Vancouver Island Generation Project Decision, September 8, 2003.