Fifty years ago, BC Hydro was created as a Crown corporation to deliver electricity to homes and businesses throughout much of the province. Investments in dams, generating stations, transmission and distribution networks, and programs to encourage conservation have provided a reliable supply of electricity for generations of British Columbians at some of the lowest rates in North America.

Currently, BC Hydro serves 1.8 million customers in an area containing more than 94 per cent of British Columbia’s population. The third-largest electric utility in Canada, BC Hydro provides electricity to its customers through an integrated grid. BC Hydro generates the majority of its power from large hydroelectric stations on the Columbia and Peace rivers. The remainder of its domestic electricity supply comes from smaller BC Hydro-owned generating stations and purchases from Independent Power Producers (IPPs).

In years when domestic requirements have exceeded domestic supply, BC Hydro has also imported some of its total net annual supply from other jurisdictions. Facing a growing population with an increasing appetite for electricity-driven technology and signs of new growth in the energy-intensive industrial sector, BC Hydro is forecasting that demand for power will increase by approximately 40 per cent over the next 20 years, before accounting for savings that can be achieved through promoting energy efficiency and conservation.

On its 50th anniversary, BC Hydro is looking back on its legacy in helping to develop the province, and it is examining the challenges that await British Columbians in the next 50 years. To ensure that future generations will continue to enjoy the competitive advantage of clean, reliable power, BC Hydro must plan ahead to upgrade and expand its heritage facilities, secure new supplies of renewable energy, build new transmission and distribution lines, encourage conservation, and integrate new technologies to modernize the system.
BC Hydro wants to hear from British Columbians as it develops its Integrated Resource Plan. To add your voice, attend a public open house in a community near you.
POWER FOR OUR HOMES AND WORKPLACES

It can seem like a bit of magic: you flick a switch and whatever gadget or appliance you choose jumps to life. You get heat, you get light. You get music or entertainment. All this electrical “fuel” arrives at our homes or workplaces safely, silently and consistently. It leaves no smell, and there is never any left over when you finish. You just turn it off and it stops. It all seems so simple.

Of course, it’s not. The electricity that powers our lives comes in the form of a strictly controlled current of electrons. Most of the actual electricity is generated in the far corners of the province and carried over thousands of kilometres of transmission and distribution lines to reach the bulk of us who live in the province’s southwest corner. Along the way, it passes through a range of landscapes, habitats and communities before it arrives at our homes and places of business.

The tricky part is that electricity doesn’t actually “go away” when you turn off the switch. Once generated, it has to be used or it can overload and crash the system. Accordingly, BC Hydro must anticipate how much people will want at any given time of the day or year and introduce exactly that amount into the network.

Over the longer term, BC Hydro must also anticipate future demand. It can take five to seven years to build a new generation facility and even longer to build transmission, so BC Hydro must plan carefully – and well into the future – to ensure that it has encouraged conservation and acquired the right mix of generation and transmission resources to meet its customers’ needs.

Whether it’s our homes, communities, businesses or industries, we depend on affordable, reliable electricity when and where we need it. It’s essential that BC Hydro understands customers’ needs and meets the demand for electricity now and for years to come. It’s also essential that we consider the consequences of our decisions from a broad range of perspectives – for example, on our pocketbooks, on our economy, and on the people and the environment where our electricity is generated and transmitted.

THE INTEGRATED RESOURCE PLAN

The Integrated Resource Plan – the IRP – is BC Hydro’s long-term plan for acquiring the resources to meet customers’ needs for the next 20 years. It is guided by the government of British Columbia’s new Clean Energy Act, which came into effect in June 2010 and sets specific new energy objectives for BC Hydro with respect to its long-term electricity plan (see page 8). Notably, long-term electricity planning is not a once-every-20-years exercise. Over the course of its history, BC Hydro has renewed its long-term plan at regular intervals. Most recently, it developed an Integrated Electricity Plan in 2006 and a Long-Term Acquisition Plan in 2008. Once developed, BC Hydro will renew the Integrated Resource Plan periodically.

Integrated electricity systems are inherently complex and capital-intensive, and most new resources require significant lead times to develop. As a result, electric utilities must plan ahead to be sure that the required resources will be in place when needed. And implementation of long-term electricity plans requires a staged and flexible approach to account for changes in everything from the economy to technology.

Notably, BC Hydro’s IRP does not, by itself, lock the utility into any of the specific projects identified over the planning horizon. Rather, the plan, if approved by government, will set out a path for BC Hydro and will require key actions to be taken over the next few years that will ensure customers’ needs can be met over the next 10 and 20 years. Any specific project that is later developed in response to the IRP – whether a transmission line, a generation project, a power call or a conservation plan – will have its own individual design, consultation, permitting and approval process.
As BC Hydro considers how to meet B.C.’s electricity needs over the next 20 years, it asks three basic electricity planning questions:

1. **How much electricity will British Columbians need over the next 20 years?** This depends on a host of issues, some that may increase demand on the system, and some that may reduce demand. The demand must also be understood in two ways: how much energy will be required on an annual basis, and how much energy might be needed at any given point in time to meet peak demand and to ensure that we can “keep the lights on”, even on the coldest days in winter.

2. **What is the gap between existing supply and forecast electricity demand?** What electricity generation and transmission assets does BC Hydro currently have that can continue to be relied upon going forward, and how much electricity can it source from its existing contracts with B.C.-based Independent Power Producers? As well, to what degree can current conservation and efficiency measures such as conservation rates be relied upon to reduce demand?

3. **How can BC Hydro close the gap?** What blend of additional conservation measures and generation and transmission resources will be needed to meet demand, reliably and cost-effectively? As BC Hydro examines how to close the gap, it considers:
   - How much savings can be achieved from conservation and efficiency
   - What portfolio of electricity generation options it should plan on
   - How much electrification will contribute to growth in electricity demand
   - What the transmission requirements will be
   - What the export market potential may be

**CLEAN ENERGY SUPPLY AND TRANSMISSION**

The majority of B.C.’s electricity demand is located in the Lower Mainland and on Vancouver Island, while the overwhelming majority of supply is remote and must be moved over very long distances across rugged terrain and through a relatively small number of transmission lines. More than 93 per cent of BC Hydro’s electricity supply is renewable, and creates little or no greenhouse gas emissions, making it desirable at a time when the world faces climate change. BC Hydro’s energy supply comes from a combination of its own heritage resources (see below) and power purchases from Independent Power Producers who generate their energy from a range of sources, including hydro, biomass and wind.

BC Hydro is regulated by the BC Utilities Commission and governed by the BC Hydro and Power Authority Act, the Utilities Commission Act and the B.C. Clean Energy Act. Collectively, this legislation ensures that BC Hydro will continue to provide clean, reliable and cost-effective electricity to its customers.

**BC HYDRO GENERATION**
HOW MUCH ELECTRICITY WILL BRITISH COLUMBIANS NEED OVER THE NEXT 20 YEARS?

BC HYDRO’S ELECTRICITY LOAD FORECAST

The annual long-term load forecast provides planners with an understanding of how much electricity will be required 10 and 20 years from now. Trends that influence future electricity needs include economic growth and population growth, as well as predictions on how electricity use will change as a result of changes in lifestyle, electricity rates, legislation and technology.

The 2010 Electricity Load Forecast indicates that demand will increase by approximately 40 per cent in the next 20 years before accounting for savings that can be achieved through conservation and efficiency.

The demand forecast is developed by examining BC Hydro’s three customer classes: residential, commercial and industrial. The primary drivers for future increased electricity consumption among residential customers include population growth and housing starts. Drivers for the commercial sector are general economic activity, which includes gross domestic product (GDP) and retail sales, and employment. The industrial sector’s demand is the most volatile year over year, and it is the most challenging to forecast, as it is sensitive to the unpredictability of international commodity prices, economic cycles, natural disasters [e.g., mountain pine beetle], regulatory approvals and labour disputes.

WHAT AFFECTS LOAD GROWTH?

Population – The B.C. population is expected to grow to nearly 5.8 million people over the next 20 years, an increase of almost 25 per cent over the current population of 4.6 million.

Conservation – Programs, such as BC Hydro’s award-winning Power Smart, have been effective in helping people use electricity more efficiently and reduce the amount of energy they use, through everything from turning out the lights, to turning down the heat, to improving home insulation.

Consumption – The increased popularity of computers, larger televisions and other consumer products has greatly increased the demand for electricity in individual homes.

Efficiency – Manufacturers are consistently producing conventional goods [washers, dryers, refrigerators, compact fluorescent light bulbs] that use much less electricity.

Electrification – The rising price, environmental impact and threatened shortage of fossil fuels may drive people to choose electricity to power everything from home heating to automobiles.

Economic Activity – The current forecasted expansion in the mining and the oil and gas industry has the potential to significantly increase electricity use in B.C.
WHAT IS THE GAP?
A LOOK AT EXISTING RESOURCES COMPARED TO FORECAST DEMAND

Before BC Hydro can assess the future gap between supply and demand, it first must assess how much electricity it can produce and rely upon from its current generating facilities, its existing contracts with Independent Power Producers and its current conservation plan.

Approximately 85 per cent of domestic supply comes from generation resources owned and operated by BC Hydro; the remaining 15 per cent of electricity need is met with power purchased from Independent Power Producers in B.C.

Of the electricity produced by BC Hydro, almost 80 per cent comes from its large hydroelectric installations in the Peace and Columbia river basins.

BC Hydro currently has more than 100 electricity-purchase agreements with Independent Power Producers, some of which date back to the 1980s. Sixty-five of these purchase agreements involve projects that have reached commercial operation. While the majority of these projects generate electricity from run-of-river hydro plants, there are also a number of wind and biomass generating plants. In wind alone, BC Hydro has purchase agreements with Independent Power Producers that represent a total of 700 megawatts (MW), of which 100 MW has reached commercial operation as of January 2011.

As the “gap” diagram below illustrates, even after the increase in demand for electricity is adjusted to account for savings from BC Hydro’s current conservation and efficiency plan, an energy gap between future electricity needs and current resources still exists, particularly after 2020. The planning challenge begins with the task of how best to fill the gap.
HOW CAN THE GAP BETWEEN FUTURE ELECTRICITY NEEDS AND EXISTING RESOURCES BE CLOSED?

FUTURE RESOURCE OPTIONS

After identifying the gap between forecasted demand and current supply, planners look at possible new sources of electricity, or resource options. These include additional conservation and efficiency measures, supply-side options such as new generating resources [supplied by BC Hydro or Independent Power Producers], and the necessary transmission options to ensure that the energy from these resources can be optimally brought to customers.

BC Hydro periodically updates its inventory of potential future resources, most recently in the 2010 Resource Options Report.

ADDITIONAL ELECTRICITY CONSERVATION AND EFFICIENCY

Encouraging electricity conservation and efficiency is called demand-side management (DSM). This can be voluntary, as when BC Hydro encourages its residential, commercial and industrial customers to use less electricity by, for example, adopting efficient technology options such as ENERGY STAR® windows, or it can be regulated, as when governments pass regulations that, by similar example, mandate low-emissivity windows. BC Hydro can also design electricity rates that encourage conservation, for example, by charging more for power at certain times of the day in an attempt to shift the time of use and lower the peak demand. There is potentially more to gain from conservation [a reduction of up to 79 per cent under the current plan] than what is mandated under the Clean Energy Act.

Power Smart is BC Hydro’s branded program encompassing all of its demand-side management programs. Power Smart uses a wide range of approaches, including information programs, incentives specific to particular enterprises or homes, and rebate programs to assist customers in paying for conservation or efficiency measures.

Overall, demand-side management helps to keep rates low, as saving electricity is lower in cost than new generation.

GENERATION AND TRANSMISSION OPTIONS

For an overview of generation options and their potential implications, see the table on pages 14–15. For a discussion on approaches to transmission planning, see pages 22–24.

ENERGY, CAPACITY AND CUSTOMER DEMAND

Electricity consumption varies by customer type, by day, and by year. Some customers, such as large industries, need a steady amount of electricity delivered. Others consume in short bursts. Residential customers, for example, draw most of their energy in the early evening when they are preparing dinner, using appliances and watching TV. Over the whole year, demand is highest in November, December and January, when people use more electricity for heat and light.

To meet the demand for electricity, a utility must have:

- **Firm Energy** – refers to electricity that is available at all times. Resources typically providing firm energy include large hydroelectric dams, bioenergy, geothermal and natural gas.
- **Dependable Capacity** – the maximum amount of electricity that all of the generating stations combined can reliably produce in any one instant, usually measured in megawatts (MW)
- **Adequate Generation Reserve** – sufficient additional capacity to cover forecast uncertainties, unscheduled outages, and system fluctuations
INDEPENDENT POWER PRODUCERS

Since the 1980s, Independent Power Producers (IPPs) have been helping BC Hydro meet its customers’ electricity demand. Currently, IPPs provide BC Hydro with approximately 12,000 GWh/year of electricity, equal to about 15 per cent of BC Hydro’s total supply. IPPs include independent power companies, municipalities, First Nations and customers, working alone or in partnership.

BC Hydro has 100 electricity purchase agreements with IPPs, 65 of which have reached commercial operation. Electricity comes from a range of sources including wind, run-of-river hydro, and biomass.

BENEFITS OF IPP POWER

IPPs identify, design and build innovative clean renewable power projects that help BC Hydro meet customers’ electricity needs and achieve electricity self-sufficiency at competitive prices. Through the development and operation of their projects, IPPs are responsible for securing all necessary regulatory approvals and permits. IPPs take on the financial, development, construction and operating risk associated with their projects while delivering electricity at secured prices over the life of the contract with BC Hydro.

WHICH BLEND OF FUTURE RESOURCES WILL BEST MEET ELECTRICITY NEEDS?

To effectively compare resource portfolios (bundles of different resource options), BC Hydro uses characteristics to evaluate at a high level the reliability, cost, economic development and environmental implications of different portfolios. Characteristics include:

- **Technical**: How much dependable capacity can it provide? In the case of conservation, how much energy or capacity savings can it offer?
- **Financial**: What are the estimated costs of the resource options? The costs associated with developing additional generation facilities, including building new roads and transmission lines or undertaking more conservation, ultimately affect the cost of electricity to consumers.
- **Economic Development**: What are the characteristics of different resource options to support economic development? For example, employment and gross domestic product impacts.
- **Environmental**: What are the environmental characteristics of the different resource options? For example, what is their greenhouse gas emissions profile?

The characteristics listed above are appropriate for comparing a wide range of resource options across a range of environments located throughout the province.

COMPARING ALTERNATIVE PORTFOLIOS

There are many combinations of resource options that could be used to fill the gap between future demand and the current supply. These combinations, or bundles, are described as “portfolios”. It is important to look at resources in combination, because the limitations of some resources can be balanced by the strengths of others. For example, some resources are intermittent and must be backed up by a dependable supply of power. As well, the sequence or timing of acquiring or developing new resources is important to ensure that supply is available, to avoid unnecessary costs, and to ensure reliable power.

Later on in this workbook, we examine several portfolios for the purpose of seeking input on the draft plan. Planners examine the performance of many portfolios to understand the consequences of different mixes of resource options.

Risk management also is a central focus in resource planning. A robust portfolio consists of electricity resources that will ensure that customer needs are met cost-effectively, reliably and at low risk.
WHAT IS THE PLANNING CONTEXT?

BC Hydro’s electricity plans and planning processes are shaped by government legislation and policies, by changing market structures and conditions, and by new developments in technologies.

On June 3, 2010, the government of British Columbia passed the Clean Energy Act, legislation that changes the approach that BC Hydro must take to planning. The Act reaffirms the requirement that BC Hydro must achieve electricity self-sufficiency by 2016 and each year after.

The Clean Energy Act also sets out several new or updated objectives, including:

- Generate at least 93 per cent of all electricity in British Columbia from clean or renewable sources and build the infrastructure necessary to transmit that electricity
- Use renewable power potential to help achieve the provincial government’s greenhouse gas (GHG) reduction targets
- Meet at least 66 per cent of any increase in demand through conservation and efficiency
- Include an assessment of anticipated transmission requirements over the next 30 years as part of the Integrated Resource Plan
- Encourage economic development
- Explore and pursue, subject to Cabinet approval, the opportunity to develop and sell clean energy into the interprovincial and international markets
- Foster the development of First Nations and rural communities through the use and development of clean and renewable resources

PROVINCIAL GREENHOUSE GAS TARGETS

The government of British Columbia has ambitious targets for reducing greenhouse gas emissions. Having always delivered most of its power from hydroelectric sources, BC Hydro has one of the smallest “carbon footprints” of any major utility in Canada or the U.S. It is BC Hydro’s intention – and responsibility under the provincial Clean Energy Act – to maintain and improve upon that position by concentrating on development in clean, renewable sources of energy while maintaining reliability and low cost.

B.C.’s low-carbon electricity can play a key role in reducing emissions by offering customers a low-emission alternative to fossil fuels for vehicles, homes, businesses and industry.
WHAT’S IN THE PLAN?
The Integrated Resource Plan will provide an analysis and outlook that can guide BC Hydro operations for two decades and beyond. It will include:

- A 20-year Base Resource Plan that sets out a mix of demand reduction and generation and transmission options that are able to fulfill the forecasted demand
- Contingency Resource Plans that address the uncertainties inherent in long-term planning, such as higher than expected demand. Contingency resource plans put forth a range of alternate resource options that would be relied upon if conditions change significantly.
- A 30-year transmission plan

These plans will include addressing key questions, such as:

- How much further can demand be reduced by conservation?
- How can the Site C Project help meet future demand?
- When should the next call for power from Independent Power Producers be made? Should it include natural gas?
- What are the transmission requirements?
- How does BC Hydro balance competing policy objectives?

The IRP will also include a consideration of:

- The potential to use electrification to reduce greenhouse gas emissions in B.C.
- The opportunity to develop revenue-earning clean energy exports, and the potential associated costs of building capacity to serve such a market

The planning process includes consultation with the public, First Nations and other stakeholders. An account of those consultations and a thorough review of stakeholder feedback will form part of the final Integrated Resource Plan when it is submitted for government consideration by early December 2011.
BC Hydro wants to hear from British Columbians as it develops its Integrated Resource Plan. To add your voice, attend a public open house in a community near you.

**IRP PUBLIC OPEN HOUSE SCHEDULE**

<table>
<thead>
<tr>
<th>Community</th>
<th>Date</th>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria</td>
<td>Wednesday, March 9</td>
<td>6:00 – 9:00 p.m.</td>
<td>Hotel Grand Pacific</td>
</tr>
<tr>
<td>Campbell River</td>
<td>Thursday, March 10</td>
<td>6:00 – 9:00 p.m.</td>
<td>Coast Discovery Inn &amp; Marina</td>
</tr>
<tr>
<td>Vancouver</td>
<td>Tuesday, March 15</td>
<td>6:00 – 9:00 p.m.</td>
<td>Simon Fraser University Harbour Centre</td>
</tr>
<tr>
<td>Abbotsford</td>
<td>Wednesday, March 16</td>
<td>6:00 – 9:00 p.m.</td>
<td>Clearbrook Community Centre</td>
</tr>
<tr>
<td>Kamloops</td>
<td>Thursday, March 17</td>
<td>6:00 – 9:00 p.m.</td>
<td>Ramada Kamloops</td>
</tr>
<tr>
<td>Terrace</td>
<td>Tuesday, March 22</td>
<td>6:00 – 9:00 p.m.</td>
<td>Terrace Sportsplex</td>
</tr>
<tr>
<td>Prince George</td>
<td>Wednesday, March 23</td>
<td>6:00 – 9:00 p.m.</td>
<td>Ramada Prince George</td>
</tr>
<tr>
<td>Fort St. John</td>
<td>Thursday, March 24</td>
<td>6:00 – 9:00 p.m.</td>
<td>Quality Inn Northern Grand</td>
</tr>
<tr>
<td>Vernon</td>
<td>Tuesday, March 29</td>
<td>6:00 – 9:00 p.m.</td>
<td>Best Western Vernon Lodge</td>
</tr>
<tr>
<td>Castlegar</td>
<td>Wednesday, March 30</td>
<td>6:00 – 9:00 p.m.</td>
<td>Castlegar &amp; District Community Complex</td>
</tr>
<tr>
<td>Fort Nelson</td>
<td>Thursday, March 31</td>
<td>6:00 – 9:00 p.m.</td>
<td>Woodlands Inn</td>
</tr>
<tr>
<td>Cranbrook</td>
<td>Thursday, April 7</td>
<td>6:00 – 9:00 p.m.</td>
<td>Prestige Rocky Mountain Resort and Convention Centre</td>
</tr>
</tbody>
</table>

*Please check bchydro.com/irp for schedule updates.*
CONSULTATION TOPICS

Through this Consultation Workbook and Feedback Form, BC Hydro is seeking input on the following consultation topics:

1. Conservation and Efficiency
2. Electricity Generation Options
3. Electrification
4. Transmission Planning
5. Export Market Potential

A brief description of each of the consultation topics is provided below.

1. Conservation and Efficiency

The first and best way to meet our future electricity needs is to reduce demand through conservation and energy efficiency. Conservation occurs when customers change their behaviours, business operations, equipment purchases, or capital investment decisions in ways that reduce electricity use. Methods of conservation include programs, electricity rates and government regulations designed to encourage or require customers to conserve electricity. The current conservation and efficiency plan is designed to reduce the forecast growth in demand by 79 per cent by 2020. This is above the new Clean Energy Act target of 66 per cent. One of the important questions in the IRP is whether BC Hydro should target additional savings from conservation and efficiency over and above our current significant plan to reduce growth by 79 per cent by 2020.

2. Electricity Generation Options

While British Columbians are doing more than ever to conserve electricity, electricity use is expected to continue to increase over the coming decades due to growth in population and among energy-intensive industries. BC Hydro will develop and analyze various portfolios (sets of resource options) that may be used to meet future electricity needs and clean energy objectives. Potential resource generation options include run-of-river hydro, biomass, wind, large hydroelectric with storage (Site C), natural gas, and emerging technologies, such as tidal and wave.

3. Electrification

Electrification describes the process of switching from other fuel sources to electricity. For example, switching vehicles from petroleum to electric or switching household heating or large industrial processes from natural gas. Efficient electrification is one way of supporting the province’s greenhouse gas emission reduction targets. The Integrated Resource Plan will consider how potential electrification can affect electricity demand over time and what measures BC Hydro may need to take to serve its customers.

4. Transmission Planning

The transmission system, the essential link between electrical generators and energy consumers, is planned and designed to deliver energy efficiently and reliably. Because transmission lines require long lead times to plan and construct, the Integrated Resource Plan will assess the demand forecast and the transmission options that will most effectively meet those demands over the next 30 years.

5. Export Market Potential

While BC Hydro currently trades electricity when it has a short-term surplus, the B.C. Clean Energy Act includes the objective that the province be a net exporter of clean or renewable power. The Integrated Resource Plan will assess the export market potential, including the share of the clean energy market that B.C. could expect to capture, and make recommendations to the provincial government about what actions, if any, are required now.
TOPIC 1: CONSERVATION AND EFFICIENCY

The latest forecasts show that demand for electricity in B.C. will grow by approximately 40 per cent over the next 20 years. That’s the equivalent of adding the energy demand of five more cities the size of Vancouver to our system, before accounting for savings that can be achieved through conservation and efficiency. Conservation is the cleanest and least expensive way to meet demand.

Conservation – often referred to as demand-side management (DSM) – is BC Hydro’s first strategy for closing the gap between future electricity demands and existing resources. Conservation options include programs, specifically designed electricity rates (e.g., residential inclining block rate), and government regulations.

From a planning perspective, however, it is difficult to guarantee a particular volume of conservation over time – dependent as that is on customers’ behavioural response.

To be sure that it can reliably meet future demand, BC Hydro must evaluate conservation plans in a way similar to new generation options. Key questions include:

- How much additional electricity can be saved, in particular above the current plan, to reduce growth in demand by 79 per cent?
- By when can the electricity be saved?
- How certain are the savings in the existing conservation plan? How much risk is associated with extending that target? How persistent are the savings?
- What is the cost to create these savings?

Depending on what combination of conservation and efficiency measures is undertaken, BC Hydro can target different levels of savings. For this IRP, BC Hydro is evaluating a range of options that could provide savings of between 66 per cent and 83 per cent of the gap between current resources and anticipated demand.

GREATER CONSERVATION AND EFFICIENCY

To achieve significantly higher energy savings from current targets, BC Hydro would have to:

- Expand its Power Smart programs
- Send stronger signals through specially designed electricity conservation rates
- Request that the provincial and federal governments commit to bring in new conservation regulations

These measures combined would be expected to change societal norms and energy consumption patterns throughout the entire provincial electricity market. They might include making all buildings net zero consumers of electricity, meaning they produce as much electricity as they consume over the course of a year. This would require super-efficient building envelopes, widespread integration of district energy systems and small distribution generation, and more community densification, as well as best practices in construction and renovation. Every British Columbian would have to make energy efficiency a personal responsibility beyond what we currently do.
BC Hydro is currently implementing a 20-year conservation and efficiency plan from the 2008 Long-Term Acquisition Plan that targets reducing the forecast growth in demand by 79 per cent by the year 2020. It contains four main strategies:

1. **Government regulations:** The introduction of approximately 30 new federal and provincial government regulations and building code standards aimed at making buildings and equipment more energy efficient, including water heaters, windows, electronic equipment, lighting, appliances, motors, building code standards, and commercial and industrial equipment.

2. **Conservation rates:** These rates, in place for more than 90 per cent of BC Hydro’s customers, encourage conservation by delivering a specially designed higher price signal for a portion of customers’ consumption. The rates are revenue neutral, in that BC Hydro collects the same amount of revenue as the original standard rate.

3. **Power Smart programs:** Approximately 20 programs aim to help customers improve their energy efficiency and conserve electricity. Programs target residential, commercial and industrial customers and range from collecting old or second refrigerators to ensuring that new industrial plants are as energy efficient as possible.

4. **Supporting initiatives:** These initiatives focus on things like public awareness, community engagement, and technology innovation and provide a foundation for the other three main strategies.

In the fiscal year ending March 31, 2010, BC Hydro spent $135 million on conservation and efficiency measures for its 1.8 million customers. For more information about BC Hydro’s Power Smart programs, go to bchydro.com/powersmart.

The table below compares BC Hydro’s current plan to an approach that could achieve greater conservation and efficiency:

<table>
<thead>
<tr>
<th>CONSERVATION (DSM) APPROACH</th>
<th>DESCRIPTION</th>
<th>TECHNICAL</th>
<th>FINANCIAL</th>
<th>ENVIRONMENTAL</th>
<th>ECONOMIC DEVELOPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current Plan</strong></td>
<td>Combination of initiatives that include government regulations, conservation rates and Power Smart programs for all classes of customers (see sidebar).</td>
<td>Targets reducing 79 per cent of future load growth by 2020. Moderate uncertainty that expected electricity savings will materialize.</td>
<td>Less costly than buying or building new electricity supply.</td>
<td>Avoid environmental footprint because BC Hydro would not need to build new generation and transmission.</td>
<td>Moderately more jobs relative to new electricity generation options.</td>
</tr>
<tr>
<td><strong>Greater Conservation and Efficiency</strong></td>
<td>Increase in mandatory government regulations on energy efficiency. Send stronger rate signals through conservation rates. Expanded Power Smart programs to help consumers find savings.</td>
<td>Could achieve more savings than current approach above. Significant uncertainty that electricity savings will materialize.</td>
<td>Less costly than buying or building new electricity supply.</td>
<td>Avoid greater environmental footprint because BC Hydro would not need to build new generation and transmission.</td>
<td>More jobs relative to current plan and more jobs relative to an equivalent bundle of electricity generation options.</td>
</tr>
</tbody>
</table>
## POTENTIAL ENERGY RESOURCES

<table>
<thead>
<tr>
<th>RESOURCES</th>
<th>DESCRIPTION</th>
<th>RESOURCE POTENTIAL</th>
<th>Cost Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass:</td>
<td>• Electricity generated by burning wood residues from the forest industry</td>
<td>• Potential varies with availability of fuel source</td>
<td>$77–$200*</td>
</tr>
<tr>
<td>• Wood-Based</td>
<td>• Biogas from landfills or municipal solid waste</td>
<td>• Some uncertainty may arise with regard to long-term fuel availability</td>
<td></td>
</tr>
<tr>
<td>• Municipal Solid Waste</td>
<td>• Provides reliable supply with both dependable capacity and firm energy</td>
<td>• Wood-based biomass availability varies with the state of the forest industry</td>
<td></td>
</tr>
<tr>
<td>• Biogas (Landfill)</td>
<td>• Project developers face costs of emissions mitigation</td>
<td>• Identified within BC Clean Guidelines and may be certified as green energy</td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td>• Electricity generated from onshore or offshore wind farms using large</td>
<td>• Potential located across the province</td>
<td>$95–$200*</td>
</tr>
<tr>
<td></td>
<td>wind-powered turbine generators</td>
<td>• Identified within BC Clean Guidelines and may be certified as green energy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Provides intermittent supply with low dependable capacity</td>
<td>• Potential varies with geological formations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Identified within BC Clean Guidelines and may be certified as green energy</td>
<td>• Large and uncertain initial capital investment related to exploration phase and</td>
<td>$71–$200*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>confirmation of resource potential</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>• Identified within BC Clean Guidelines and may be certified as green energy</td>
<td></td>
</tr>
<tr>
<td>Geothermal</td>
<td>• Electricity generated from high temperature naturally occurring gaseous</td>
<td>• Potential located across the province</td>
<td>$58–$200*</td>
</tr>
<tr>
<td></td>
<td>or liquid water at a depth of up to 3000 m used to drive conventional</td>
<td>• Identified within BC Clean Guidelines and may be certified as green energy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>power generation technologies</td>
<td>• Potential varies with geological formations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Provides reliable supply with both dependable capacity and firm energy</td>
<td>• Large and uncertain initial capital investment related to exploration phase and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>once geological formation is discovered and proven</td>
<td>confirmation of resource potential</td>
<td></td>
</tr>
<tr>
<td>Run-of-River</td>
<td>• Electricity generated from water temporarily diverted from a stream (i.e.,</td>
<td>• Potential located across the province</td>
<td>$58–$200*</td>
</tr>
<tr>
<td></td>
<td>not significant storage reservoir), passed through turbines and returned to</td>
<td>• Identified within BC Clean Guidelines and may be certified as green energy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the stream</td>
<td>• Potential varies with geological formations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Provides intermittent supply with low dependable capacity</td>
<td>• Large and uncertain initial capital investment related to exploration phase and</td>
<td></td>
</tr>
<tr>
<td>Large Hydro</td>
<td>• Electricity generated from water released from a storage reservoir and</td>
<td>• Large hydro projects often require long lead times – 10 years or more – and</td>
<td>$85**</td>
</tr>
<tr>
<td>(Site C)</td>
<td>passed through turbines</td>
<td>require early evaluation and study</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Would typically involve the construction of a dam on a river</td>
<td>• Proposed Site C dam on the Peace River would optimize upstream storage and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Provides reliable supply with both dependable capacity and firm energy</td>
<td>regulation by taking advantage of water already stored in the Wiliston Reservoir</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Dispatchable with storage</td>
<td>• Clean Energy Act prohibits, with the exception of the proposed Site C project,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>future large hydro projects in B.C.</td>
<td></td>
</tr>
</tbody>
</table>

* Prices capped at $200/MWh to reflect what might be acquired over the planning horizon.
** Cost is based on Site C’s 30-year-old historical design, as per Scenario G in the Site C Stage 1 Report ($6.6 billion). An updated cost forecast is expected by spring 2011, based on an upgraded design for the proposed project.
<table>
<thead>
<tr>
<th>POTENTIAL ENERGY RESOURCES</th>
<th>DESCRIPTION</th>
<th>RESOURCE POTENTIAL</th>
<th>Cost Range ($/MWh)</th>
</tr>
</thead>
</table>
| Natural Gas-Fired Generation & Cogeneration | • Electricity generated from high-efficiency gas-fired turbines  
• Provides reliable supply with both dependable capacity and firm energy  
• May be situated on existing industrial sites  
• Dispatchable | • Project developers face long-term fuel availability/price risks and cost of greenhouse gas emissions | $79–$109 |
| Coal-Fired Generation with Carbon Capture and Storage | • Integrated Gasification Combined Cycle (IGCC) process gasifies coal into a synthetic gas that is burned in a combined cycle generator to produce electricity  
• Provides reliable supply with both dependable capacity and firm energy | Emerging Technology:  
• Large-scale greenhouse gas capture and sequestration technology not yet commercially available  
• Project developers face long-term fuel availability/price risks and cost of greenhouse gas emissions, sequestration | $81 |
| Wave | • Electricity generated from waves  
• Provides intermittent supply with low dependable capacity | Emerging Technology:  
• Technologies at early stages of commercial development | $480–$824 |
| Tidal | • Electricity generated from tides  
• Predictable intermittent supply with low dependable capacity | Emerging Technology:  
• At early stage of tidal current technologies  
• Limited total extractable resource owing to technical limitations and environmental considerations | $227–$850 |
| Large-Scale Solar | • Electricity is generated from sunlight using photovoltaic cells.  
• Provides intermittent supply with low dependable capacity | • Potential varies with length of day and availability of sunlight. Throughout the year, power generation fluctuates with cloud cover. | $351–$410 |

**SITE C PROJECT DESCRIPTION**

BC Hydro is proposing to develop a dam and hydroelectric generating station on the Peace River in northeast B.C. The Site C Clean Energy Project (Site C) would involve the construction and operation of a third dam and hydroelectric generating station on the Peace River, downstream from the existing Williston and Dinosaur reservoirs and the respective BC Hydro generating facilities at G.M. Shrum and Peace Canyon.

If approved, Site C will provide approximately 900 megawatts (MW) of capacity, and produce an average of 4,600 gigawatt hours (GWh) of electricity each year — enough to power more than 400,000 homes. Site C would be publicly owned and become a heritage asset for BC Hydro. Compared to conventional or renewable alternatives, Site C would have higher up-front capital costs but lower long-term operating costs, and it would provide a clean and renewable source of firm and reliable electricity for more than 100 years.

**SITE C PUBLIC AND STAKEHOLDER CONSULTATION**

Site C is currently in Stage 3 (Environmental and Regulatory Review). This stage will include consultation with the public, communities and property owners, as well as with the Province of Alberta and the Northwest Territories. In addition, BC Hydro and First Nations communities are engaged in a continuing consultation process.

The following public and stakeholder consultation will be included:

- Local Government Liaison
- Property Owner Consultation
- Environmental Assessment and Regulatory Processes
- Preliminary Design Consultation

A range of consultation methods will be utilized, including the Fort St. John and Hudson’s Hope Community Consultation Offices, stakeholder meetings, open houses, print and online feedback forms, and written submissions.

For more information on Site C, visit bchydro.com/sitec.
PORTFOLIO 1 – RENEWABLE MIX
This portfolio includes a mix of renewable resources such as wind, run-of-river and biomass from Independent Power Producers. The Site C Project is specifically excluded. Given that wind and run-of-river hydro are intermittent resources, this portfolio requires backup resources when the intermittent sources are not available. These backup resources would generally consist of additions at existing BC Hydro generating facilities, or new pumped storage facilities or gas-fired generation. This portfolio has low greenhouse gas emissions, with a geographically widespread environmental footprint. The cost of renewable resources and the need for backup resources make this the most expensive portfolio of the three.
POLICY CONTEXT FOR PORTFOLIOS

The Clean Energy Act specifies limits for what can be included in a portfolio:

- Future development of specified large-scale hydroelectric storage projects on river systems in B.C. is limited to Site C
- No nuclear resources
- No coal resources without the capture and storage of carbon dioxide

PORTFOLIO 2 – RENEWABLE MIX WITH SITE C

This portfolio includes a mix of renewable resources that include Site C along with wind, run-of-river and biomass projects from Independent Power Producers. Site C is included to provide system storage and capacity to back up intermittent resources, but ongoing additions at existing BC Hydro generating facilities and additional capacity and storage still may be required if a large amount of intermittent resources are added. This portfolio has the lowest greenhouse gas emissions, with its environmental and social footprint concentrated in the Peace region. This portfolio will have a lower cost than Portfolio 1.

PORTFOLIO 3 – RENEWABLE MIX WITH SITE C AND GAS-FIRED GENERATION (WITHIN 93 PER CENT CLEAN ENERGY ACT TARGET)

This portfolio includes Site C, other potential renewable resources such as wind and run-of-river from Independent Power Producers, and gas-fired generation allowable under Clean Energy Act limits. Both Site C and gas-fired generation are available to back up intermittent resources. This portfolio has higher greenhouse gas emissions than Portfolios 1 and 2 due to its reliance on natural gas-fired generation, and has a more concentrated environmental footprint in the Peace region. It has the lowest cost if the price of natural gas remains low but, again, this is subject to uncertain natural gas and carbon emission prices.
The table below highlights different characteristics and trade-offs associated with each electricity generation portfolio:

<table>
<thead>
<tr>
<th>ELECTRICITY GENERATION PORTFOLIO</th>
<th>DESCRIPTION</th>
<th>TECHNICAL</th>
<th>FINANCIAL</th>
<th>ENVIRONMENTAL</th>
<th>ECONOMIC DEVELOPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base Energy:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>827 ▶ 72 ◀</td>
<td>Backup:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PORTFOLIO 2</td>
<td>Renewable mix including Site C. No gas.</td>
<td>Increased system flexibility to respond to changes in demand. Requires less backup generation than Portfolio 1.</td>
<td>Lower cost of clean resource. Lower long-term price risk. Larger up-front single capital cost but lower operating costs. Public ownership of a 100-year expected life asset.</td>
<td>Lower GHG emissions. More concentrated/localized footprint in the Peace region.</td>
<td>More job-intensive capital project and concentrated jobs in the Peace region. Same GDP and tax revenue.</td>
</tr>
<tr>
<td></td>
<td>Base Energy:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>496 ▶ 43 ◀ 1 ◀</td>
<td>Backup:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PORTFOLIO 3</td>
<td>Renewable mix with wind. Site C and gas within 93 per cent Clean Energy Act target.</td>
<td>Requires no backup. Highest flexibility of system to respond to changes in demand.</td>
<td>Lowest cost of the three.</td>
<td>Higher GHG emissions. More concentrated/localized footprint in the Peace region.</td>
<td>More job-intensive capital project and concentrated jobs in the Peace region and wherever the gas plant is sited.</td>
</tr>
<tr>
<td></td>
<td>Base Energy:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>438 ▶ 38 ◀ 1 ◀ 1 ◀</td>
<td>Backup:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The symbols provide a general reference tool to compare the three sample portfolios. They represent resource requirements for a 10,000 GWh and 1,800 MW sample portfolio, and relative portfolio costs.
TOPIC 3: ELECTRIFICATION

WHAT IS ELECTRIFICATION?
Provincial greenhouse gas (GHG) reduction targets will require making deep cuts in GHG emissions in the coming decades. One way to reduce those emissions is by switching from fossil fuel energy to electrical energy derived from clean generation sources. This is referred to as electrification. BC Hydro’s clean electricity supply therefore has a key role to play in BC’s Climate Action Plan by helping the province reduce GHG emissions. The Clean Energy Act includes, as an energy objective for B.C., “to encourage the switching from one kind of energy source or use to another that decreases greenhouse gas emissions in British Columbia”.

WHERE MIGHT ELECTRIFICATION OCCUR?
Fuel switching to clean electricity could occur across the economy. The transportation sector is the largest source of GHG emissions in B.C., and replacing vehicles that use gasoline and diesel with electric vehicles could be one of the most significant long-term actions B.C. could take to reduce emissions.

Many of the large automakers are bringing electric vehicles to market in the near future; key models include the Chevy Volt and the Nissan LEAF. The impact of electric vehicles will depend on availability, price and customer acceptance. Successful introduction of electric vehicles will require that consumers are able to charge their vehicles, and that any charging infrastructure is smoothly integrated into the grid. BC Hydro has an obligation to be ready to serve electric vehicles’ electricity requirements, should our customers decide to embrace the technology.

Also in the transportation sector, the provision of shore power can enable ships to avoid running generators while in port. The cruise ship terminal in Vancouver and the container terminal in Prince Rupert already have shore power.

Air and ground source heat pumps can be extremely efficient sources of energy for heating and cooling homes and buildings. Switching from oil or natural gas to efficient heat pumps can significantly reduce residential and commercial GHG emissions and can lower overall energy consumption.

In the industrial sector, electrification options include the use of electric compressors to replace those fuelled by natural gas in the growing number of natural gas fields in northeastern B.C. Electricity can also be used to replace diesel generators and to drive mining conveyor systems that replace diesel trucks.

Given that economic growth, energy prices and other factors are already driving electrification, BC Hydro includes all reliable new demand in its load forecast. The 2010 Electricity Load Forecast incorporates some electric vehicle take-up and also some industrial conversion from fossil fuels, particularly in the oil and gas sector.

ELECTRIC VEHICLES
A long-term benefit of electric vehicles is the potential to reduce GHG emissions, as 38 per cent of B.C.’s emissions are attributed to transportation. A move to plug-in vehicles will also reduce the cost of fleet operations and reduce reliance on fuel imports.

A potential fuel switch of this magnitude presents a number of issues for the provincial electricity grid, including:

- Long-term impacts to transmission and generation (the rate of load growth from electric vehicles is expected to be gradual and well within BC Hydro’s planning cycles)
- Near-term impacts on distribution infrastructure
- Impacts on the relationship with customers and their expectations of BC Hydro as a transportation energy supplier

To prepare for this possibility in the next five to 20 years, BC Hydro has undertaken numerous initiatives over the past few years to learn more about how plug-in vehicles will interact with the hydroelectric system, including:

- The creation of charging infrastructure guidelines
- Participation in a provincial working group
- Implementation of agreements with manufacturers to demonstrate different models of plug-in vehicles in B.C.
WHEN MIGHT ELECTRIFICATION OCCUR?

Electrification requires equipment changes that normally occur over the short, medium or long term. In some sectors, equipment is replaced fairly frequently; for example, vehicle fleets will turn over several times by 2050. In other cases, infrastructure is replaced slowly; most of the 2050 housing stock has already been built.

Electrification also depends on the rate of commercialization and acceptance of new technologies. For example, electric vehicles will not likely gain wide acceptance until the purchase costs are closer to conventional vehicles and consumers are satisfied they will have reliable places to recharge.

Government and BC Hydro actions can also influence the timing and nature of new investments in energy-using equipment, as well as the commercialization of new technologies, and therefore influence the rate at which electrification occurs.

APPROACH TO ELECTRIFICATION

Under its current responsive approach (outlined on the next page), BC Hydro does not encourage fuel switching; rather, it forecasts and responds to the fuel switching that occurs naturally. As part of its obligation to serve, BC Hydro will ensure that, as electric vehicles arrive in B.C. and as customers request electricity services, the generation, transmission and distribution systems are able to meet that demand.

In a proactive approach, BC Hydro would work with government and other partners to promote and encourage efficient electrification to benefit customers and to reduce greenhouse gas (GHG) emissions. Under this approach, BC Hydro could support the development of charging infrastructure in advance of significant electric vehicle sales in B.C., thereby encouraging consumers to purchase electric vehicles. BC Hydro could also introduce programs to encourage electrification in other market sectors, such as industry and port operations. BC Hydro can also expand its transmission and distribution systems, providing electricity service to new customers. The wider availability of clean electricity will not only reduce emissions but may also spur new investment and economic activity. In this approach, BC Hydro would work to ensure that new electricity consumption is as efficient as possible.
The table below highlights different characteristics and trade-offs associated with each electrification approach:

<table>
<thead>
<tr>
<th>ELECTRIFICATION APPROACH</th>
<th>DESCRIPTION</th>
<th>TECHNICAL</th>
<th>FINANCIAL</th>
<th>ENVIRONMENTAL</th>
<th>ECONOMIC DEVELOPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESPONSIVE APPROACH TO ELECTRIFICATION</td>
<td>BC Hydro responds to electrification driven by customers’ needs, and works to ensure electricity is used efficiently as part of its obligation to serve customers’ needs.</td>
<td>Increased electricity supply required to support this level of electrification is already being considered by BC Hydro.</td>
<td>Natural electrification included in current rate forecast.</td>
<td>Modest long-term reductions in GHG emissions in B.C. from displaced fossil fuel use.</td>
<td>Modest increase in clean energy sector economic development/jobs. This would result in redistribution of economic resources to clean energy sector from other parts of the economy.</td>
</tr>
<tr>
<td>PROACTIVE APPROACH TO ELECTRIFICATION</td>
<td>BC Hydro works with government and other partners to facilitate and encourage increased efficient electrification.</td>
<td>Requires additional electricity supply beyond what BC Hydro is currently considering.</td>
<td>Increase in utility costs to supply electricity and promote electrification. Financial risk if electrification does not occur as forecasted.</td>
<td>Significant reductions in GHG emissions in B.C. Significant reductions in air pollutants and human health impacts. Additional environmental footprint from additional electricity supply.</td>
<td>Moderate increase in clean energy sector economic development/jobs. This would result in shifting economic resources to clean energy sector from other parts of the economy. Expansion of the electricity grid could spur new economic activity.</td>
</tr>
</tbody>
</table>
TOPIC 4: TRANSMISSION PLANNING

The system that delivers electricity to British Columbians is divided into two major infrastructures: the transmission system, which carries high-voltage electricity from where it is generated to the cities, towns and industrial centres where it is consumed, and the distribution system, which delivers lower voltage electricity to individual customers. The IRP will examine the high-voltage province-wide transmission system by analyzing the investments that may be needed to ensure the system can meet future electricity requirements. The IRP will also examine regional transmission requirements in areas such as Fort Nelson, where new transmission may be an option for an area that is facing potentially significant demand growth from the oil and gas sector. The IRP will also examine regional transmission requirements needed to connect clusters of new generation resources to the bulk system.

As a result of the Clean Energy Act, which integrated BC Hydro with the former BC Transmission Corporation, BC Hydro’s IRP will now include a description of transmission infrastructure demands 30 years out, which is a reflection of the long lead times required for planning, siting and constructing transmission lines.

When assessing future bulk transmission system requirements, planners need to consider the following:

- The need to maintain an optimal level of reliability for customers
- Growth in demand by geographic area
- Potential location and size of new generation resources
- The need to minimize electricity losses that occur when electricity is carried over long distances
- The expected retirement or refurbishment of existing transmission resources

In recent years, the provincial government and utilities have become increasingly concerned about timely development of transmission infrastructure. In the past, transmission systems have been planned in response to generation projects and demand growth that were expected to occur. This approach increasingly poses the following risks:

- Generation projects may be completed before transmission lines are ready or may need to be delayed until lines can be finished
- Generation projects might develop in a way that leads to a spiderweb of intersecting transmission lines that are inefficient and have avoidable adverse environmental impacts (see diagrams on page 23)
- New demand for electricity may occur sooner than transmission lines can be built to provide the service
Planners are now looking farther into the future to anticipate where the largest potential exists for generation options and consumer needs. Rather than responding to individual projects, this process identifies where clusters of projects could appear across the province (i.e., regions with a combination of run-of-river, wind and biogas potential). This allows planners to lay out transmission systems in an optimal way. However, a key risk is that a transmission investment might be stranded if generation resources do not develop as expected. Other considerations in this longer term planning regime include the following:

- Potential for transmission lines to spur regional economic development
- Potential cost savings and environmental benefits from avoiding multiple transmission lines
- Potential to facilitate the use of clean or renewable electricity rather than GHG-intensive fuels; for example, by targeting transmission for the oil and gas sector in the province’s northeast

The critical question is the extent to which BC Hydro should consider, plan and build transmission lines in anticipation of need. Two broad and distinctly different approaches are described for consultation purposes:

**RESPONSIVE APPROACH**: BC Hydro develops transmission plans in response to forecast need.

**PROACTIVE APPROACH**: BC Hydro develops long-term transmission plans in anticipation of potential future need over a 30-year horizon.

While BC Hydro is likely to use both approaches going forward, emphasis can be placed on one or the other.
The table below highlights different characteristics and trade-offs associated with each transmission planning approach:

<table>
<thead>
<tr>
<th>TRANSMISSION PLANNING APPROACH</th>
<th>DESCRIPTION</th>
<th>TECHNICAL</th>
<th>FINANCIAL</th>
<th>ENVIRONMENTAL</th>
<th>ECONOMIC DEVELOPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESPONSIVE APPROACH</td>
<td>BC Hydro develops transmission plans in response to forecast need.</td>
<td>Higher reliability risk if transmission delayed. May lead to suboptimal build of the transmission system in the long run.</td>
<td>Lower transmission costs in the short term but risk of higher costs in the long run due to suboptimal system build.</td>
<td>Lower transmission footprint in the short term due to suboptimal system build.</td>
<td>May constrain economic development in certain regions or communities, as there may not be enough transmission.</td>
</tr>
<tr>
<td>PROACTIVE APPROACH</td>
<td>BC Hydro develops long-term transmission plans in anticipation of potential future need over a 30-year horizon.</td>
<td>Lower reliability risk. Leads to larger transmission projects.</td>
<td>Higher transmission costs in the short term. Lower costs in long term due to optimal system design if growth materializes. Risk of stranded investment if need does not materialize.</td>
<td>Higher transmission footprint in the short term but lower in the long run if need materializes.</td>
<td>May facilitate economic development in certain regions or communities, as transmission has been planned and built to facilitate this.</td>
</tr>
</tbody>
</table>
TOPIC 5: EXPORT MARKET POTENTIAL

ENERGY EXPORT

BC Hydro, through its wholly owned subsidiary Powerex, has a long and successful track record of trading electricity. As discussed in the sidebar, BC Hydro’s reservoirs and the connectivity of its integrated bulk transmission system to Alberta and the western United States have enabled electricity trading that has provided a range of benefits for BC Hydro and its customers. For example, it has provided power and system stability when British Columbians have needed it, and it has enabled BC Hydro to keep rates lower by taking advantage of imported electricity when it is inexpensive. In the future, these transmission links could open up markets for new clean electricity generated by producers in B.C. to support economic development in regions across the province.

WHAT IS NEW?

In the new Clean Energy Act, one of B.C.’s energy objectives is that B.C. should be a net exporter. The Act directs BC Hydro to assess the potential export market for clean resources. BC Hydro may also acquire, subject to Cabinet approval, renewable energy from Independent Power Producers in B.C. for the sole purpose of exporting to Alberta or the U.S. Importantly, the Act protects existing BC Hydro ratepayers from the cost risks associated with energy purchased solely for export. It stipulates that the benefits derived from the existing BC Hydro system are to continue to flow to ratepayers and that the costs of building or acquiring renewable energy solely for the purpose of exporting are not to be recovered from ratepayers.

For planning purposes, it is important to distinguish between two different types of potential export activity:

- **Current Approach – “Traditional” Exports:** these are exports of surplus energy during times when BC Hydro has excess water in the hydroelectric system, including energy that is acquired to achieve the legal requirement of self-sufficiency by 2016 with an additional 3,000 GWh of “insurance” by 2020
- **Clean Generation for the Purpose of Export:** these are exports that would come from the aggregation of renewable energy from Independent Power Producers in B.C. for the sole purpose of long-term export contracts

For purposes of the IRP, the latter new approach to considering export is the focus of this Consultation Topic: Export Market Potential.

IMPORTING AND EXPORTING ELECTRICITY HAS BENEFITS

Exports and imports are a natural part of integrated electricity systems. In regions that are dependent on hydroelectric power, as is the case in B.C. and the Pacific Northwest of the United States, trade in electricity helps utilities address natural variations in water supply (wet years and dry years) that change by season and year. Similarly, trade can be beneficial when different regions have different electricity usage depending on the season – for example, in winter, when usage is highest in the Pacific Northwest, it is lower in the desert regions of the southwest.

While electricity exports happen in every year, just as imports do, it is the difference between the two that determines whether a utility is a net exporter or importer. For many years, BC Hydro sold more energy than it bought. However, as domestic demand has crept up, BC Hydro has found itself becoming a net importer – in some years, purchasing more than 10 per cent of B.C.’s total annual electricity consumption.

BC Hydro, through its wholly owned subsidiary Powerex, has had a long and successful track record of importing and exporting energy for the benefit of British Columbians. Originally established in 1988 to market the province’s surplus electricity, Powerex’s trading activity has evolved and now much of Powerex’s trading activity is not directly linked to the BC Hydro system. Powerex has enabled BC Hydro to make the best use of its resources and has ensured a stable electricity supply while generating revenue that has helped keep rates low for customers.

BC Hydro’s bulk transmission system has connection points both to Alberta and the western United States. A key ingredient in BC Hydro’s electricity trade is the flexibility created by the large reservoirs behind its major dams. These reservoirs enable BC Hydro to make economic decisions about when to use the water to generate electricity and when to take advantage of the other sources. For example, when water levels in B.C. are high, or demand in the market is high (during peak periods of the day or the year), Powerex can purchase electricity from our neighbours in Alberta and the western United States.
CLEAN GENERATION FOR EXPORT
The Clean Energy Act requires BC Hydro to prepare an IRP by December 2011 (and every five years thereafter). Among other things, the IRP must include:
- An assessment of demand for renewable energy in markets that BC Hydro can serve
- An estimate of the market share that BC Hydro might capture
- An estimate of the expenditures that will be required to undertake exports beyond traditional exports

Upon reviewing the IRP, the provincial government may direct BC Hydro to begin acquiring energy from Independent Power Producers in B.C. explicitly for export. The government has stated that it will only begin this process if there is a clear business case demonstrating that such exports will provide a benefit to British Columbians.

BC Hydro will consider a number of factors when examining export market opportunity, including:
- Current and potential federal, provincial and state energy and environmental policies
- The estimated size of the renewable electricity market under current and potential policies

Sources of attractively priced power may provide economic development benefits to B.C.

The table below summarizes the differences between the current approach – “traditional” exports – and an additional approach - clean generation for the purpose of export:

<table>
<thead>
<tr>
<th>EXPORT APPROACH</th>
<th>DESCRIPTION</th>
<th>TECHNICAL</th>
<th>FINANCIAL</th>
<th>ENVIRONMENTAL</th>
<th>ECONOMIC DEVELOPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CURRENT APPROACH – “TRADITIONAL” EXPORTS</strong></td>
<td>Sell the surplus capability (system) including that which arises from achieving self-sufficiency by 2016 and insurance by 2020.</td>
<td>System reliability maintained at planned levels.</td>
<td>First $200 M of net income from trade goes to ratepayers. Any losses and any net income above $200 M goes to the Province.</td>
<td>The transmission system will only be expanded to maintain reliability, to meet domestic load, and to comply with the requirement of self-sufficiency/insurance.</td>
<td>Sources of attractively priced power may provide economic development benefits to B.C.</td>
</tr>
<tr>
<td><strong>CLEAN GENERATION FOR THE PURPOSE OF EXPORT</strong></td>
<td>Acquiring additional renewable energy produced in B.C. for the sole purpose of export. This will cause additional Independent Power Producers generation projects to be built in B.C.</td>
<td>System reliability maintained at planned levels.</td>
<td>Additional revenues for the Province to the extent that sales of renewable energy exceed the costs involved in delivering electricity to other jurisdictions.</td>
<td>Additional environmental footprint in B.C. and elsewhere due to building additional clean generation resources and additional transmission in B.C. to deliver electricity to markets in the U.S.</td>
<td>Potentially more jobs, GDP and tax revenue than current approach. [Will lead to additional clean electricity generation construction and generation jobs in the regions.]</td>
</tr>
</tbody>
</table>
WE WANT TO HEAR FROM YOU!

2011 INTEGRATED RESOURCE PLAN

PLANNING FOR A CLEAN ENERGY FUTURE

CONSULTATION WORKBOOK

MARCH 1 – APRIL 30, 2011

FEEDBACK FORM
CONSERVATION & EFFICIENCY

GREATER CONSERVATION & EFFICIENCY

To achieve higher energy savings from conservation and efficiency than BC Hydro already targets, BC Hydro would need to rely on additional changes to federal and provincial regulations, send stronger rate signals through specially designed electricity conservation rates, and expand Power Smart programs. Greater emphasis would be placed on changing province-wide market parameters, and on changing societal norms and patterns that influence electricity savings.

From a planning perspective, BC Hydro must be highly confident that savings from conservation and efficiency will be achieved as and when expected – otherwise it risks falling short of meeting future energy requirements. Increasing the current aggressive target carries risk that the savings will not materialize, meaning that BC Hydro would not have the adequate supply to meet legislated self-sufficiency requirements and would need to act quickly to procure a potentially more costly supply from Independent Power Producers.

Here are some trade-offs and other factors to consider:

• This approach would require you and your neighbours to reduce your electricity consumption by adopting additional energy-efficient technologies, responding to conservation rates, and making conserving energy a focus of your daily activity
• It would require additional regulations to make energy-efficient building practices and technologies mandatory
• If higher electricity savings are not achieved, higher cost electricity may need to be acquired from other jurisdictions on the open market or from accelerated power acquisition processes in B.C.

Refer to pages 12–13 for more information

Q1.

Please indicate your level of agreement with this greater conservation and efficiency approach. In developing your response, please consider the summary to the left, including the trade-offs and other factors that have been provided.

(please check one box only)

❑ Strongly Agree
❑ Somewhat Agree
❑ Neither Agree nor Disagree
❑ Somewhat Disagree
❑ Strongly Disagree

Please provide any comments in the space provided below to explain the reasons for your agreement or disagreement.*

__________________________________________________________________________________________________________
__________________________________________________________________________________________________________
__________________________________________________________________________________________________________
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*For privacy reasons please do not provide opinions about identifiable third parties.
ELECTRICITY GENERATION OPTIONS
These portfolios are offered as examples to illustrate key trade-offs that arise between generation options.

PORTFOLIO 1: RENEWABLE MIX
This portfolio includes a mix of renewable resources such as wind, run-of-river and biomass from Independent Power Producers. The Site C Project is specifically excluded. Given that wind and run-of-river hydro are intermittent resources, this portfolio requires backup resources when the intermittent sources are not available. These backup resources would generally consist of additions at existing BC Hydro generating facilities, or new pumped storage facilities or gas-fired generation. This portfolio has low greenhouse gas emissions, with a geographically widespread environmental footprint. The cost of renewable resources and the need for backup resources make this the most expensive portfolio of the three.

Here are some trade-offs and other factors to consider:
- More diverse mix of renewable resources
- More dispersed regional jobs
- Lower greenhouse gas emissions and more dispersed environmental footprint
- Requires additional backup (capacity) resources
- Costs more than other portfolios

Base Energy: 827 72  Backup: $$$$ 

Q2.1 Please indicate your level of agreement with Portfolio 1 – Renewable Mix. In developing your response, please consider the summary to the left, including the trade-offs and other factors that have been provided.

(please check one box only)
- Strongly Agree
- Somewhat Agree
- Neither Agree nor Disagree
- Somewhat Disagree
- Strongly Disagree

Please provide any comments in the space provided below to explain the reasons for your agreement or disagreement.*

*For privacy reasons please do not provide opinions about identifiable third parties.
PORTFOLIO 2: RENEWABLE MIX WITH SITE C
This portfolio includes a mix of renewable resources, that include Site C along with wind, run-of-river and biomass projects from Independent Power Producers. Site C is included to provide system storage and capacity to back up intermittent resources, but ongoing additions at existing BC Hydro generating facilities and additional capacity and storage still may be required if a large amount of intermittent resources are added. This portfolio has the lowest greenhouse gas emissions, with its environmental and social footprint concentrated in the Peace region. This portfolio will have a lower cost than Portfolio 1.

Here are some trade-offs and other factors to consider:
• Economic and environmental impacts are relatively more geographically concentrated
• Lowest greenhouse gas emissions
• Requires less backup generation than Portfolio 1
• Relatively lower cost – lower than Portfolio 1, but higher than Portfolio 3

Base Energy: 496
Backup: 43
Cost: $$$!

Q2.2
Please indicate your level of agreement with Portfolio 2 – Renewable Mix with Site C. In developing your response, please consider the summary to the left, including the trade-offs and other factors that have been provided.

(please check one box only)
- Strongly Agree
- Somewhat Agree
- Neither Agree nor Disagree
- Somewhat Disagree
- Strongly Disagree

Please provide any comments in the space provided below to explain the reasons for your agreement or disagreement.*

*For privacy reasons please do not provide opinions about identifiable third parties.
Q2.3
Please indicate your level of agreement with Portfolio 3 – Renewable Mix with Site C and Gas-Fired Generation (within 93 per cent Clean Energy Act target). In developing your response, please consider the summary to the left, including trade-offs and other factors that have been provided.

(please check one box only)

- [ ] Strongly Agree
- [ ] Somewhat Agree
- [ ] Neither Agree nor Disagree
- [ ] Somewhat Disagree
- [ ] Strongly Disagree

Please provide any comments in the space provided below to explain the reasons for your agreement or disagreement.*

Q2.4
Do you have any other comments about electricity generation resource options to meet customers’ future electricity needs? (please provide any comments in the space provided)*

*For privacy reasons please do not provide opinions about identifiable third parties.
Q3.

Please indicate your level of agreement with this approach to electrification that involves active promotion by BC Hydro. In developing your response, please consider the summary to the left, including as well as the trade-offs and other factors that have been provided.

(please check one box only)

- [ ] Strongly Agree
- [ ] Somewhat Agree
- [ ] Neither Agree nor Disagree
- [ ] Somewhat Disagree
- [ ] Strongly Disagree

Please provide any comments in the space provided below to explain the reasons for your agreement or disagreement.*

*For privacy reasons please do not provide opinions about identifiable third parties.
Q4. Please indicate your level of agreement with this proactive approach to transmission planning. In developing your response, please consider the summary to the left, including the trade-offs and other factors that have been provided.

(please check one box only)

❑ Strongly Agree
❑ Somewhat Agree
❑ Neither Agree nor Disagree
❑ Somewhat Disagree
❑ Strongly Disagree

Please provide any comments in the space provided below to explain the reasons for your agreement or disagreement.*

*For privacy reasons please do not provide opinions about identifiable third parties.
Q5. Please indicate your level of agreement with this export approach. In developing your response, please consider the summary to the left, including the trade-offs and other factors that have been provided.

(please check one box only)
- Strongly Agree
- Somewhat Agree
- Neither Agree nor Disagree
- Somewhat Disagree
- Strongly Disagree

Please provide any comments in the space provided below to explain the reasons for your agreement or disagreement.*

*For privacy reasons please do not provide opinions about identifiable third parties.
ADDITIONAL COMMENTS:
PLEASE PROVIDE ANY ADDITIONAL COMMENTS.*

*For privacy reasons please do not provide opinions about identifiable third parties.

THANK YOU FOR YOUR INPUT.
Input received through consultation will be considered, along with technical, financial, environmental, and economic development input, as BC Hydro evaluates alternatives and drafts the Integrated Resource Plan.
HOW INPUT WILL BE USED

Input received through consultation will be considered, along with technical, financial, environmental, and economic development input, as BC Hydro evaluates alternatives and drafts the Integrated Resource Plan.

A Consultation Summary Report summarizing input received through consultation, will be posted on BC Hydro’s website at bchydro.com/irp.

FEEDBACK DEADLINE:

Please submit your feedback by APRIL 30, 2011.

Please provide your contact information (optional):

Name: ____________________________
Address: __________________________
Postal Code: _______________________
Phone: ____________________________
Email: ____________________________

Consent to Use Personal Information

I consent to the use of my personal information by BC Hydro for the purpose of contacting me and keeping me updated about future consultations on integrated resource planning. For the purposes of the above, “my personal information” includes name, mailing address, telephone number, and email address, as per the information I provide.

Signature: ______________________ Date: ______________________

BC Hydro is collecting information with this form for the purpose of its Integrated Resource Plan in accordance with BC Hydro’s mandate under the Hydro and Power Authority Act, the BC Hydro Tariff, the Clean Energy Act and related Regulations and Directions. If you have any questions regarding the information collection undertaken on this form, please contact the IRP Project Team Administrator at 1 888 747-4832.

For further information or to submit your feedback form:

BC Hydro Integrated Resource Plan
Email: integrated.resource.planning@bchydro.com
Web: bchydro.com/irp
Mailing Address:
P.O. Box 2850
Vancouver, B.C. V6B 3X2
• ALTERNATIVE TECHNOLOGIES Non-conventional electricity generation methods such as fuel cells, tidal current, solar, wind and wave energy sources.

• ATTRIBUTE A characteristic that describes a resource option or portfolio, used to assess its performance in meeting the planning objectives.

• BASE LOAD An amount of electricity committed or available over a period of time at a steady rate.

• BLACKOUT Loss of all electrical load in a given area.

• BC TRANSMISSION CORPORATION (BTC) The Crown corporation created by the government of B.C. in 2003 to plan, operate and maintain BC Hydro’s high-voltage transmission system. The 2010 Clean Energy Act consolidated BC Hydro and BC Transmission Corporation.

• BC UTILITIES COMMISSION (BCUC) An independent regulatory agency of the provincial government operating under and administering the Utilities Commission Act. The BCUC regulates BC Hydro’s domestic supply and rates and the safety and reliability of the BC Hydro system, as well as operating, managing and administrative costs, and also assesses concerns from ratepayers regarding BC Hydro practice.

• BULK TRANSMISSION The transfer of electricity on the major high-voltage transmission system that carries the majority of power from the generators to the lower-voltage distribution systems.

• CAPACITY The instantaneous power output or electricity demand at any given time, normally measured in kilowatts (kW) or megawatts (MW). A transmission time, normally measured in kilowatts output or electricity demand at any given.

• CODEREGEN The simultaneous production of electrical or mechanical energy and useful heat energy from a single fuel source.

• COLUMBIA RIVER TREATY A treaty signed in 1961 between Canada and the U.S. that enabled storage reservoirs to be built and operated in British Columbia to regulate Columbia River flows to the U.S. for power production and flood control.

• CONSERVATION Reducing the level of energy service to reduce energy consumption. For example, turning off unused lights.

• CURTAILMENT A reduction in demand as a result of demand-side management.

• DEMAND Customers’ requirement for electric power.

• DEMAND-SIDE MANAGEMENT Actions, programs and initiatives aimed at modifying or reducing energy consumption through conservation, energy efficiency and distributed generation.

• DEPENDABLE CAPACITY The amount a plant can reliably produce when required, assuming all units are in service, measured in megawatts (MW). Factors external to the plant affect its dependable capacity. For example, steamflow constraints can restrict the dependable capacity of hydro plants and fuel supply constraints can impact thermal plant dependable capacity. Planned and forced outage rates are not included. The dependable capacity used for long-term planning is the maximum capacity that a plant/unit can reliably provide for three hours in the peak load period of week during two continuous weeks of cold weather.

• DISPATCHABLE A resource whose output can be adjusted to meet various conditions including fluctuating customer demand, weather changes, utility practices, market price changes and non-power considerations.

• DISTRIBUTION SYSTEM Electrical lines, cables, transformers and switches used to distribute electricity ever short distances from substations to the customer, generally at voltages lower than 69 kV.

• EFFICIENCY The effective rate of conversion of a natural resource (e.g., electricity) to usable energy, the effective rate of conversion of electricity to an end use (e.g., heating).

• ELECTRICITY A type of fuel energy transferred by the transfer of electrons from positive and negative points within a conductor.

• ELECTRICITY PURCHASE AGREEMENT (EPA) The contract that defines the terms and conditions by which BC Hydro purchases electric energy from Independent Power Producers.

• EMERGING TECHNOLOGIES Technology at the first stages of development or demonstration. Not readily available in commercial markets, energy efficiency and in commercial use, as evidenced by at least three generation plants generating energy for a period of not less than three years, to a standard of reliability generally required by good utility practice.

• ENERGY The amount of electricity produced or used over a period of time, usually measured in kilowatt hours, megawatt hours and gigawatt hours.

• ENERGY CAPABILITY Is the amount of energy that can be generated under specified conditions by a generating unit or by the electrical system over a period of time, typically expressed in GW/year.

• FIRM ENERGY refers to electricity that is available at all times. Resources typically providing firm energy include large hydroelectric dams, biomass, geothermal and natural gas.

• GREEN ENERGY Energy produced from a green power project, BC Hydro uses the ECOLOGO standard to determine green projects.

• GREENHOUSE GASES (GHG) Gases that contribute to global climate change, or the “greenhouse effect,” including carbon dioxide (CO2), methane (CH4), and nitrous oxides (N2O).

• GAIN A network of distribution or transmission lines.

• GHSGW stands for gigawatt hour, a unit of electrical energy equal to one billion watt hours.

• HERITAGE CONTRACT A 49,000 gigawatt hour per year contract between BC Hydro and Independent Power Producers.

• INDEPENDENT POWER PRODUCER (IPP) A non-utility-owned electricity-generating facility that produces electricity for sale to utilities or other customers.

• INTEGRATED RESOURCE PLAN The document describing BC Hydro’s long-term plan to meet customers’ needs by using existing and new resources and demand side management.

• INTEGRATED SYSTEM An interconnected network of transmission lines, distribution lines and substations linking generating stations to one another and to customers throughout a utility’s service area. Excludes customers located in remote areas who are connected via non-integrated generating plants.

• INTERMITTENCY Electricity supply that fluctuates or is not available at all times. For example, wind energy only produces power when the wind is blowing.

• LARGE HYDRO (SITE C) Site C is a proposed third dam and hydroelectric generating station on the Peace River in northeast B.C.

• LOAD The amount of electricity required by a customer or group of customers.

• LOAD FORECAST The expected amount of electricity required to meet customer needs in future years.

• MW stands for megawatt, a unit of electrical power equal to one million watts.

• OUTAGE A planned or unplanned interruption of one or more elements of an integrated power system.

• PEAK CAPACITY The maximum amount of electrical power that generates stations can produce in any instant.

• PEAK DEMAND The maximum instantaneous demand on a power system. Normally, the maximum hourly demand.

• PORTFOLIO A group of individual resources to be acquired in a sequence over time to fill customers’ future electricity needs.

• POWER The instantaneous rate at which electrical energy is produced, transmitted or consumed, typically measured in watts, kilowatts (kW), or megawatts (MW).

• POWER SMART BC Hydro’s demand-side management initiative to encourage energy efficiency for customers. Originally launched in 1989, Power Smart includes a full range of DSM programs aimed at BC Hydro’s residential, commercial and industrial customers.

• PORT FLOW The strength of electromagnetic force (EMF).

• RESERVE System generating capacity beyond that required to meet peak demand, ensuring sufficient generation is available if some generating units are not available, necessary to meet reliability criteria for planning and operation.

• RESERVOIR STORAGE The volume available in a reservoir to hold water for power generation or flood control.

• RESOURCE OPTION A source of electricity that could help meet or reduce electricity demand, including generation, purchases, demand-side management and transmission facilities.

• RUN-OF-RIVER A hydroelectric facility that operates with no significant reservoir facility.

• SCENARIO ANALYSIS A set of planning assumptions to test the long-term performance of a portfolio.

• TRANSMISSION SYSTEM Electrical facilities used to transmit electricity over long distances, usually at voltages greater than 69 kV.

• VOLTAGE The strength of electromagnetic force (EMF).

7. GLOSSARY (IN ALPHABETICAL ORDER)
For more information, please visit: bchydro.com/irp

You can also provide feedback and learn more about the Integrated Resource Plan by:

- Attending a public open house: bchydro.com/irp
- Online feedback form: bchydro.com/irp
- Written submissions: integrated.resource.planning@bchydro.com or P.O. Box 2850, Vancouver, B.C. V6B 3X2
- Toll-free phone: 1 888 747-4832