BC Hydro Overview: Forecasting, Planning & Power Acquisitions

Presentation to the Association of Professional Economists of BC

November, 2011
BC Hydro Overview

BC HYDRO'S CORPORATE PURPOSE IS TO PROVIDE RELIABLE POWER, AT LOW COST, FOR GENERATIONS

- Commercial Crown corporation owned by the Province of British Columbia
- Serving approximately 95 per cent of the province’s population and approximately 1.8 million customers
- Clean or renewable generation accounts for 90% of total supply
- Responsible for reliably generating between 42,000 and 52,000 gigawatt hours (GWh) of electricity per year
- Electricity is delivered to our customers through a network of over 18,500 kilometres of transmission lines and 57,000 kilometres of distribution lines
- Among the lowest electricity rates in North America. All-in rates approximately:
  - 6.5 cents residential
  - 5 cents commercial
  - 3.5 cents industrial
How it Works
Independent Power Projects

- BC Hydro manages 69 Electricity Purchase Agreements (EPAs) for projects in commercial operation
- Delivering 12,600 GWh/year of contracted energy to both its integrated and non-integrated system

<table>
<thead>
<tr>
<th>Project Type</th>
<th>EPAs</th>
<th>Contracted GWh/year</th>
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<tbody>
<tr>
<td>Biogas</td>
<td>4</td>
<td>80</td>
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<tr>
<td>Biomass</td>
<td>8</td>
<td>1,933</td>
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<tr>
<td>Energy Recovery Generation</td>
<td>2</td>
<td>75</td>
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<tr>
<td>Gas-Fired Thermal</td>
<td>2</td>
<td>3,140</td>
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<td>Municipal Solid Waste</td>
<td>1</td>
<td>131</td>
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<tr>
<td>Non-Storage Hydro</td>
<td>43</td>
<td>3,412</td>
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<tr>
<td>Storage Hydro</td>
<td>7</td>
<td>3,291</td>
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<tr>
<td>Wind</td>
<td>2</td>
<td>538</td>
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<tr>
<td><strong>Total</strong></td>
<td>69</td>
<td><strong>12,600</strong></td>
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Dokie Wind Project & Bear Mountain Wind Park

Dokie Wind Project photos courtesy of Alterra Power Corp.

Bear Mountain Wind Park photos courtesy of AltaGas Ltd.
The Integrated Resource Plan (IRP) is the long-term plan to meet customers’ needs for electricity over the coming decades.
IRP Overview

Potential ways to meet demand

- Encourage conservation and energy efficiency
- Upgrade and expand heritage facilities
- Secure new supplies of renewable energy
- Build new transmission and distribution lines
- Integrate new technologies to modernize the system
Demand Forecast

- Forecast to grow approx. 40% over 20 years
- Load growth affected by:
  - Population
  - Conservation
  - Consumption
  - Efficiency
  - Electrification
  - Economic Activity
Future Electricity Demand in B.C.
Meeting Future Electricity Demand

Conservation
Required to meet 66% of load growth through conservation and efficiency

Purchases of renewables
15% of current system, 25% by 2016

Re-investment in existing assets
Upgrades to aging infrastructure

New capacity resource
Site C Clean Energy Project
Resource Options

Potential ways to meet demand

- Biomass
  - Woodwaste
  - Municipal Solid Waste
  - Biogas
- Wind
- Geothermal
- Run-of-River
- Large Hydro (Site C)

- Natural Gas-Fired Generation & cogeneration
- Coal-Fired Generation with Carbon Capture and Storage
- Wave
- Tidal
- Large-Scale Solar
About Site C

**DAM**
Capacity: Up to 1,100 MW
Energy: 5,100 GWh/yr.

**RESERVOIR**
Length: 83 km
Area: 9,310 hectares; 2-3 times width of current river
Introduction to the Load Forecasts

2 MAIN PRODUCTS:

- Annual Peak Forecast
  - Distribution substations
  - Transmission substations

- Annual Energy Forecast
  - Total Sales forecast includes
    - Residential
    - Commercial
    - Industrial

3 PRIMARY APPLICATIONS:

- Generation operations capital planning
- Revenue Forecast
- Supply and demand balance for system planning
Uses of the Load Forecast

**Generation**
- Real Time Forecast
- Generation Dispatch
- System Optimization

**Power Trading**
- Resource Availability for Trade

**Rates & Regulatory**
- Hearings
- Rate Design & Structure

**Resource Planning**
- Long-Term Resource and DSM Planning

**Field Operations**
- Distribution Planning

**Regulator**
- Reliability: obligation to Serve
- Investment and Operations Prudency

**Finance**
- Income Forecasting

**BCTC**
- Transmission Planning and Investment

**Board and Executive**
- Approval of expenditures and plans
Forecast Principles

The BC Hydro Reference (Mid) load forecast attempts to represent the most likely (P50) load outcome.

- That is, realized load will be higher and lower than the reference forecast equally.
- Coordination between load forecast and planning criteria

Credible inputs: the forecast is constructed using credible, independent third-party inputs

“Evidence” principle - not speculative.

- BC Hydro adds (and subtracts) loads to the forecast based on concrete evidence
- Existing customer loads are not removed until BC Hydro has a clear indication that the shutdown or curtailment is permanent
- Defensibility of the forecast before the regulator
BC Hydro Sales History

GWh Economic Slowdowns

Coastal Forestry Strike
Historical and Forecast Loads (Weather and Strike-Adjusted) with Rate Impacts and with DSM
Drivers of Demand

Unprecedented load growth potential in the North
Driven by shale gas and mining developments

- Montney 350 -800 MW
- Horn River basin 250 -750 MW
- North coast LNG up to 1700 MW
- Mining 300 –500 MW
MEETING DEMAND

- Unprecedented load growth potential in the North
- Driven by shale gas and mining developments
  - Montney: 350 - 800MW
  - Horn River basin: 250 - 750MW
  - North coast LNG: up to 1700MW
  - Mining: 300 – 500 MW

- Key challenges
  - Timing – transmission and generation
  - Ratepayer impacts

- Customers should approach BC Hydro early to ensure supply
The LNG Market

Source: Encana Presentation – Horn River Conference Call – October 4, 2011.
Kitimat LNG Project

- Co-owners
  - Apache (40%, operator)
  - Encana (30%)
  - EOG (30%)

- 1,400 MMcf/d (10 MMT*) export capacity
- Pending final investment decision

*MMT = million metric tonnes

Source: Encana Presentation – Horn River Conference Call – October 4, 2011.
MONTNEY / SOUTH PEACE

- Significant oil and gas developments driving need for rapid investment in infrastructure

MONTNEY BASIN: DEMAND GROWTH

Dawson Creek and Groundbirch Load Forecast

- **CUSTOMER REQUEST**
- **HIGH**
- **BASE**

- **Existing transmission capacity**

**Fiscal Year**
- '10
- '15
- '20
- '25
- '30
- '35
- '40

**MW**
- 0
- 100
- 200
- 300
- 400
- 500
- 600
- 700
- 800
- 900
Fort Nelson integrated with Alberta system via a single 144 kV transmission line.

Electricity supply to the Fort Nelson area provided by the Fort Nelson Generating Station (FNG) with backup from Alberta.

Horn River Basin is further north and has no interconnections.

HORN RIVER DEMAND GROWTH

Horn River Basin - Electrical Load Scenarios

- **BC Hydro High**
- **BC Hydro Mid**
- **BC Hydro Low**
- **CAPP Industry Survey**

MW

<table>
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<tr>
<th>Year</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
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<tbody>
<tr>
<td>MW</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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January 2011
HORN RIVER BASIN SUPPLY OPTIONS

- Interconnect with new transmission lines from the south
  - Transmission line from BC integrated system to Fort Nelson / HRB
  - Sub-transmission throughout the Horn River Basin

- Customers to self-supply
  - No transmission line required

- Increase Fort Nelson’s thermal generation
  - Transmission line from Fort Nelson to the HRB
  - Sub-transmission throughout the HRB

- BC Hydro is working with the HRB producers, pipelines, BC Hydro, BC Ministry of Energy to evaluate options
NORTHEAST TRANSMISSION LINE

- 500 km with capital cost = $1.5-2B
- Commitment from producers to take service and contribute capital
- In service date 2017
- 230kv, 287kv and 500kv under consideration
- Mostly new right of way
- New station at Horn River Basin
- Connection at Fort Nelson
Mines in Skeena Region
NORTHWEST BC

NORTH OF TERRACE
- 6 mining projects – load scenarios: up to 400MW
- 3 generation projects to date – 0MW in winter to 305MW peak

SOUTH / WEST OF TERRACE
- Major load development with LNG projects – up to 1700MW
NORTHWEST SUPPLY OPTIONS

- Existing 500kv line from Prince George to Terrace
  - Current available capacity ~400MW

Options:
- Transmission
  - Upgrade existing line from 800 MW to 1380MW with series compensation equipment at substations.
  - New 500kV line from Prince George to Terrace.

- Generation
  - Clean energy – province-wide (requires new 500kV line)
  - Local generation without new transmission – renewables firmed with SCGTs

- Industry self-supply (for LNG projects only)
  - Direct gas compressor drives
  - Customer self generation

- Combinations of above options
BC HYDRO ANALYSIS UNDERWAY

- Load forecast, IRP

- System impact studies underway for:
  - 4 mines
  - 3 LNG projects (with multiple phases at each)

- Regional options
  - Transmission solutions
  - Generation solutions
  - Combinations

- Rate impact analysis and potential mitigation measures
  - Existing tariff
  - New tariff
  - LNG-specific rates
  - Negotiated contributions
  - Fixed rate/risk sharing agreement (under section 9 of CEA)
SUMMARY

- Natural gas and mining developments are driving unprecedented electric load growth in BC

- Major focus for BC Hydro in four areas:
  - Montney / South Peace
  - Horn River Basin
  - Northwest Mining
  - North coast LNG

- Timelines are tight for building new infrastructure

- Customers and potential customers should approach BC Hydro early in the planning stages