Using Price Incentives to Stimulate Development of "Green" Electricity Generation

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The Big Picture: electricity is an essential input

- Electricity is becoming the energy input of choice (e.g., fuel switching to electric vehicles)
- Jurisdictions face potential shortfall in generating capacity relative to growing demand
- There are many ways to generate electricity, and growing demand for ‘green’ technologies
- Key issue = how to increase generation capacity from green sources while controlling costs

What you should take away from this presentation!

- Govt can (should?) help stimulate investment in clean electricity generation
- But not in the usual sense of providing direct subsidies:
- Govt can help:
  - Enact policies that make the regulatory framework ‘friendly’ to clean technologies -- full social cost pricing
  - Provide long-term security of demand for output in the form of a guaranteed price from green suppliers which in turn helps to reduce barriers to development, construction & helps stimulate technologies
  - Credibly & clearly set a consistent policy stance

Objectives for talk

- Illustrate the role of govt policy in assisting conversion to cleaner electricity generation by looking at a case study of British Columbia, Canada
- Identify barriers to policy formation: how government thinking needs to change
- Challenges to bringing green generation on line
  - Regulatory conflict amongst agencies
  - Financial barriers
  - Macro impacts – construction & commodity boom, labour shortages
  - Technological & operational knowledge
  - Trust in government

Outline of situation & issues

- A few facts for BC to set context
  - Electricity generation and demand in BC
- Evolution of energy and regulatory policy
  - Provincial Energy Plans 2003, 2007
  - Regulatory commission: BC Utilities Commission (BCUC)
- Implementation of policy
  - Role of private versus public sector

British Columbia Electricity Generation

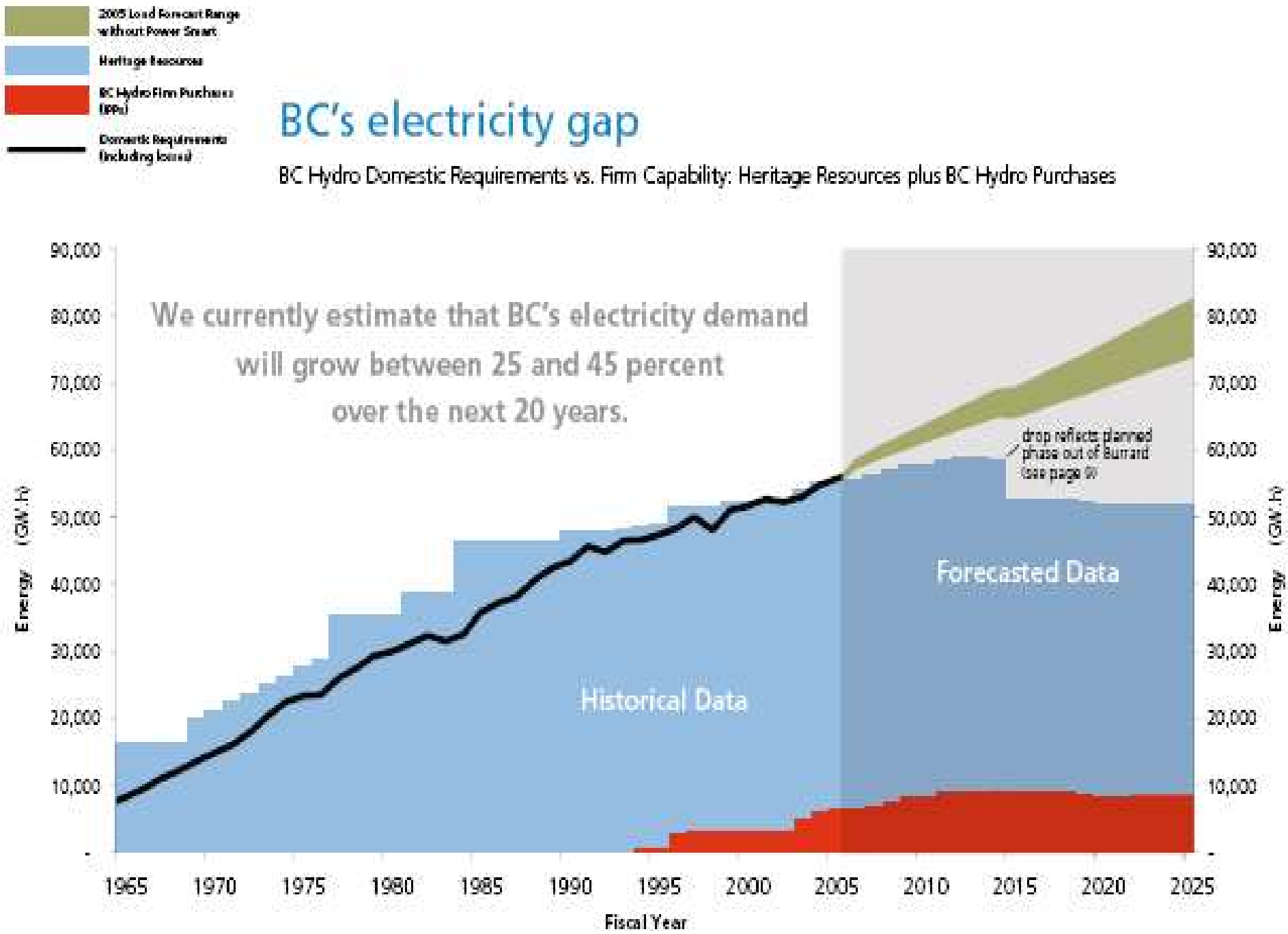
- Most of province served by govt-owned regulated entity, BC Hydro (BCH)
  - Regulator is BC Utilities Commission (BCUC) Is independent of govt, but takes directives from govt
- System is mostly hydroelectric with growing private sector suppliers, who are renewable sources

2004 Total Electricity Production by Source (% of total)

	Other Renewables	Hydro Electric	Nuclear	Waste and Biomass	Natural Gas	Diesel Oil	Coal	TOTAL
British Columbia	**0.0**	**92.8**	**0.0**	**1.0**	**6.0**	**0.2**	**0.0**	**100**
Alberta	2.3	4.4	0.0	0.0	12.0	2.6	78.7	100
Australia	0.3	6.9	0.0	0.6	12.3	0.70	79.2	100
California	10.7	17.0	14.5	0.0	37.7	0.0	20.1	100
Denmark	16.3	0.1	0.0	8.8	24.7	4.0	46.1	100
Finland	0.4	17.6	26.5	12.4	14.9	0.7	27.5	100
France	0.2	11.3	78.3	1.0	3.2	1.0	5.0	100
Germany	4.2	4.5	27.1	2.6	10.0	1.6	50.0	100
Japan	0.4	9.5	26.1	1.9	22.6	12.3	27.2	100
Norway	0.3	98.8	0.0	0.5	0.3	0.0	0.1	100
Ontario	1.8	24.8	49.7	0.0	5.2	0.5	18.0	100
Oregon	2.3	64.4	0.0	0.0	26.3	0.1	6.9	100
Quebec	0.7	94.5	3.2	0.0	0.1	1.5	0.0	100
United Kingdom	0.5	1.9	20.2	2.1	40.3	1.2	33.8	100
Washington	2.3	70.0	8.8	0.0	8.6	0.1	10.2	100

Challenges

- Gap between demand and supply forecast to grow over next 20 years
  - Annual electricity demand increasing by 1.2 % to 1.8%
  - Existing generation = ageing assets + at capacity (when at peak)
- Gap can be met by:
  - Imports: problems = could be GHG-intensive, subject to market conditions (price & supply uncertainty)
  - New generation in the province
  - Demand side management


2005 Load Forecast Range without Power Smart
Heritage Resources
BC Hydro Firm Purchases (IPPs)
Domestic Requirements (including losses)
BC's electricity gap
BC Hydro Domestic Requirements vs. Firm Capability: Heritage Resources plus BC Hydro Purchases
We currently estimate that BC's electricity demand will grow between 25 and 45 percent over the next 20 years.
drop reflects planned phase out of Burrard (see page 9)
Historical Data
Forecasted Data
Energy (GW.h)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Fiscal Year

Capacity versus energy

- **Capacity** = the instantaneous power output of a power plant at any given time (MW)
- **Energy** = the total amount of electricity produced by a power plant over a given period of time (GWh)
- Capacity = limiting factor when at peak
  - Need to build enough capacity or have access to enough energy to always “keep the lights on”

Constraints for BC system

- Rain/snowfall and water levels in reservoir
  - Have had high degree of variability over time, recent 5-year low water, spring 2007 near flooding
  - Cannot draw down reservoir below regulated minimum
  - Reservoirs cannot absorb more water than capacity need to spill excess at dams (environmental impact)
- System = Winter peaking, 7 pm time of day peak
- Transmission congestion for imported power – cannot always get it to BC & highly variable price

BC Government shapes policy direction

- Current govt elected spring 2001 with a ‘private market/efficiency/tax cutting agenda’, soundly defeated an interventionist govt who was seen by much of the public as incompetent, corrupt, and harming the provincial economy
- Province remains polarized: sizeable segment of public feared new govt would privatize BC Hydro and open the doors to full competition in electricity generation
- First major govt policy statement re: electricity = 2003 Energy Plan

2003 Energy Plan: key components

- “BC aims to be a leader in energy efficiency & alternative energy”
- Promote clean and renewable energy
  - Voluntary goal = acquire 50% of new supply from BC Clean Electricity over the next 10 years from the private sector
    - “BC Clean Electricity” refers to alternative energy technologies that result in a net environmental improvement relative to existing energy production
- Keep electricity rates low
- BC Hydro will not be privatized; heritage hydro assets belong to British Columbians

2003 Energy Plan initial impacts = mixed messages

- Public & stakeholder skepticism
- “Clean” is not necessarily “green”
- Wary support from Independent Power Producers (IPPs) – the private sector
- BC Hydro had limited experience buying generation output from the private sector; needed clarification from govt on policy
- Was the regulatory environment ready for a shift to greener generation?

Challenges for BC Hydro

- How to buy generation: learning by doing with calls for new generation
- Regulatory issues:
  - BCUC challenges the need for new supply because does not believe BC Hydro's load forecasts
  - Shouldn't we simply buy needed power on market? (how to incorporate market risk)
  - Bottom line matters most: cost effectiveness to keep rates low = basic conflict between environmental & regulatory goals

BCH 2006 open call for power – the price instrument

- Open call = any type of power (except nuclear), not constrained by govt policy to only solicit clean sources
- Competitive bidding with adders for some environmental characteristics
- BCH commits to awarded price for length of contract (inflation adjusted over time)
- Bidder specifies length of contract, flexible

Outcomes of 2006 Call

- 81 bidders registered, 61 completed the entire process, 38 Electricity Purchase Agreements awarded
  - Yield when operating: approximately 1,500 MW of capacity and 7,000 GWh/year of energy (4,200 GWh/year of firm energy net of attrition and outages).
  - Projects distributed across province & by fuel type and for large and small companies, with some First Nation involvement

Total energy by resource type

Resource Type	Total Energy (GWh/year)	Percentage of Total Energy Awarded
Water	2,854	40%
Wind	979	14
Biomass	1,185	17
Coal/Biomass	2,032	28
Waste Heat	75	1
Total	7,125	100%

Assessment of 2006 Call: Good news

- Long-term contracts mitigate exposure to market and transmission risk for BCH
- Long-term contracts provide security for IPPs
- Achieved diverse set of clean resources, not all of which were hydro so mitigates precipitation risk
- Development risk lessened with projects at various stages in the permitting process
- Geographically diverse
- First Nations projects included

Assessment of 2006: Not so good news

- Will this supply cost BC less than if bought on the market? Market prices = $15 to $75/MWh
- Attrition of projects due to: market conditions (massive building boom, labour & materials shortages, financing) + regulatory delays
- 2 coal projects met all the criteria: environmental problems!! Clean, maybe? But not green!
- Some IPPs grumbling: call wasn't large enough or put barriers to their bids (financial)
- Not much incremental generation capacity

Did BC Hydro pay too much for new power? Comparison to prices paid in Pacific NW to private sector producers, 2006

Levelized plant gate prices	Pacific NW C$/MWh	BCH 2006 Call C$/MWh
Wind	84-118 (76-106) US$2006	71-91
Coal	79-139 (71-125) US$2006	67-82
Hydro	66-111 (59-100) US$2006	56-95

Energy Plan 2007 = massive change to “Green Agenda”

- Environmental Leadership
  - Zero net greenhouse gas emissions by 2016
  - Zero greenhouse gas emissions from any coal-fired thermal electricity facilities (CCS)
  - Clean or renewable generation to account for 90 per cent of total generation
- Energy Self-Sufficiency
  - Province to be electricity self-sufficient by 2016

Impact of 2007 Energy Plan

- Way too soon to tell, but BC Hydro has major shift to:
  - Contracts for green energy – coal EPAs likely to be canceled by suppliers (cannot achieve zero GHGs at price of contract)
  - New calls for green power by end of this year: 5,000 GWh/year of firm energy for delivery by 2015 to be green & self sufficient
  - Bioenergy call under development for sawmill residue, logging debris & timber killed by the mountain pine beetle timber [climate change impact]
    - More than 80 submissions received to date

Analysis of impacts

- Major shift to green economy possible
- Relations with IPPs improving
- Still are barriers to green technologies only part of which can be addressed by government
- A challenge to get capacity instead of just energy (run-of-river hydro, wind, solar have no storage)
- Bioenergy is capacity, but for how long? Is it GHG neutral or not?

Challenges remain: Next steps

- Need more regulatory change – BCUC still needs more directives re green economy
  - Need a BC govt directive to BCUC to allow incorporation of environmental benefits in cost calculations
- Stakeholders concern about green generation
  - BC govt has removed requirement for municipality to approve projects in jurisdiction
  - First Nations involvement & governance a major issue
  - Ratepayers (large industrial, consumers) concerned about cost – need education and engagement/dialogue
- Attrition in IPPs awarded contracts due to labour and capital markets & adopting new technologies
  - Need to spread out time to bring on new capacity to reduce cost impact
  - Help with technological barriers (PowerTech = BCH subsidiary)

Final words

- Tremendous potential for growth in new supply & emerging technologies
- Investment in regions of BC where need economic activity & jobs
- Government policy change sets ‘tone at the top’ creates a sense of excitement and commitment (while learning about barriers) (watch for next BC provincial budget)
- Competitive bidding process + “green” means full cost pricing at work, not a ‘subsidy’