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INTRODUCTION

- British Columbia has committed to become energy self-sufficient by 2016 and generate 3,000 MWh additional (insurance) energy.
- Currently imports are required to meet BC domestic load and load is expected to grow substantially over the next five years, thereby increasing the supply gap.
- The province could allow for self-generation via natural gas fired units in the province's north east .
- However, amongst other objectives, the BC Clean Energy Act requires the province to use clean or renewable resources to generate electricity.

GOALS/OBJECTIVES

- Whether or not the province can be self-sufficient in electricity, and what this means, is the issue addressed in this paper.
- We create a linear programming model of the BC electric system, with energy flows between Alberta and BC.
- Power systems on the two largest rivers systems (Columbia and Peace) are modelled independently with variable head heights.

DATA SOURCE

- Historical inflow, outflow and reservoir elevations are from the Environment Canada Data Explorer (ECDE) and the HYDAT Database.
- Information about hydroelectric generating capacity, constraints and technical specifications are primarily from Sawwash (2000) and BC Hydro (2009).
- Historical balancing authority load data are available from BC Hydro (2008).
- Data for revenue and costs are from BC Hydro's 2008 Annual Report.

PROJECT OVERVIEW

- The electricity sector in British Columbia is dominated by hydroelectric generation. In 2009, hydroelectric generation accounted for approximately 86% of electricity supplied in BC (BC Hydro, 2009). We focus on the province's hydroelectric generating assets, although we allow for thermal units to be used as required and for imports and exports when it proves economically feasible
- The LP model maximizes revenues subject to the constraint that generation must exceed domestic demand including net exports for each jurisdiction
- BC can trade with Alberta to the east and the U.S. to the south; respective intertie capacities are 800 MW and 2000 MW.
- Terminal storage volumes are constrained initially to be 100% of start volumes, although we can allow these to vary in the simulations to mimic drought or high water conditions.
- Import and export prices for the US and Alberta markets are fixed and constant across simulations..

RESEARCH FINDINGS

Results

- Given reservoir volume requirements, hydro alone is not sufficient to meet BC's 2008 load. BC cannot be self-sufficient without the Burrard natural-gas plant, and cannot possibly generate 3,000 MWh of insurance energy
- As end-of-period (terminal) reservoir volumes are increased (to ensure future generation of power), reliance on imports increases.
- Nearly twenty-two percent of generation is from imports when no domestic thermal power is produced and terminal reservoir volumes are 100% of their start values.
- Since the price of imported electricity from the U.S. and Alberta is less than the cost of thermal generation, the model imports as much as it can before using thermal, if permitted.

Further Areas of Research

- In the current research, we employ fixed import and export prices for Alberta and the U.S. Further research would include the dynamics of BC's adjacent markets, thereby endogenizing the price of electricity.

Generation by Type for Various Scenarios

Scenario	Hydro	Site C	Thermal	Imports	Exports
2008 Demand, No Thermal, No Exports, VolRes=50%	94.7%	n/a	0.0%	5.3%	n/a
2008 Demand, No Thermal, No Exports, VolRes=100%	78.1%	n/a	0.0%	21.9%	n/a
Oil/Gas Demand, Site C, VolRes=50%	68%	7%	0%	13%	13%
Oil/Gas Demand, Site C, VolRes=100%	65%	5%	0%	23%	7%
Site C Oil and Gas, No Thermal No Exports Vol Res=50%	89.9%	8.8%	0.0%	1.3%	n/a
Site C Oil and Gas, No Thermal No Exports Vol Res=100%	74.3%	6.1%	0.0%	19.5%	n/a

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