

Title: Factors affecting electricity pricing and forecasting models

Corporate and Project Finance (Debt Management Branch, Provincial Treasury)

The Debt Management Branch provides centralized liability management and project finance services to the government and its Crown corporations and agencies. In addition to borrowing funds to meet client requirements, the branch manages all principal and interest payments and enters into derivative transactions to manage interest rate and foreign currency risk exposure. The Branch is structured into five groups; Capital Markets, Corporate and Project Finance, Legal and Corporate Affairs, Reporting and Analysis, and Risk and Performance Measurement.

The Corporate and Project Finance group provides Financial Advisory and Arranger/Placement services with respect to alternative procurement of capital assets, public-private partnerships and divestiture initiatives. Financial Advisory Services includes support in developing business cases, deal and governance structures, debt and financing models, valuations and discount rates; and Arranger and Placement Services includes support in engaging external advisors and placement agents, credit rating agencies, and borrowing from the banks and capital market.

Problem description and electricity markets:

Corporate and Project Finance (CPF) has been conducting due diligence in connection to the potential build out and financing of a large hydro electric power generating station in British Columbia. As a financial advisor, we are interested in discovering the factors that affect the price of electricity, i.e., seasonal factors, the magnitude of seasonal price variances, the drivers of electricity prices ...etc.

BC has natural advantages in energy resources and an energy sector that is rapidly growing. This sector could very well support the Province's growth over the long term. Growth requires a balanced approach that includes conventional, new, and alternative sources of supply which has a focus on efficiency and ensures self-sufficiency and promoting economic gain through export opportunities.

In evaluating potentially new hydroelectric power projects, the CPF group is interested in understanding the dynamics of the BC power markets specifically focused on the pricing of electricity. Thereby in evaluating the long term strategic options for the new project, the Province is interested in discovering the relationship that alternative energy resources such natural gas have on electricity price (i.e., the price of electricity is a function of ...). An additional topic of interest is the relationship between the **reserve margin** and the price of electricity. This type of information can help understand how much capacity it's in the electricity system or how thinly the system is stretched. Also, the Province is interested in long term trends and market dynamics that might influence the cost of electricity.

(The reserve margin is a measure of available capacity over and above the capacity needed to meet normal peak demand levels. Reserve margin and reserve capacity are synonymous. For a producer of energy, it refers to the capacity of a producer to generate more energy than the system normally requires. For a transmission company, it refers to the capacity of the transmission infrastructure to handle additional energy transport if demand levels rise beyond expected peak levels.)

Power Sales:

There are two primary methods of power sales and purchases in the electricity markets. These two methods are through Power Purchase Agreements (PPAs) or through merchant sales (Spot). PPAs are negotiated and structured between two parties and consequently a vast amount of detailed information may not be readily available.

Under merchant pricing, power which is sold at an energy trading hub, is more readily available and data points can be obtained. For example, the Mid-Columbia hub is a source of price discovery for power traders in the Northwest. To help market participants better manage their price risk, the Mid-C or Mid-Columbia electricity hub provides financially settled futures contracts based on the average peak day price for the electricity market. These prices are reflected in the Dow Jones Mid-Columbia electricity index.

Specific questions:

- 1) What drove the prices in the past and if such correlations still hold today?
- 2) How electricity prices are connected to other commodity prices? (Specifically natural gas prices)
- 3) If possible, provide a forecast of future electricity prices (5,10,15,20 years, for example).....within a 95% confidence interval? (Could be something else, if you determine it is more appropriate).
- 4) What are the correlation between natural gas, water levels, and coal prices on electricity prices?
- 5) Is there any correlation between electricity prices and water inflow levels?
- 6) What is the relationship between the reserve margin and electricity prices?