

THE INTRODUCTION OF COMPETITION IN THE RETAIL SUPPLY OF ELECTRICITY IN BRITISH COLUMBIA: LESSONS FROM OTHER JURISDICTIONS

by

Carl Badenhorst
B.Sc. (Eng), University of Cape Town, 1994

PROJECT SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

Master of Business Administration

In the
Faculty
of
Business Administration
Executive MBA Program

© Carl Badenhorst 2006

SIMON FRASER UNIVERSITY



Summer 2006

All rights reserved. This work may not be reproduced in whole or in part,
by photocopy or other means, without permission of the author.

APPROVAL

Name: Carl Badenhorst

Degree: Master of Business Administration

Title of Project: The Introduction of Competition in the Retail Supply of Electricity in British Columbia: Lessons from Other Jurisdictions

Supervisory Committee:

Dr. Richard Schwindt
Senior Supervisor
Associate Professor of Economics and Business Administration

Dr. Neil Abramson
Second Reader
Associate Professor of Strategic Management

Date Approved:

August 4, 2006



**SIMON FRASER
UNIVERSITY library**

DECLARATION OF PARTIAL COPYRIGHT LICENCE

The author, whose copyright is declared on the title page of this work, has granted to Simon Fraser University the right to lend this thesis, project or extended essay to users of the Simon Fraser University Library, and to make partial or single copies only for such users or in response to a request from the library of any other university, or other educational institution, on its own behalf or for one of its users.

The author has further granted permission to Simon Fraser University to keep or make a digital copy for use in its circulating collection, and, without changing the content, to translate the thesis/project or extended essays, if technically possible, to any medium or format for the purpose of preservation of the digital work.

The author has further agreed that permission for multiple copying of this work for scholarly purposes may be granted by either the author or the Dean of Graduate Studies.

It is understood that copying or publication of this work for financial gain shall not be allowed without the author's written permission.

Permission for public performance, or limited permission for private scholarly use, of any multimedia materials forming part of this work, may have been granted by the author. This information may be found on the separately catalogued multimedia material and in the signed Partial Copyright Licence.

The original Partial Copyright Licence attesting to these terms, and signed by this author, may be found in the original bound copy of this work, retained in the Simon Fraser University Archive.

Simon Fraser University Library
Burnaby, BC, Canada

ABSTRACT

A number of jurisdictions around the world have introduced competition, at the retail level, into their electricity supply industries. This paper examines the issues that may influence, or be influenced by, such an industry restructuring in British Columbia.

In order to present a complete analysis, the structure and characteristics of the British Columbia electricity industry are discussed in the context of a possible restructuring. Then, the key issues for policy makers to consider are described, including stakeholder interests, costs, availability and quality of supply, and environmental impacts.

The examination of three case studies leads to the conclusion that electricity reform can be successfully implemented, however, the development and implementation need to be carefully and methodically carried out. To this end, an action plan, consisting of 14 specific action items, is presented. These action items cover four distinct stages, namely; design, legislate and motivate, implement, and monitor and enforce.

Keywords: electricity, deregulation, retail, competition, British Columbia

DEDICATION

This project is dedicated to my wife, Anabela, for giving me the strength and encouragement to take on a mighty challenge.

ACKNOWLEDGEMENTS

I would like to thank my senior supervisor, Dr. Richard Schwindt, for the very relevant and always timely feedback, and for making this challenge a little easier to master.

I am also very grateful to my colleagues who made this whole adventure possible and provided great advice and mentorship during the journey; thank you Fred, Ann, Bruce, Joanna, and Sandra.

Finally, I would like to extend an extra-special thanks to my support system; my wife for taking care of business when I couldn't and my parents, brother and sister for cheering me on.

TABLE OF CONTENTS

Approval	ii
Abstract	iii
Dedication	iv
Acknowledgements	v
Table of Contents	vi
List of Figures	viii
List of Tables	ix
Glossary	x
1 Introduction	1
1.1 Background.....	1
1.2 Rationale for Study	2
1.3 Objectives	2
1.4 Organization of Project	3
2 Overview of the Retail Electricity Sector in B.C.	4
2.1 Structure of the Electricity Industry	4
2.1.1 Fuel Supply	6
2.1.2 Generation	6
2.1.3 Transmission.....	7
2.1.4 Distribution	8
2.1.5 Electricity Sales.....	8
2.2 Evolution to Current State.....	9
2.2.1 Chronology	9
2.2.2 Recent Developments in B.C.	10
2.3 Scope of the Electricity Retail Sector.....	11
2.3.1 Customers and Growth	12
2.3.2 Retail versus Wholesale Markets.....	13
2.3.3 Retail Competition.....	14
2.3.4 Current Status of Electricity Retail in B.C.....	14
2.4 Regulation.....	15
2.4.1 Coordination Economies	15
2.4.2 Economies of Scale and Scope	17
2.4.3 Natural Monopoly.....	17
2.4.4 Vertical Integration	18
2.4.5 Competitive versus Non-Competitive Supply of Electricity	20
3 Key Issues For Policy Makers to Consider	23
3.1 Stakeholders and Their Interests.....	23
3.1.1 Suppliers	24
3.1.2 Consumers.....	28

3.1.3	B.C. Residents	31
3.1.4	First Nations	32
3.1.5	Provincial Government	32
3.2	Cost and Pricing of Electricity	34
3.2.1	Inefficiencies Associated with Monopolies	34
3.2.2	Cost of Heritage versus Non-Heritage Energy	36
3.2.3	Stranded Costs / Benefits	38
3.2.4	Market Power	39
3.2.5	Wholesale versus Retail price Controls	40
3.3	Availability and Quality of Supply	41
3.4	Sustainability and Environmental Impact	43
3.4.1	Competition promotes low cost generation	43
3.4.2	Competition promotes smaller generation	44
3.4.3	Competition does not promote conservation	44
3.5	Summary of Key Issues	45
4	Others' Experience in Retail Competition.....	48
4.1	Global Overview	48
4.2	Recent Trends	49
4.3	Case Studies	50
4.3.1	United Kingdom.....	50
4.3.2	United States (California).....	57
4.3.3	United States (Texas)	63
5	Application to B.C.'s Electricity Sector.....	71
5.1	Design.....	71
5.2	Legislate and Motivate	80
5.3	Implement.....	83
5.4	Monitor and Enforce	86
6	Conclusions.....	87
Appendices.....		89
Appendix A.....		90
Appendix B.....		91
Reference List		92

LIST OF FIGURES

Figure 2-1 Physical arrangement of generation, transmission and distribution	5
Figure 2-2 Arrangement of industry relationships	5
Figure 2-3 Industry diagram showing deregulated components	21
Figure 6-1 Extract from BC Hydro survey	91

LIST OF TABLES

Table 2-1 Average number of BC Hydro retail accounts.....	13
Table 2-2 BC Hydro electricity sales by customer group	13
Table 3-1 Summary of stakeholder group representation in BC Hydro's F07/F08 Revenue Requirements Application	24
Table 3-2 Summary of cost of energy by source for F2007	37
Table 3-3 Summary of issues affected by retail competition.....	45
Table 4-1 Status of retail competition globally	49
Table 4-2 Evolution of the UK electricity industry (pre-deregulation).....	51
Table 4-3 Evolution of the California electricity industry (pre-deregulation).....	57
Table 4-4 Evolution of the Texas electricity industry (pre-deregulation)	64
Table 6-1 Registered intervenors and the stakeholders they represent	90

GLOSSARY

BCTC	British Columbia Transmission Corporation – A Crown corporation responsible for planning, operating and maintaining B.C.'s transmission system.
BCUC	British Columbia Utilities Commission – A regulatory agency of the Provincial government responsible for ensuring that customers receive safe, reliable and non-discriminatory energy services at fair rates from the utilities that it regulates.
Commercial Customers	Typically non-manufacturing businesses, including hotels, restaurants, wholesale businesses, and retail stores. Their electrical machinery generally consists of medium consumption devices such as computer equipment, lighting, cash registers and communication devices.
Distco	An organization that manages the distribution network or a portion thereof.
Distribution Network	The network of wires, transformers and switches that are used to carry electricity the short distances from the transmission network to the end user.
Economies of Scale	Cost savings that are achieved by producing a greater output through the use of higher capacity facilities.
Economies of Scope	Cost savings that are achieved by increasing the range of products or services offered, through the sharing of resources common to those products or services.
Genco	An organization that manages generation infrastructure
Generation	The equipment involved in the production of electricity.
Industrial Customers	Customers that generally require a large amount of power in order to run their operations which include mining, forestry and manufacturing. Their electrical equipment consists of heavy machinery such as motors, smelters and other machines typically used to change raw material into semi-finished or finished form.
IPP	Independent power producer – An organization other than a utility that generates electricity.
Market Power	The ability of a supplier to raise prices above competitive levels

over a significant period of time, to its benefit.

MES	Minimum efficiency scale – the lowest level of output at which the average cost of production is minimised.
Residential Customers	Residential consumers typically use electricity for heating, cooking, air-conditioning, communication, and entertainment.
Retail Market	Customers that purchase goods for their own use.
ROE	Return on equity – An indication of an organization’s profitability equal to the annual after-tax income divided by total equity.
Stranded Costs	Costs incurred by a utility that are not recoverable under a competitive market structure. A negative stranded cost may be referred to as a stranded benefit.
Transco	An organization that manages the transmission network or a portion thereof.
Transmission Network	The network of wires, transformers and switches that are used to carry electricity over long distances from the generation facilities to the areas supplied by a distribution network.
Vertical Integration	A single organization provides or controls all stages of the product processes. In the electricity industry, these include generation, transmission, distribution, and retail.
Wholesale Market	Customers that purchase goods for resale.

1 INTRODUCTION

1.1 Background

Starting in the 1990s, numerous jurisdictions around the world introduced competition at the retail level of their electricity industries with some, such as the UK and U.S. being more proactive than others. The reasons for this trend included the fact that generation technology was maturing, making it difficult for utilities to show the efficiency improvements that the industry had come to expect, and significant increases in fuel prices. This competition has generally been achieved through the unbundling and deregulation of parts of the industry, primarily the generation and retail sectors. Although electrical utilities were once considered natural monopolies in all three primary aspects of their business (generation, transmission and distribution), the generation of electricity has become more open to competition. This has resulted from the development of technologies that have substantially reduced the costs to build and operate small generators, moving them closer to the costs of the typical large utility generators.

This move towards deregulation was significantly hampered, primarily in the U.S., as a result of the failure of the California electricity industry in 2000 after its deregulation. Many of the states have either delayed, or dropped plans to institute electricity deregulation. Some, such as Texas, have gone on with their plans to deregulate and are achieving successful results.

Although retail competition has not been introduced in B.C., in 2002 the B.C. government mandated some changes to BC Hydro that would facilitate the introduction of competition, including the separation of the transmission component of the industry

from the generation and distribution components. On the surface, B.C. has little incentive to change the way it provides electricity services. It currently provides residential consumers with the third lowest rates in North America and industrial consumers with the second lowest (BC Hydro, 2006a). However, generation resources within B.C. are not sufficient to supply the current or forecast consumption, resulting in a net import of electricity (BC Hydro, 2006b). These market purchases come at a higher cost than the electricity generated within B.C. With the high economic growth in B.C., rates are likely to increase. This may prompt the decision to implement a competitive retail electricity market in B.C.

1.2 Rationale for Study

An industry is generally restructured in order to produce improvements of some kind, such as reduced costs or improved quality. In some cases, however, the restructuring may not lead to the intended result, for example, the restructuring of California's electricity industry. By studying both the successful and unsuccessful cases there is a far greater chance of designing and implementing an industry structure that will succeed. Now is a good time to reflect on, and analyse, the current situation, while the efforts towards reform have slowed down and information from real deregulation attempts (both successful and unsuccessful) becomes available for analysis.

1.3 Objectives

The slowdown in reform efforts may change direction again, particularly as industry analysts study the market failures and take away lessons that result in an improved industry design. This paper provides some useful lessons and policy analyses based on the successes and failures in other jurisdictions, and applies these findings to the situation in B.C. This paper does not intend to provide a recommendation on whether

to implement retail competition or not, but rather to provide direction in the event that such a decision is made. Assuming that the decision has been made, the analysis presented in this paper has been formulated from the view of maximising social welfare, rather than from any specific interest group's perspective. The target audience of this paper includes the policy makers and teams that would be responsible for designing and implementing a new electricity structure in B.C.

1.4 Organization of Project

This paper is organised in the following manner:

Chapter 2 describes the electricity industry both in terms of its physical arrangement and the relationships that exist between the various lines of business. It also highlights where the retail sector fits into the industry, and presents a chronology of how the industry evolved to where it is today.

Chapter 3 outlines the issues that policy makers should consider when deciding whether to implement a competitive retail market in the supply of electricity in B.C. This includes an analysis of stakeholder interests as well as the factors that affect the cost of electricity, the availability and quality of supply, sustainability, and environmental impact.

Chapter 4 presents three case studies of other jurisdictions that have deregulated their electricity industries. These include the UK, California, and Texas. Both positive and negative attributes and consequences are discussed, particularly where they relate to the issues outlined in chapter 3.

Chapter 5 provides specific recommendations, in the form of action items, intended to provide direction to the policy makers in B.C. in the re-design of the industry and processes, should the provincial government decide to deregulate the industry.

2 OVERVIEW OF THE RETAIL ELECTRICITY SECTOR IN B.C.

The electricity industry in the United States accounted for U.S.\$8,780 billion in annual revenues in 2004 (Energy Information Administration, 2004a), and electricity usage worldwide is expected to double by 2030 (Energy Information Administration, 2006). By all accounts, the electricity industry is one of the largest and most important sectors on the globe, touching almost every human being during almost every second of the day. This section provides an overview of the electricity industry while emphasising aspects that are relevant to B.C.

2.1 Structure of the Electricity Industry

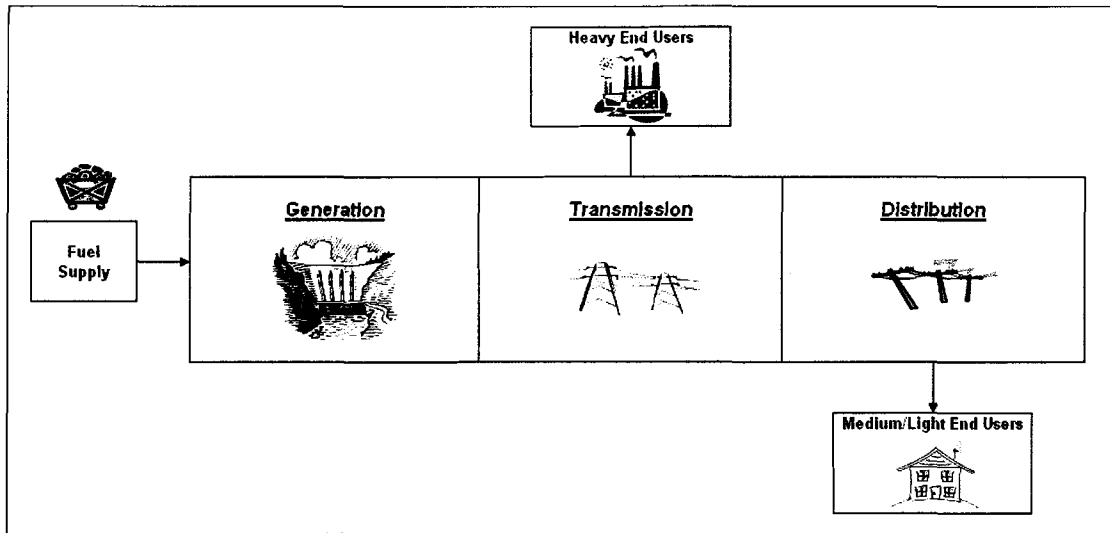
The industry is comprised of three primary components, namely; generation, transmission, and distribution. The primary input into this industry is fuel and the primary output is electricity sales.

Figure 2-1 shows the arrangement of the various physical components of the electricity industry. In contrast, Figure 2-2 shows the relationships between the various lines of business that exist in the industry. In some cases these lines of business may be associated with the physical assets (for example genco, transco and distco¹). In other cases the line of business may not be associated with a particular asset (for example traders and retailers). The retailers are responsible for negotiating contracts to purchase power either directly from the gencos or through traders, and then the sale of that power

¹ Genco, transco and distco are the terms used throughout the industry to represent the organizations that control the generation, transmission and distribution assets respectively.

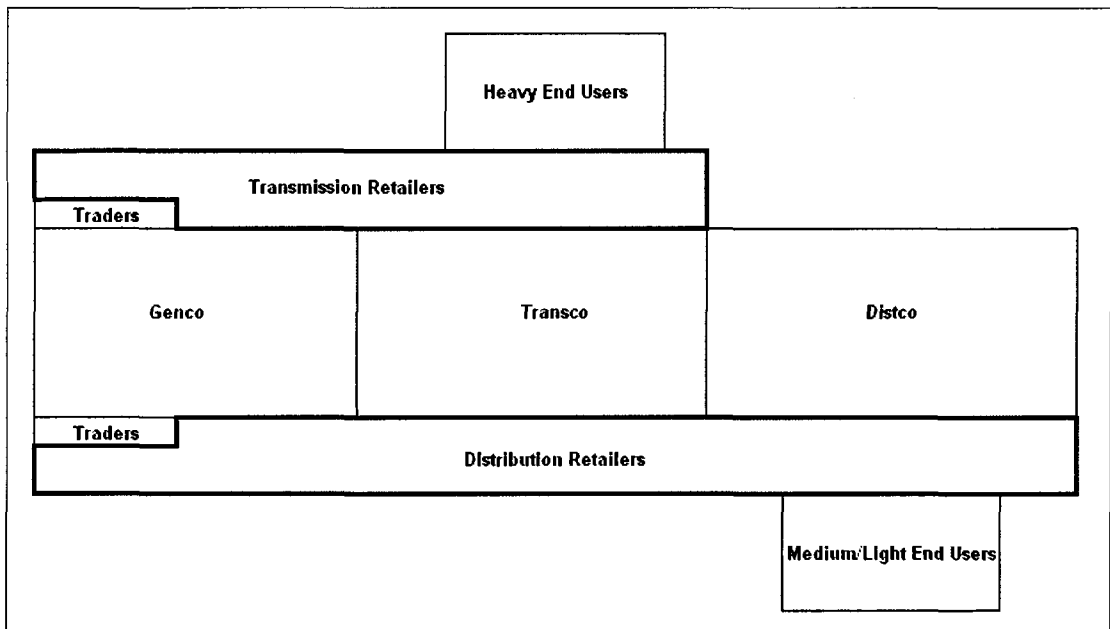
to the end user. They also need to contract with both the transco and distco organization to ensure that line capacity is available to transport that power from the generator to the user.

Figure 2-1 Physical arrangement of generation, transmission and distribution



Includes clip art © Microsoft, by permission

Figure 2-2 Arrangement of industry relationships



2.1.1 Fuel Supply

The fuel used to drive the generators could take a number of forms, including coal, natural gas, and water. The type of fuel to be used is determined primarily by the resource availability to that particular geographic area. For example, B.C. has an abundance of waterways, and therefore supplies almost 95 percent of its energy demand through hydro powered generators. The most commonly used fuel worldwide is coal (Energy Information Administration, 2004b). The delivery mechanism differs for the various types of fuel. Coal is typically delivered by rail directly to the power station, whereas generators fuelled by natural gas are generally built adjacent to gas transportation lines or have dedicated lines built to them. For hydro generators, once the dam has been built, nature takes care of the delivery, however, the uncertainty in this case is the quantity delivered. The same is true for other renewable fuel sources such as wind, solar, and wave energy. The supply of fuel is essential to the operation of an electricity system, affecting both the price and availability of electricity. In order to reduce the risk of substantial cost increases or inability to supply, many utilities will diversify their portfolio of power plants so that any deficiency in one type of fuel can be offset by utilizing the alternative fuel generators.

The genco is generally responsible for ensuring an adequate and timely supply of fuel. BC Hydro relies on long term contracts with other companies (e.g., Terasen Gas) to deliver its combustible fuel requirement, however as mentioned above, most of the generators operated by BC Hydro simply require an adequate rainfall season.

2.1.2 Generation

Generators are not only driven by numerous fuel types, but also vary in size and may be positioned close to, or far away from the point of consumption. Grid connected

generators typically range from 1MW (enough to satisfy the demand of about 300 houses) to over 3GW (enough for about 900,000 houses).

In B.C., generation is owned by both BC Hydro and Independent Power Producers (IPPs). Currently, the larger generators are owned by BC Hydro; however, many IPPs are building larger units. It is also becoming increasingly difficult to build very large hydroelectric projects in B.C. (BC Hydro, 2006b). In addition, new technology is reducing the per unit cost of smaller generating units, and making it possible to position these units closer to the load center (i.e., the consuming area), thereby lowering transmission costs. As a result, the opportunity for smaller generation companies to provide the new energy requirements in B.C. is increasing.

In order to build grid connected generation, IPPs may, establish a non-competitive interconnection and sales contract (through a call for tenders) with the British Columbia Transmission Corporation (see section 2.1.3 below) and BC Hydro. The sales price is determined by the contract. Alternatively, they may sell competitively to the wholesale market, or customers on BC Hydro's transmission service rate (see section 2.3.4), at prices determined by the market.

2.1.3 Transmission

Once the electrical power has been generated, it generally needs to be transmitted long distances so that it is available closer to where the load center is situated. This operation must be performed at a very high voltage (called a transmission voltage) to ensure an adequate voltage level at the receiving end of the line. With modern technology, the distance could be thousands of kilometres; far enough to enable connection to a neighbouring province or country's electricity grid. Compared to distribution, the cost of the transmission lines is very high, and they are therefore only

used for the bulk transfer of power from one point to another (i.e., from the generator to a significant load center).

BC Hydro owns the majority of the transmission lines in B.C. However, the management of these assets has been handed over to a recently formed, regulated crown corporation called British Columbia Transmission Corporation (BCTC). BCTC was formed under the order of the Provincial Government with the purpose of promoting investment in independent power production by providing equitable grid access to all generator proponents (B.C. Provincial Government, 2002).

2.1.4 Distribution

Once it has reached the load center, electricity is then distributed to the end user via multiple “medium voltage” electrical lines. The cost of these lines is much lower than the transmission lines, but their distance carrying capabilities are significantly less. These lines are predominantly overhead, but could be buried underground in built up areas. In any event, space is generally allocated within the pre-defined utility corridor on every street, as opposed to transmission lines that require their own rights-of-way of significant size.

BC Hydro performs almost all of the functions related to building and maintaining the distribution system.

2.1.5 Electricity Sales

In general, electricity may be sold in one of two markets, namely; the wholesale market and the retail market (section 2.3.1. provides a detailed description of the two markets). Wholesale customers could be other utilities or electricity resellers. These

purchasers buy large quantities of power and therefore purchase from the transmission network.

Domestic end use customers would be considered the retail market. These customers may be connected to either the transmission or the distribution network, depending on their power requirements. Typically, heavy industrial customers require a large amount of power and are therefore connected to the transmission network, whereas commercial and residential customers are connected to the distribution network.

In B.C., BC Hydro manages the relationship with both of these groups of customers.

2.2 Evolution to Current State

2.2.1 Chronology ²

Electricity suppliers started out small, generally consisting of generators set up to supply power for street lighting, industrial facilities and street car services. These companies often competed against each other in the same service territory, using different equipment and operating specifications that were not compatible with each other, leading to a chaotic operating environment.

On a global scale the electricity industry developed into vertically integrated monopolies in the late 1800s and early 1900s. These monopolies had very specific characteristics such as being publicly owned, or at least being subject to regulation. They were closely monitored and expected to deliver services within certain minimum technical standards and price parameters. At that stage many believed (as many still do

² This section draws upon Hirsh (2001) and Edison Electric Institute (n.d.)

today) that all customers benefited when one organization supplied all of the services related to that industry. One of the problems associated with a natural monopoly is that the organization supplying the products and services can take advantage of being the only supplier by raising prices or providing an inadequate quality of product. In the U.S., state regulation of electric utilities began in 1907. The purpose of this regulation was to prevent these natural monopolies from abusing their power. This regulation served the industry well. As a result of new emerging technologies, costs declined, leading to a significant increase in electricity usage, and thus a decline in rates.

In the 1970s, however, costs ceased to decline as a result of some technologies reaching a plateau, an exhaustion of economies of scale, and a significant increase in fuel prices. The resulting popular opposition to utilities created an environment for political action. In the U.S., the Public Utilities Regulation Policies Act (PURPA) was created in 1978. The purpose of this Act was to reform utilities' rate structures, and one significant immediate impact was the creation of a new class of small generator called qualifying facilities (QFs). The utilities were required to purchase power from these facilities. This signified the end of the monopoly era and the start of restructuring of the electricity industry.

2.2.2 Recent Developments in B.C.

In 2002 the provincial government released its energy plan "Energy for our Future: A Plan for B.C.". This plan contained a number of policy actions related to the electricity industry in B.C., some of these taking the industry a step closer to being able to introduce retail competition. The most significant of these action items was the creation of a new publicly owned entity, BC Transmission Corporation (BCTC), which effectively removed the transmission component from BC Hydro's vertically integrated

structure. The reasons for introducing this new organization, regulated by the BC Utilities Commission (BCUC), were to provide non-discriminatory access to the transmission network and to encourage the development of independent power producers (IPPs).

Another significant action item was the internal separation of the distribution and generation lines of business. The distribution line of business would then acquire energy from the generation line of business as a semi-independent entity. The significance of this separation is explained elsewhere in this paper. Finally, another action item required that new generation facilities be developed by the private sector and that BC Hydro be restricted to improvements at existing plant.

Although retail competition was not suggested as an action item in the energy plan, the items mentioned above have paved the way, should the policy makers decide in favour of such a direction.

2.3 Scope of the Electricity Retail Sector

The retail sector is indicated by the heavy line in Figure 2-2. In the figure, the retailers are shown separately as either transmission or distribution retailers; however, these functions could both be performed by the same organization. Also, under a retail competition system, the retail function may be performed by any one of the genco, transco, or distco organizations, or may be performed by a separate organization altogether. The primary purpose of the retailer is to sell electricity to an end user. This would entail providing services and functions such as:

- Customer acquisitions: through advertising and other marketing techniques and price competitiveness, the retailer must acquire new customers and convince existing

customers of other retailers to purchase power through them (called switching). See section 2.4.5 for rationale behind customer choices.

- Energy purchases: the other side of the equation is the purchase of the power required to supply the customers. Retailers have two channels available through which they can purchase energy. This could be from either the gencos or from energy traders.
- Transmission and distribution network services: in order to get the electricity from the supplier to the customer, the retailer needs to secure the rights to transfer this power over the transmission and distribution lines (contracts with the transcos and distcos in the jurisdictions through which the electricity needs to travel).
- Customer care services: this function includes providing customer call center services, billing services, providing electricity related information and advice, etc.

2.3.1 Customers and Growth

Three types of retail (end use) customers exist in B.C., namely; industrial, commercial, and residential. Over 90 percent of the load required by these customers is supplied by BC Hydro. The forecast number of retail customer accounts served by BC Hydro in its 2006 fiscal year is 1.69 million and is anticipated to increase by 3.5 percent over the next two years (BC Hydro F07/F08 Revenue Requirement Application). Table 2-1 below shows BC Hydro's actual and anticipated number of customer accounts from fiscal 2005 to fiscal 2008. The anticipated growth in sales within the three retail segments is shown in Table 2-2.

Table 2-1 Average number of BC Hydro retail accounts

(million)	F2005 Actual	F2006 Forecast	F2007 Plan	F2008 Plan
Average Number of Accounts	1.663	1.690	1.719	1.749

Source: BC Hydro F07/F08 Revenue Requirements Application

Table 2-2 BC Hydro electricity sales by customer group

(GWh)	F2005 Actual	F2006 Forecast	F2007 Plan	F2008 Plan	F2006 to F2008 Growth
Residential	15,814	16,147	16,675	16,999	5.2%
Light Industrial and Commercial	17,459	17,892	18,334	18,381	2.7%
Large Industrial	16,177	16,392	16,326	16,622	1.4%
Total	49,450	50,431	51,335	52,042	3.2%

Source: BC Hydro F07/F08 Revenue Requirements Application

The overall growth in sales over the next two years is anticipated to be around 3.2 percent. However, the largest growth, by far, will be within the residential customer group. This group's electricity requirement is anticipated to grow by 852 GWh over two years, representing an increase of 5.2 percent.

2.3.2 Retail versus Wholesale Markets

The retail market is limited to the end users of electricity, namely; residential, commercial and industrial customers who purchase electricity for their own use. These customers need not be within the same jurisdiction, state, or even country. The possibility of a retail transaction exists as long as an adequate transmission and / or distribution network is in place between the genco and the end user.

The wholesale market, on the other hand, is limited to market participants acquiring power for the purpose of resale. The power is transferred in bulk, generally

over the transmission network only. These participants could include utilities or even local municipalities, who would then distribute the power to their customers. It could also include separate retailers who have acquired end use customers.

The purpose of this project is to investigate the introduction of competition into the electricity industry at the retail level only. It does not include an evaluation of the wholesale market.

2.3.3 Retail Competition

In order to enjoy competition at the retail level, consumers need to be able to choose the firm that will generate the electricity they wish to purchase. It follows therefore that a pre-requisite for competition in the retail sector is unregulated competition in the generation sector. In addition, the jurisdiction introducing competition must have more than one local generator, or alternatively have transmission access to generators in other jurisdictions. The extent of retail competition can vary from full retail competition, allowing all customers to choose their source of generation, to limited retail competition, for example allowing only large industrial customers to choose.

2.3.4 Current Status of Electricity Retail in B.C.

In B.C. there are a number of utilities supplying electricity. However, the supply areas for these utilities do not overlap; each is therefore a monopoly supplier of transmission and distribution services. Since the BC Hydro supply area includes over 90 percent of the electricity requirements in B.C., this project focuses exclusively on BC Hydro as B.C.'s utility model.

Within B.C., only those customers connected to the transmission network have a choice of who to buy their power from. These are the customers that fall under the

Transmission Service Rate, and are typically large industrial customers. Within the Transmission Service Rate, BC Hydro has identified a stepped rate. The purpose of introducing the stepped rate was to provide price signals that encourage customers to implement energy efficiency projects to reduce their energy consumption. This is achieved by charging customers a rate based on BC Hydro's blended marginal cost of energy³ for 90 percent of their base load⁴, and the actual cost to acquire new energy for the balance (10 percent) of their base load requirements plus any increased load requirement. It is the latter portion (i.e., energy charged at new acquisition rates) that customers may want to obtain from other gencons. The Transmission Service Rate was implemented on 1 April 2006.

2.4 Regulation

In B.C., electrical utilities are regulated by the BC Utilities Commission (BCUC). The BCUC's mandate is to "protect the public interest by reviewing and approving energy rates, reliability standards and other conditions of service" (BCUC 2003 Service Plan). A number of characteristics of the electricity industry promote regulation of at least some of the components shown in Figure 2-2. These characteristics include network effects, economies of scale and scope, natural monopoly, and vertical integration benefits. These, as well as a discussion on the competitive versus non-competitive supply of the services are discussed below:

2.4.1 Coordination Economies

Significant coordination economies exist in a typical electricity network. It is not possible to direct, or even determine, what electrons (or electrical power) flow from a

³ The marginal cost of energy includes BC Hydro's heritage generation resources that are less costly than new energy resources.

⁴ An existing customer's base load is determined from historical data.

source to a load on an interconnected system (more than one path between the source and the load). The electrons will take the route of least resistance, which will in turn depend on numerous factors, such as the magnitude of each load connected to the system, the layout of the electrical network at the time, and the output from each generator connected to the system. This profile of load, system, and generator characteristics not only changes from day to day, but even from one instant in time to another.

In the case where one organization is responsible for the electrical network between all generators and loads connected to this interconnected network there are no concerns over whose responsibility it would be to ensure that adequate capacity is available. In addition, there would be no question about whose network the electrons flowed through, and therefore to whom any benefits of such use of the network should go. However, where two or more organizations own different components of the interconnected transmission or distribution networks it would not be possible to determine whose network was responsible for the delivery of power to the end user without installing metering equipment on every node within that network (this would be a costly and unfeasible solution). Therefore the physical electricity delivery path would almost certainly not match the contractual arrangements between the suppliers (genco), the transporters (transco and distco) and the end users.

This is the primary reason why the transmission and distribution sectors are unlikely to be opened up to competition within a single jurisdiction. In B.C. the transmission and distribution networks are owned and managed by crown corporations (BC Hydro owns the transmission assets and owns and manages the distribution assets while BCTC manages the transmission assets) and all are regulated by the BCUC.

2.4.2 Economies of Scale and Scope

In the past, generation was considered to be a natural monopoly as a result of economies of scale and scope. As a result of technological advances, this is no longer the case. See discussion in section 2.4.3 below.

2.4.3 Natural Monopoly

Generation used to be considered a natural monopoly since it was more efficient to have one or a small number of large generators serving a local area. This was as a result of the two factors. Firstly, the installed cost per unit of capacity was lower for larger generators, and secondly, the losses associated with carrying power over long distances were quite significant. Over time, however, this has changed as a result of technical innovations as well as other factors as follows:

- Advancements in generation technology have led to a much lower minimum efficiency scale (MES). As a result, a smaller capital investment is required to generate power at a cost comparable to much larger units;
- Advancements in transmission technology have led to significantly lower losses. Power can be carried much longer distances with the same amount of losses. Generators can therefore be situated considerably further from the load, and still compete with others to supply that load;
- It is becoming increasingly difficult to build large generation plant. This is as a result of a significant regulatory burden including more stringent environmental laws, increased public consultation requirements, complicated First Nations negotiations, and more onerous requirements by the utility regulator; and

- Both public and political pressure is causing more focus on small, low impact “green” energy resources. These could include wind, wave, solar, run of the river hydro, etc. This shift in focus favours the independent power producers.

As a result of the above, few would argue that generation should still be considered a natural monopoly, both worldwide and specifically in B.C.

The transmission and distribution functions, on the other hand, are still considered natural monopolies. The capital, operating, and maintenance costs are minimized when these functions are provided by a single organization. In terms of capital, the cost per unit of capacity of a transmission or distribution line is lower for a single high capacity line than two or more lower capacity lines. This rationale can be expanded to include a single network of lines versus multiple networks of lines. In addition, valuable real estate is required to build transmission and distribution lines, and rights of way are often assigned to these electrical corridors. With respect to operating costs, the cost of electrical losses are lower (per unit) for larger capacity lines than they would be for smaller lines. In terms of maintenance, the costs to service a large single line using a single work crew is also lower than servicing multiple smaller lines using multiple work crews.

2.4.4 Vertical Integration

The generation, transmission and distribution functions have typically been integrated into a single utility. The benefit of this vertical integration is lower transaction costs than if the various functions were managed by separate organizations. The transaction costs referred to are the additional costs that organization A would incur as a result of transacting with organization B, which would not have been incurred if the function was performed internally by the organization A.

However, in order to introduce competition into one or more of the electricity industry functions, those functions must be unbundled and operated separately from the other non-competitive components. For example, if generation resources were to be supplied competitively, there would be a significant advantage to the utility who supplied both the generation as well as the transmission and distribution components. This advantage would be considered a barrier to entry by the other prospective participants and as a result, no competition would exist in the supply of generation resources. The separation of generation from transmission and distribution could be achieved by the transco and distco organizations divesting themselves from all generation assets. Alternatively they may continue to retail generation, but would need to be subject to regulation restricting them from having a competitive advantage over other gencos. Unbundling these competitive components introduces the need for separate coordination of certain activities or ancillary services. These ancillary services include:

- Supply / demand coordination: with multiple gencos supplying the load requirements in real time, an independent party is required to match the quantity supplied with the quantity demanded at all times;
- Compensation for network losses: the total amount of power consumed within a network includes not only the quantity demanded by the end user, but also the losses incurred over the transmission and distribution networks. If this additional power requirement is not met through the existing generators connected to the system, then the demand will be greater than the supply and parts of the grid would fail. This also requires an independent party to determine who will supply the additional power requirement;

- Capacity constraints: as the characteristics of the electrical network change (electricity usage, generator output and system configuration), the amount of available transmission and distribution capacities also change. Again, an independent party is required to provide non-discriminatory network upgrade services; and
- Spinning reserves: since load requirements change almost instantaneously, some generation needs to be allocated in order to provide this immediate requirement. This generally means that the generator must be running and ready to generate at a moment's notice. The amount of spinning reserve required needs to be coordinated by an independent party.

In jurisdictions where unbundling has been mandated the organization that handles the above coordination role is called an independent system operator (ISO).

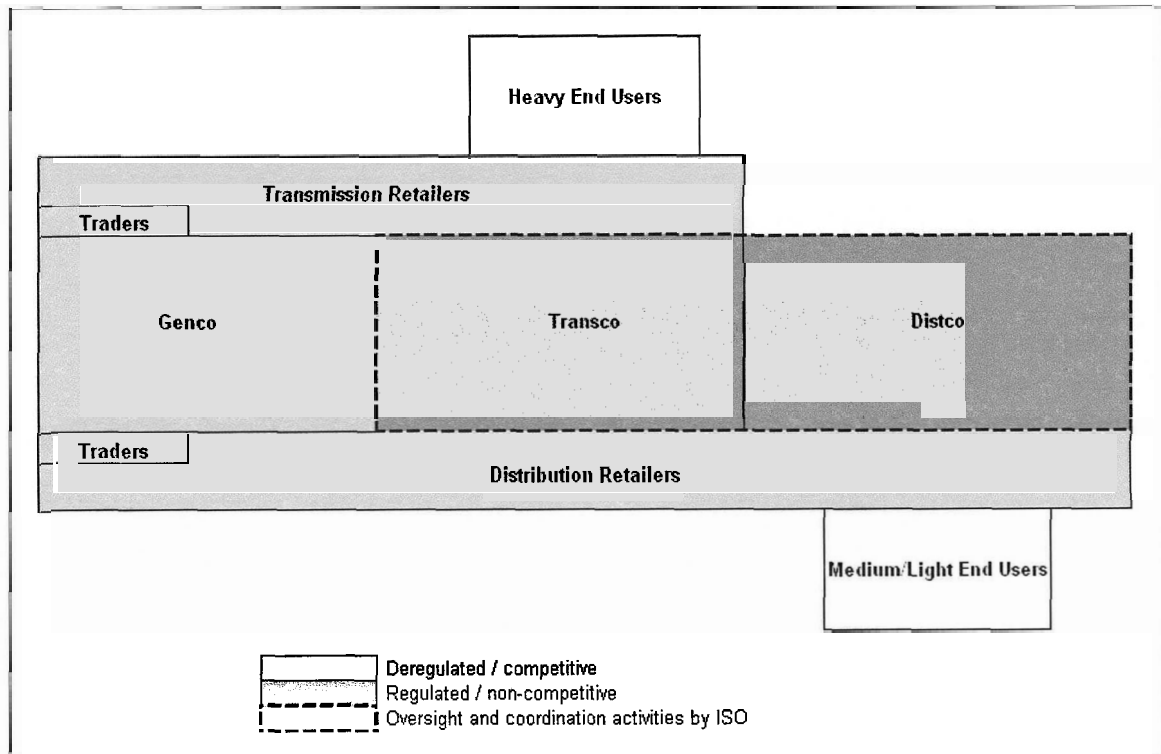
2.4.5 Competitive versus Non-Competitive Supply of Electricity

Restructuring the electricity industry is not necessarily the same as deregulation of the industry. Restructuring could take place in order to facilitate deregulation, but could also take place to better serve the public good without deregulation. Deregulation, on the other hand, is the removal or reduction of restrictions such as entry barriers, price controls, etc. The primary effect of deregulation is the introduction of, or increase in the level of, competition in the industry being deregulated.

As explained in the preceding sections, the only components of the electricity industry that would benefit from competition, and therefore deregulation, are generation and retail. Currently too many inefficiencies would result from the deregulation of the transmission and distribution components (this too may change as further technological

advancements are introduced in the future). With the deregulation of the generation and retail components, the electricity industry can be represented as shown in Figure 2-3.

Figure 2-3 Industry diagram showing deregulated components



The following benefits are expected to be realized through the introduction of retail competition:

- **Increased efficiency:** a regulated utility is generally allowed to charge rates that allow it to recover its costs and earn a return on equity, subject to certain prudence reviews by the regulator. There is little incentive on the part of the utility to identify cost savings. With retail competition, gencos compete against each other and those with the lowest cost structure will have the most to gain since their prices are related to

what the market is willing to pay. There are thus large incentives to identify and implement efficiency gain initiatives;

- Lower costs of electricity production: in a competitive market, the supply of electricity will come from the lowest cost gencos. As gencos compete to be the lowest cost providers, the price will be driven towards the marginal cost of production; and
- Customer choice: customers may choose to obtain their supply from various gencos based on factors other than price. These factors could include quality of customer service, bundling of services, and type of generation (for example, some customers prefer to purchase power produced by more environmental friendly green generators).

It should be noted, however, that a number of conditions are required for perfect competition to occur. The market must determine the price, perfect information about the product must exist and be freely available, the product must be fully homogenous, and participants should be free to enter or leave the market at any time. Although perfect competition does not exist in any market, these factors provide indicators of where market failures may be more likely to occur. One concern with retail competition is the emergence of market power as a result of a small number of players, i.e., gencos. In such an oligopoly situation, the largest firm will have market power, and may have the ability to influence prices in its favour.

3 KEY ISSUES FOR POLICY MAKERS TO CONSIDER

Policy makers need to equip themselves with sufficient information in order to consider the option of introducing retail competition into B.C.'s electricity industry. To do this, they must investigate the numerous effects that such a decision would have. If, after this consideration is given, the decision is made to go ahead, then they will need to consider these same aspects in the way that they redesign the industry. At a high level, the resulting policy decisions should seek to maximize the social welfare of British Columbians. The purpose of this section is to identify the various stakeholders and the issues that are important to them, and then to analyse the effect of retail competition on those issues.

3.1 Stakeholders and Their Interests

Everyone in B.C. is, to a greater or lesser degree, affected by policy changes within the electricity industry. The most direct effect is felt through any changes in the cost of electricity. On the other hand, they could be affected through indirect consequences such as changing impacts on the environment. The key stakeholder groups can be grouped into suppliers, consumers, residents, First Nations, and the Provincial government. Appendix A shows the intervenor groups that have registered with the BCUC to participate in the review of BC Hydro's F07/F08 Revenue Requirements Application. Table 3-1 below provides a summary. This gives an indication of the representation and strength of each stakeholder group.

Table 3-1 Summary of stakeholder group representation in BC Hydro's F07/F08 Revenue Requirements Application

Stakeholder Group	Number of Intervenors
Utilities	5
IPPs	8
Suppliers to the Industry	3
Industrial Consumers	7
Commercial Consumers	2
Residential Consumers	2
Residents	10
First Nations	1
Government	2

Source: BCUC plus author's assessment of stakeholders' interests

3.1.1 Suppliers

Two primary types of suppliers exist in the industry, namely; BC Hydro and IPPs. These suppliers are considered primary since they provide the infrastructure (generation, transmission and distribution) to produce and transport electricity to the end users. Other suppliers such as contractors, consultants, and materials providers are considered secondary suppliers (i.e., suppliers of materials and services necessary for the primary suppliers to carry out their business).

3.1.1.1 BC Hydro

BC Hydro is the largest supplier of electricity services in B.C. These services include generation, transmission and distribution. In addition, BC Hydro currently provides retail services to all the customers in its jurisdiction. Since, by the very nature of competition, it is expected that existing customers will be tempted to switch, and new customers may opt for alternate suppliers, BC Hydro is the only supplier that stands to lose end use customers and, as a result, the revenue associated with those customers.

This leads to a concern over job losses. Unionised staff at BC Hydro are currently represented by two unions, namely; Canadian Office and Professional Employees' Union⁵ (COPE) and International Brotherhood of Electrical Workers (IBEW). Both unions have expressed their concerns over any privatisation of the various components currently managed by BC Hydro (see BC Federation of Labour, 2002 and IBEW, 2004).

However, even under a competitive retail market BC Hydro would continue to provide the transmission and distribution services. This would require it to build new assets as required by the industry and also to maintain and operate the current assets. In addition, the cost of these services would be recovered either from the end use customers as a component on their bill, or directly from the retailer.

The two components within the BC Hydro value chain that are likely to be most affected are generation and customer services:

- Generation: In order to allow for fair competition amongst new entrants and existing players in the generation market, the generation line of business within BC Hydro may need to be separated from the transmission and distribution lines of business. This would result in fair and equitable access to the networks. Alternatively, BC Hydro's existing (heritage) generation assets could be excluded from the competition and remain regulated. The primary argument for keeping the heritage assets regulated would be that the cost to generate power from these existing generating stations is significantly lower than the cost of new energy (BC Hydro, 2006a). If BC Hydro were to price on the basis of historical costs this would seriously impede the entry of competing electricity generators. Excluding existing BC Hydro assets would

⁵ Formerly called Office and Professional Employees' International Union (OPEIU).

also satisfy the recommendations of the 2002 Energy Plan to ensure public ownership of BC Hydro generation, transmission and distribution assets (BC Provincial Government, 2002). A more detailed discussion on the cost of existing versus new generation is provided in section 3.2 below.

- Customer service⁶: Much of the customer service provided by BC Hydro is performed through a third party, namely; Accenture Business Services for Utilities (ABSU). As a result of customer switching, some of these services would be provided by the new retailers.

Although some restructuring within BC Hydro may be required to align itself better to the changing business needs, it is unlikely that any significant job losses would be required as a result of the introduction of retail competition, provided that existing generation remains within BC Hydro. In the event that existing generation is separated from BC Hydro, it is likely that the current staff would be needed in the new organization and would follow the work.

The unions representing BC Hydro employees would probably be the most vocal in opposing retail competition.

3.1.1.2 IPPs

Currently, IPPs in B.C. only have direct access to the wholesale market and the transmission end users on the Transmission Service Rate tariff (see section 2.3.4). BC Hydro estimates that total domestic electrical energy consumption will increase by almost 19,500 GWh over the next 10 years (BC Hydro, 2006b). This represents a 37 percent increase from today's usage, almost three quarters of which is attributable to

⁶ Customer service includes functions such as account management, complaint handling, meter reading, and electricity service initiation.

residential and commercial customers (i.e., customers that are currently exclusive to BC Hydro). At current BC Hydro rates this implies that annual revenues would increase by \$770 million over 10 years⁷. In the event that retail competition is introduced in B.C., then the generation component of this additional revenue will be directly accessible to IPPs.

It is estimated that IPPs in B.C. will supply 7,291 GWh of electricity (in F2006) to BC Hydro under existing purchase contracts (BC Hydro, 2006b). These are mostly long term contracts (10 to 20 years). If retail competition is introduced in B.C., then these purchase contracts may either 1) be honoured and the IPP remain suppliers to BC Hydro, or 2) through mutual agreement, the contracts may be terminated after which the existing IPPs will compete with new entrants. The former may be advantageous to the existing IPPs since they will be assured long term revenue for electricity sales to BC Hydro as per the contractual arrangements. However, this may also be disadvantageous since the market price for electricity may be higher than the contractual price.

According to the 2002 Energy Plan, new energy is to be developed by the private sector, with BC Hydro restricted to improvements at existing plants (BC Provincial Government, 2002). This means that new energy will come from IPPs regardless of the status of retail competition. Therefore, the abovementioned advantages and disadvantages hold true for new IPP entrants as well, i.e., depending on the market price of electricity, they may be better off or worse off by selling under contract to BC Hydro.

New IPP proponents that would benefit most from retail competition are those that would otherwise struggle to enter into a contract with BC Hydro. This could include IPPs that may be able to corner niche markets. An example of this would be an IPP

⁷ Residential rate based on \$0.0605 per kWh. Commercial rate based \$0.0492 per kWh as per a comparative analysis provided by BC Hydro (BC Hydro, 2006c)

planning to operate a wind farm. The cost of this option may be more than the other options considered in BC Hydro's call for tenders, and as a result would not be considered. However, if given the opportunity through retail competition, the IPP proponent may be able to find a sufficient number of customers willing to pay more for wind energy if it is more in line with their environmental values.

3.1.1.3 Suppliers to the industry

Suppliers to the industry include the contractors, consultants, and materials suppliers that provide the services and materials that are not provided in-house. These inputs are typically acquired on a contractual basis, ranging from a once off provision (for example a specific piece of equipment that is rarely required) to a long term partnership (ABSU, for example, delivers customer care and IT services for BC Hydro on a long term basis).

Since this work would still need to be performed after the introduction of retail competition, it is unlikely that the current suppliers of these services and materials would feel any significant impact. In addition, economic growth in B.C. has caused a severe shortage of certain skills, particularly in the trades. It is therefore very unlikely that a restructuring of the electricity industry would pose any concerns to these suppliers.

3.1.2 Consumers

Consumers fall into three different categories, namely; industrial, commercial, and residential. These consumer groups tend to have different interests and are therefore discussed separately below.

3.1.2.1 Industrial

Industrial customers account for about one third of the total electricity sales (GWh) in B.C. However, this customer group is by far the most participative when it comes to representing its interests. This can be seen in Table 3-1 above where the industrial consumers have 7 representatives versus 2 each for the commercial and residential consumers⁸.

Industrial consumers generally require a large amount of power in order to run their operations which include mining, forestry and manufacturing. Their electrical equipment consists of heavy machinery such as motors, smelters and other machines typically used to change raw material into semi-finished or finished form.

Since electricity is such an integral part of their businesses, it also forms a significant portion of their cost structure. As a result, a primary concern of industrial consumers is the cost of electricity and the availability of options to reduce costs (section 3.2). In addition, because power outages are likely to delay production, and therefore revenue flow, industrial consumers are concerned with the reliability of supply (section 3.3).

3.1.2.2 Commercial

Commercial consumers represent another one third of the total domestic sales in B.C. This group is far less participative when it comes to defending their interests (see Table 3-1).

Commercial consumers are typically non-manufacturing businesses, including hotels, restaurant, wholesale businesses, and retail stores. Their electrical machinery

⁸ The number of intervenors does not necessarily indicate the effectiveness of the intervenors to represent that group. It is used here as an indication of the amount of interest shown by a particular group.

generally consists of medium consumption devices such as computer equipment, lighting, cash registers and communication devices.

In many cases, commercial consumers' equipment is sensitive to fluctuations in the electricity supply; for example, some microcomputer controlled equipment may fail to function or function incorrectly if the electricity supply goes outside the parameters required for that equipment. In addition, some equipment is considered as critical and in need of a constant electricity supply (e.g., some hospital equipment). For companies operating this sensitive equipment, availability and quality of supply would likely be their most important concerns (section 3.3). Since the cost of electricity forms a part of commercial consumers' operating costs, this is also an important aspect for them (section 3.2). In some cases this group may be concerned with sustainability and environmental issues, particularly if their product or service, in turn, is intended to appeal to environmentally aware consumers (section 3.4).

3.1.2.3 Residential

The last one third of domestic electricity sales in B.C. is to residential consumers. This group is also less participative than the industrial group, and is on a par with commercial consumers (see Table 3-1).

Electricity is typically used by residential consumers for heating, cooking, air-conditioning, communication, and entertainment.

Although their individual electricity usage is the lowest of the three groups of consumers, it could be argued that residential heating (particularly in winter) is critical to the well-being of those consumers. Availability of supply would therefore be the primary concerns for residential consumers (section 3.3). For some groups of residential

consumers, particularly those with lower incomes, cost is also an important factor (section 3.2).

Since the residential customers are also residents of B.C., their interests also include those applicable to B.C. residents (see section 3.1.3 below). They have been separated here since one group can clearly be defined as a consumer of electricity (residential consumers) while the other group is more associated with the community in which they live (residents).

3.1.3 B.C. Residents

In June 2005 BC Hydro commissioned a survey in order to obtain public opinion on emerging electricity related issues. Some of the questions were designed to gauge the public's opinions on the various types of energy sources. The responses indicated that the public preference significantly favoured the environmentally friendly resources such as wind turbines over the less environmentally friendly resources such as coal-fired power plants. Appendix B shows an extract of the survey relating to resource options.

In general, the public is likely to be concerned with their own and future generations' well being. Accordingly, this group is most vocal about issues relating to the environmental impact of electricity supply as well as the sustainability of this supply as a result of current and future use (section 3.4). In addition, the public is likely to have strong opinions on political issues relating to the electricity industry. In B.C., these may include issues such as sales of electricity to the United States and the privatisation of the various parts of BC Hydro. Since opening up the generation sector to competition would very likely reduce the amount of control that the Provincial government has over that sector, B.C. residents may experience a decrease in their influence over these issues.

3.1.4 First Nations

B.C. is home to numerous First Nations groups. These groups are scattered throughout the province and are often affected by large construction projects, particularly those that are situated outside of the metropolitan areas. It is generally accepted that, in the past, First Nations were often left out of the negotiation process relating to these large construction projects. As a result of this, the First Nations people are quite vocal today on issues relating to their land and their culture, and Aboriginal rights now exist in law. Their presence and influence in negotiations are very strong.

The three most important concerns of the First Nations people are likely to be preservation of their culture and beliefs, land claims from previous injustices and active involvement in negotiations on future projects that may affect them. BC Hydro has a very pro-active approach to building relationships with First Nations (BC Hydro, 2006d). Since many of these programs are not mandated by government, it is likely that these initiatives would not be continued in a competitive generation market since they are costly to manage.

3.1.5 Provincial Government

The mandate of the Provincial government is to develop and enact policies, covering areas that fall under its control, to the benefit of its constituents. Constituents include all stakeholder groups already mentioned in this section. Since the different groups do not necessarily have the same interests, it is often very difficult for politicians to balance the gains and losses of the various groups. Often decisions come down to pleasing a particularly strong interest group and an estimation of the gains or losses of supporters. The following issues are likely to be of interest to the Provincial government:

3.1.5.1 Income

Since the Provincial government is BC Hydro's shareholder, it is allowed to earn a return on equity equal to that of a similar investor-owned utility. The estimated return on equity for fiscal 2007 is \$395 million (BC Hydro, 2006a). If BC Hydro's generation arm is subject to competition, it is likely that the shareholders equity, and therefore return on equity, will decline. This reduction could take place as a result of competition forcing down prices as well as a loss of customers switching over to competitors. This loss in shareholder income may need to be recovered from B.C. ratepayers or taxpayers.

3.1.5.2 Risk Profile

As the shareholder, the Provincial government, and therefore B.C. taxpayers, takes on the risk associated with ownership of the BC Hydro generation assets. These risks could include failure of equipment, cost overruns on capital or maintenance projects or settlements resulting from generation related activities or incidents. By transferring ownership of these assets to the private sector, much of this risk would be on private investors; the Provincial government's risk profile would therefore be lowered.

3.1.5.3 Strong Interest Groups

As suggested in Table 3-1, some interest groups are very strongly represented in the electricity industry. The three strongest groups are residents, IPPs and industrial consumers. Politicians are likely to pay particular attention to the needs of these groups when it comes to making policy decisions.

3.1.5.4 Control

The Provincial government currently has a fair amount of influence over BC Hydro's investments and operations. As a result, it can play a fairly direct role in determining the specific types of generation resource that are developed to supply future

electricity requirements. This can be accomplished, as the shareholder, without the introduction of a significant amount of regulation. However, once generation has been privatised and subject to competition, the Provincial government would only be able to influence the industry through enacted regulation. This may represent a significant loss of Provincial government control.

3.2 Cost and Pricing of Electricity

The cost of electricity affects the majority of the stakeholders mentioned above, particularly the industrial consumers as a result of their significant power requirements. This section summarises aspects of the electricity market that influence cost, particularly those that are related to the introduction of retail competition into that market.

3.2.1 Inefficiencies Associated with Monopolies

Weimer and Vining (2005) describe two market failures that occur within monopolies as a result of inefficiencies, namely allocative inefficiency and X-inefficiency.

Perfectly competitive markets achieve allocative efficiency because every firm is driven to produce where marginal cost equals price. In effect, every unit of output that contributes more to the benefits than to costs is produced and as a result net benefits are maximized. This outcome will not be achieved when an industry is characterised as a natural monopoly. Without regulation the monopolist will restrict supply and set prices above marginal costs which in turn results in allocative inefficiency (units of output that would add to net benefits are not produced). Under regulation, utilities are not free to set their own rates; however, they are rarely forced to adopt marginal cost pricing. Typically they are allowed to recover their costs plus an approved return on equity (ROE). In its F07/F08 Revenue Requirement Application, BC Hydro's ROE for F2007 was calculated

at 13.13 percent. This is the revenue that flows to the shareholder, the Provincial government.

X-inefficiency is the term used to describe the situation where a monopoly's cost structure is greater than the costs that are technically feasible. Under competition, firms will invest effort in finding ways to reduce costs. If they do not do this, and their competitors do, then they will have a higher cost structure and will be forced out of the market. This leads firms under a competitive system to constantly trend towards minimum costs, i.e., increased efficiencies over time. Again, with monopoly, there is no competition that threatens to force the company out of business. Therefore investment in efficiency gains may not be a priority for the monopoly. Regulation helps to reduce X-inefficiency through the review of a utility's cost structure during its revenue requirements application. In reality, however, the regulator will likely only disallow additional costs that the utility has requested rather than exert ongoing monitoring of operating costs. This provides a much smaller incentive for the organization to improve efficiency when compared with the prospect of going out of business.

As a result of allocative inefficiency and X-inefficiency, a deadweight loss is experienced, i.e., society is, on balance, worse off. This is one of the reasons that certain industries are regulated (such as those that are natural monopolies). Regulation attempts to minimise the deadweight loss through rate controls, and review of the monopoly's operations.

As discussed in section 2.4.3, transmission and distribution are considered natural monopolies. As a result, it is unlikely that competition would develop in this area even if allowed to (since one firm can supply the market at lower costs than two or more can); these lines of business should therefore benefit from regulation. Generation, on the

other hand, is no longer considered a natural monopoly (section 2.4.3). Therefore through the introduction of competition, it is expected that both the problem of allocation inefficiency and X-inefficiency would be minimised, thus increasing the benefits related to generation.

3.2.2 Cost of Heritage versus Non-Heritage Energy

As a result of decisions made by Premier WAC Bennett in the 1960s, B.C. currently has a number of large, fully amortised, hydroelectric generation assets. As discussed in section 2.1.1, the cost to run this hydroelectric generation is low since the fuel (water) is provided by nature. In the case of BC Hydro, the primary costs related to hydroelectric generation are water rental fees (paid to the Provincial government in proportion to the amount of energy generated). These costs are estimated at \$5.8 per MWh of electricity generated in F2007 (BC Hydro, 2006a).

For the last few years, BC Hydro has been in a situation where sales volumes exceeded the capacity of the heritage assets. This resulted from strong economic growth in B.C. (and the associated increases in electricity demand), and also a decline in water supply over time. Declining water supply reduces the amount of water available to turn the generator turbines and thus the amount of energy that can be delivered. In order to compensate for this shortfall, BC Hydro has had to purchase electricity from two sources, direct purchase commitments with IPPs and other suppliers, and purchases through intermediaries. The commitments with IPPs and other suppliers are typically long term in duration, and established to make up for the projected shortfall. Costs to acquire power from these suppliers are estimated at \$62.70 per MWh in F2007. Spot market purchases are required to satisfy any additional requirements. A luxury that BC Hydro has is that it can choose when to generate using its hydroelectric facilities and

when to store that water for another time. In this way, it is able to determine when it will purchase from the market, and is thus able to buy at low prices. These costs are estimated at \$53 per MWh in F2007. Table 3-2 below summarises BC Hydro's anticipated costs of the various sources of energy for F2007.

Table 3-2 Summary of cost of energy by source for F2007

Source of Energy	Cost (\$/MWh)
Hydroelectric (water rentals)	5.80
direct purchases from IPPs	62.70
Purchases from intermediaries	53.40
Natural gas for thermal generation	146.10
Other	170.60
<i>Total weighted average cost⁹</i>	<i>22.60</i>

Source: extracts from BC Hydro's F07/F08 Revenue Requirements Application

As can be seen from Table 3-2, BC Hydro has planned to obtain energy from a number of sources during F2007. The rate that it has put forward to the BCUC has been determined based on a weighted average cost. The price that consumers in B.C. pay for electricity is based on this weighted average cost which is less than the cost of new energy from IPPs and the market. It is therefore evident that all consumers in B.C. currently benefit from the low cost of the heritage assets. If retail competition is introduced in B.C., the new generation sources (IPPs) will have a much higher cost structure than BC Hydro's weighted average, and will therefore need to charge higher prices. They would therefore not be able to compete with BC Hydro since most customers would choose BC Hydro's lower price. Alternatively, if BC Hydro were forced by the regulator to charge market prices, customers would see a significant increase to

⁹ Based on estimated sales volume.

their hydro bill. In order to prevent these results, carefully considered market design and regulatory controls will need to be applied.

3.2.3 Stranded Costs / Benefits

Generally, where the electricity industry has been restructured, rates were expected to drop as a result. In those cases, the utilities that supplied the area before restructuring would likely be at a disadvantage since their cost structures were higher than those of the new IPPs. As a result the utilities would not be able to recover their costs. These unrecoverable costs are known as “stranded” costs. The question is whether utilities should be compensated for these stranded costs. Some argue that the utility should be subject to the same level of competition as new entrants and should therefore not be compensated while others argue that the utility should not be expected to absorb the costs of moving to a new set of rules.

In some cases the utility may be able to make windfall profits, particularly those that own highly depreciated assets or low cost hydroelectric facilities. This results in negative stranded costs or stranded benefits. As discussed in the previous section, BC Hydro is likely to have a lower cost structure than new IPPs because it owns highly depreciated hydroelectric generation plants. Should retail competition be expanded in B.C., stranded costs would not be a concern. In fact BC Hydro would benefit from stranded benefits (as discussed in section 3.2.2). The question for B.C. is whether the stranded benefits should be returned to the ratepayer, and if so, how should that take place? It should be noted that this is a similar issue to the one described in the previous section, i.e., cost of heritage versus non heritage energy.

3.2.4 Market Power

Market power is the ability of a supplier to raise prices above competitive levels over a significant period of time, to its benefit. Market power could result from two situations, namely; where there are few players in the market (horizontal market power) and where a firm is involved in two interrelated activities (vertical market power).

3.2.4.1 Horizontal

In the case where there are few players in a competitive market, the largest firm may have the ability to influence prices through various business strategies (price maker), while the other smaller companies react to the change in prices (price takers). An example of a strategy that allows the large firm to exercise this power is to withhold supply from the market, thus forcing purchasers to offer higher prices for the available supply. This increases the per unit price for both the large firm as well as the smaller firms. The losers in this case are the purchasers since they will be paying artificially high prices, i.e., prices that are higher than they would be in a workably competitive environment. If retail competition is introduced in B.C., and BC Hydro is allowed to keep its generation assets, there will be a considerable opportunity for horizontal market power since BC Hydro owns a significant portion of the generation requirements of B.C. The market design will need to take this into account.

3.2.4.2 Vertical

Fully vertically integrated utilities manage all three lines of business associated with the electricity industry, namely; generation, transmission, and distribution. When competition is introduced in the generation sector of an area served by a vertically integrated utility, the possibility of vertical market power exists if the utility is allowed to keep its generation assets. Since the utility controls both generation and transmission, it

will have a clear advantage over the other IPPs when it comes to physical access to the network as well as knowledge about future network plans. Vertical market power is not a concern in B.C. since an independent crown corporation (BCTC) has been set up to manage the transmission network, and a code of conduct has been put in place to restrict unfair information transfer between it and BC Hydro.

3.2.5 Wholesale versus Retail price Controls

In some cases the introduction of retail competition is accompanied with the implementation of price controls. These price controls are largely exercised on the retail, or end user, side and typically include a cap or ceiling on the price that retailers may charge consumers. The purpose of the price cap is to prevent consumers from being charged artificially high prices (this may happen, for example, in the situation described in the previous section.) However, where it succeeds in preventing artificially high prices, it may fail to send the correct pricing signals to consumers. In most cases the price caps are introduced only at the retail level, and it is expected that this in turn will lead to the prevention of artificially high prices in the market. The result of this is a decoupling of the retail and the wholesale market. Market prices will react to market conditions, such as availability of supply, and as long as the price at the retail level is below the cap, consumer prices will also react to market conditions. This is ideal since the purchase habits of consumers will tend to bring the market into equilibrium. For example, low availability of supply leads to higher prices for consumers which in turn leads to lower consumption (bringing supply and demand into balance). However, once the price cap is reached, an increase in the wholesale price will not result in a decreased demand since retail prices are no longer affected. This may result in a dramatic increase in wholesale prices as wholesalers try to obtain sufficient power for their customers. Eventually

demand will exceed supply, necessitating rolling blackouts, or in the extreme case a total system shutdown. Other effects of price caps may include:

- Reduced incentive for new IPPs or investors to enter the market, resulting in less competition; and
- A tendency for prices to move towards the level of the price cap even if competitive prices are lower.

3.3 Availability and Quality of Supply

The availability and quality of the supply that is delivered to consumers is affected by the design of all three components of the electricity infrastructure; generation, transmission, and distribution, since these are connected in sequence. A failure within one section of the network generally affects the downstream network as well.

The availability of supply has two dimensions; 1) if a new electricity connection is required where one currently does not exist, can it be made available?, and 2) if a connection currently exists, is the electricity available when needed? In order to achieve the first, the transco and / or distco must be willing and able to extend the electrical network to the consumer. This provides the path between the genco and the consumer. The second dimension mentioned above refers to the balance between supply and demand at any instant in time. If demand is greater than supply, then some consumers will not receive the electricity they require. In this case, the supply could refer to the available generation capacity and also the available line capacity (transmission and distribution). In order to ensure availability of supply, both the generation and the lines need to be adequately designed. A decreasing level of availability of supply is indicated

by an increase in the number and duration of outages. As a result, this affects all types of consumers (industrial, commercial and residential).

Quality of supply refers to the condition of the electricity when it reaches the end user. The severity of events such as voltage and frequency fluctuations determines how “clean” the supply is. This is primarily affected by capacity and design of the transmission and distribution networks; however, the positioning of the generation plant also plays a role. As generators become smaller and more dispersed, the range of system operating conditions increases, and it becomes increasingly more complex to design and operate a network that will be stable through the whole range. Customers with sensitive equipment will be most affected by a reduction on quality of supply. These are primarily commercial consumers with microelectronic equipment.

If competition is introduced in the retail sector in B.C., the transmission and distribution lines of business will remain regulated monopolies, and consumers are therefore likely to continue to enjoy the same level of reliability from those portions of the network. Although the gencos would still be subject to some aspects of regulation (for example, environmental impacts and minimum technical standards), they would nevertheless be operating largely as independent competitors. As described above, both the availability and quality of supply rely very much on the coordinated design and integration of the generation, transmission and distribution assets. Without careful consideration of these aspects in the design of the restructured industry, the introduction of competition into the generation line of business may result in a less coordinated network design, and therefore a lower availability and quality of supply.

3.4 Sustainability and Environmental Impact

The process of generating and delivering electricity to end users by its very nature will have negative effects on the environment. These range from minor effects, such as the temporary disruption to vegetation growth due to the installation of an overhead line, to major effects, such as contributions to longer term degradation of the atmospheric composition due to the installation of a coal fired power station. As a result of the abundant opportunities for hydroelectric facilities, B.C. power is considered by many as one of the cleanest in the industry. However, large hydroelectric facilities do result in negative environmental effects such as disruption in fish migration, blocking downstream sediment flow, and flooding of large land areas. Policy makers have been grappling with the cost / benefit relationships of the various types of generation. The introduction of retail competition is likely to add complexities to the debate over resource options. The following issues should be considered:

3.4.1 Competition promotes low cost generation

In order for an IPP to compete effectively with others in the electricity sector, it will need to produce electricity near or at the cost of other IPPs. As a result, environmental impacts may not be considered by the IPP proponents, or would be considered as secondary to cost. This could be mitigated through mandated regulatory requirements such as a minimum requirement of green resources or greenhouse gas offset charges. However, the requirements will need to be designed not only to encourage environmental stewardship, but also to promote fair competition between the different IPPs. An exception to this generalization is the IPP that caters to a small niche market of consumers that would be prepared to pay more for a particular type of supply, for example wind generation, as a result of their strong beliefs in minimising environmental impacts.

In addition to the above, existing generators could be retired earlier than they would have been without competition in order to reduce costs. These could be generators that are not as cost inefficient compared with newer generation. Alternatively, they may be costly green generators. This could lead not only to stranded costs (see section 3.2.3), but to a reduction in available generation capacity, and therefore a potential inability to serve consumers' peak power requirements, as well.

3.4.2 Competition promotes smaller generation

As discussed previously, the introduction of competition would be more likely to lead to numerous smaller generators than few large ones. A beneficial result of this is the smaller footprint caused by the generation plant in a particular area, and therefore a less significant direct environmental impact. However, the disadvantage (from an environmental point of view) is that smaller generating plants will likely require less stakeholder engagement. Since the total capacity requirement in B.C. remains the same (whether supplied from a large plant or multiple smaller plants), the total environmental impact may be subject to less stakeholder scrutiny.

3.4.3 Competition does not promote conservation

Electricity conservation is the most effective form of environmental impact mitigation since reducing electricity usage results in a reduction in the number of generating plants required. Currently BC Hydro has a number of Demand Side Management programs aimed at reducing electricity usage (BC Hydro, 2006e). In a competitive retail environment, there is no financial incentive for IPPs to promote electricity conservation; in fact, IPPs would tend to promote increased usage of their product in order to maximize revenues.

3.5 Summary of Key Issues

Table 3-3 summarises the key issues to be taken into account when introducing competition into the electricity retail sector as well as the positive and negative effects on each issue.

Table 3-3 Summary of issues affected by retail competition

Key Issue	Potential Effects of Retail Competition ¹⁰	
	Positive	Negative
Stakeholder Interests		
Suppliers	<ul style="list-style-type: none"> • IPP access to the retail market • Increased IPP participation and revenues 	<ul style="list-style-type: none"> • Reduction in BC Hydro participation and revenues • Union concerns over BC Hydro job losses
Consumers	<ul style="list-style-type: none"> • Reduced costs • Greater choice in supplier, type of generation, and tariff options 	<ul style="list-style-type: none"> • Reduction in the availability and quality of supply
B.C. Residents		<ul style="list-style-type: none"> • Increased environmental impacts • Less influence over political issues

¹⁰ Assumes that no mitigation measures are taken.

Key Issue	Potential Effects of Retail Competition ¹⁰	
	Positive	Negative
First Nations		<ul style="list-style-type: none"> • Reduced consultation with First Nations
Provincial Government	<ul style="list-style-type: none"> • Greater support from interest groups • Transfer of generation risk to private investors 	<ul style="list-style-type: none"> • Reduced control over generation • Reduction in flow of revenues from BC Hydro
Cost and Pricing of Electricity	<ul style="list-style-type: none"> • Reduction in allocative inefficiency and X-inefficiency leading to overall reduction in cost 	<ul style="list-style-type: none"> • Complications that arise from the fact that new energy costs are higher than the weighted average cost of existing heritage energy • Complications from the stranded costs and benefits that arise when existing generation is subject to competition • Opportunity for horizontal and vertical market power to be exercised • Complications that arise from retail price controls
Availability/Quality		<ul style="list-style-type: none"> • Reduced coordination of network design leading to a reduction in availability and quality of supply

Key Issue	Potential Effects of Retail Competition ¹⁰	
	Positive	Negative
Sustainability / Environmental	<ul style="list-style-type: none"> • Opportunity for niche “green” power markets to develop • New smaller generators have a smaller environmental footprint in a particular area 	<ul style="list-style-type: none"> • Increase in low cost, “dirty” generators • Early retirement of inefficient or costly “green” generators leading to stranded costs and greater environment impact from new generators built to replace the old ones • Smaller generators subject to less stakeholder engagement leading to greater overall environmental impact • Competition discourages electricity conservation

4 OTHERS' EXPERIENCE IN RETAIL COMPETITION

The purpose of this chapter is to review the status of retail competition around the world as well as the current trends, and then to focus on three case studies from which lessons can be learned and applied to the redesign of B.C.'s electricity industry should policy makers decide to open the market up to full retail competition.

4.1 Global Overview

Table 4-1 provides an overview of the status of retail competition worldwide as at 1998. Since the industry in North America, particularly the U.S. and Canada have changed significantly since 1998, updated North American figures, based on the author's knowledge, have been included.

Western Europe has been most progressive in the implementation of full retail competition. This includes Finland, Germany, Norway and the United Kingdom. The United Kingdom was one of the first to implement widespread privatisation of its electric utilities, beginning in 1989 (Energy Information Administration, 1997). The UK model has been used as a guide for reform by other nations such as Argentina and Australia (Energy Information Administration, 1997). In South America, Argentina, Chile, and Peru have full retail competition in place.

With regard to North America, several Canadian provinces and a number of U.S. states have introduced full retail competition. In Canada this includes Alberta and Ontario. As at April 2003, 18 states of the United States had adopted competitive electricity restructuring, two had delayed their intentions to restructure, two had repealed

their intention to restructure, two had restructured for large customer access only, and one had suspended restructuring. The balance had no restructuring intentions (Edison Electric Institute, 2003).

Table 4-1 Status of retail competition globally

	Status of Retail Competition¹¹			
	Regulated	Mixed (Regulation and Competition)¹²	Partial Competition (Commercial & Industrial Segments)	Full Competition
Western Europe	53%	16%	10%	21%
Central and Eastern Europe	96%		4%	
Africa and the Middle East	100%			
Asia / Australasia	96%	4%		
South America	58%	17%		25%
North America	33%	67%		

Source: Based on information contained on the World Energy Council web site (World Energy Council, 2005) plus author's update

4.2 Recent Trends

In early 2000 it looked as though most U.S. states and some provinces in Canada were preparing to implement restructuring towards a competitive retail market in the electricity industry. In addition, in the U.S., federal legislation was seriously being considered in order to remove some final barriers to retail competition and to bring the

¹¹ Number of countries displaying the particular attribute divided by the total number of countries in the area.

¹² Some states or provinces within the country have either partial competition or full competition.

diverse state policies in line with each other. However, in late 2000, the state of California as well as many of the utilities serving the area, suffered significant financial losses, almost crippling the entire electricity industry in that state. This crisis was considered by many to be the result of an inadequate restructuring of the industry. This, along with Enron's bankruptcy, the collapse of some generation companies and rising retail prices in some states has caused a significant slow-down in the pace of restructuring reforms. Many states and provinces are now hesitant to implement retail competition, and two states (Arkansas and New Mexico) have, in fact, repealed their restructuring laws (Edison Electric Institute, 2003).

4.3 Case Studies

The intention of presenting these case studies is to draw parallels to the state of the electricity industry in B.C., particularly with respect to the issues discussed in Chapter 3, and highlight what worked and what didn't in these other jurisdictions.

4.3.1 United Kingdom

4.3.1.1 Factors Leading up to Deregulation

Table 4-2 provides a timeline of the historical development of the electricity industry in the UK leading up to the decision to deregulate. An important aspect to note, with respect to the events leading up to deregulation, is that consumers and the public in general were starting to feel the effects of an inefficient electricity industry. Indications point to the effects of government control of the industry leading to these inefficiencies, for example, the mandatory purchase of domestic coal and the policy goal to promote the development of nuclear power. This was probably the strongest driver for deregulation of the industry.

Table 4-2 Evolution of the UK electricity industry (pre-deregulation)

Year	Event	Discussion
1882	Electricity Lighting Act	Gave the central government the authority to lay electrical cables.
1926	Electricity Generation Board established	Mandated to construct a national transmission grid, coordinate transmission of electricity, and establish common technology standards.
1947	Electricity industry nationalization	Most of the generation, the national grid, and the 12 semi-autonomous regional district boards plus other vertically integrated companies now fell under the new nationalized organization.
1957	Electricity Act	Established a Central Electricity Generating Board (CEGB) that had control over the generation and transmission facilities, and the associated financial decisions. An Electricity Counsel was formed to act as a regulator.
1947-1990	Period of nationalization	Two strong political parties resulted in conflicting energy policies. Currency crises and oil price shocks resulted in the electricity industry relying more heavily on domestic coal and development of high cost nuclear power. Utilities required to purchase a minimum amount of domestic coal in order to support the coal industry. Electricity prices increased. Reduced public confidence in the state-run industry.
1979	Election of Thatcher government	Drive to privatise many of the state-owned industries.
1983	New Electricity Act	Start of deregulation initiatives. Removal of barriers to access to the national grid, and promotion of development of IPPs.

Source: Based on Energy Information Administration (1997)

4.3.1.2 Implementation of Retail Competition

As indicated in Table 4-2, the implementation of the Electricity Act of 1983 marked the start of the electricity restructuring initiatives. This Act forced the CEGB to purchase electricity from IPPs at a price equal to the amount that it would have cost the CEGB to produce the electricity itself. However, as a result of the low rates of return and significant advantages that existing power producers held over new entrants, the rate of new IPP development was low. The Electricity Act of 1989, however, laid out a detailed plan to completely restructure the industry and put parts of it up for sale. The plan was based on a phased-in approach that started with the unbundling of the CEGB into three components, namely; two gencos, one transco and a distribution network (made up of twelve regional electricity companies, or distcos). These three components initially remained under government ownership, and were then privatised in stages.

The regional electricity companies were the first to be privatised (by auction). However, they were first split into two groups, distribution wires and marketing; the latter being gradually deregulated, with the former still subject to regulation today due to its natural monopoly characteristics. The distribution wires part was subject to a form of price cap regulation (called RPI-X¹³), where the cap was determined based on the rate of inflation less an offset as a result of expected future productivity gains. Initially, only large consumers were allowed to choose their marketers (analogous to the retailers identified in Figure 2-2). The marketing arms of the regional electricity companies retained their franchise on the commercial customers until 1994 and residential customers until 1999. Other marketers were allowed to enter the market and compete for customers. Following privatisation these distcos have been allowed to acquire

¹³ Retail Price Index minus a factor (X) that represents the expected future productivity gains.

generation as long as sales from these assets are less than 15 percent of their total individual electricity sales.

Like the distribution wires system, the transmission system was considered a natural monopoly and was subject to the same type of price cap regulation. Initially the regional electricity companies took ownership of the transmission assets under the National Grid Company (NGC), although their influence over the management of the grid was restricted in order to avoid market power (see section 3.2.4). Further, in 1995 the regulator required the regional electric companies to sell their shares in the NGC, thereby ensuring equitable access to the grid. The NGC also provides power pool services, the purpose of which is to balance electricity supply and demand. This is based on a bid system whereby the cheapest suppliers are selected based on a daily estimate of the demand requirements, and then all participants are paid the pool purchase price, which is the highest price bid by the last genco facility needed to make up the last unit of demand. In theory, this should lead prices towards the industry's marginal cost.

Soon after the sale of the regional electricity companies, the two gencos (National Power and PowerGen) were sold to the public through share offerings. The government has been pro-active in ensuring fair competition between gencos, and on a number of occasions prevented the regional electricity companies from acquiring generation assets, stating their concern over increasing vertical integration and its detrimental effect on competition.

4.3.1.3 Result

Since the introduction of competition, prices have dropped quite significantly. The average residential bill has dropped, in real terms, by 25.8 percent from 330 pounds in 1990 to 251 pounds in 2005 (Department of Trade and Industry, 2005). For industrial

and commercial consumers, the drop has been even more substantial at between 25 and 30 percent from April 1998 to March 2002 (National Audit Office, 2003).

The marketing side of the electricity market became subject to increased competition levels. This was achieved through the opening up of what had been a captive market for the regional electricity companies. Between 1990 and 1995, these new retailers increased their share of the industrial consumer market from 43 to 69 percent, and from 30 to 43 percent for commercial consumers between 1994 and 1995 (Energy Information Administration, 1997). The residential market was opened to full retail competition in May 1999 and by March 2003, 38 percent of residential consumers had switched to alternate retailers (OFGEM, 2003).

On a less positive note, electricity pool prices were quite volatile and subject to manipulation. It was believed that the two large gencos, PowerGen and National Power could consistently raise prices above the competitive level through independently withholding capacity. This is an example of horizontal market power as described in section 3.2.4. Two changes resulted in a significant decrease in the gencos' ability to manipulate market prices, namely; the introduction of contract for differences¹⁴ hedging strategies and the forced sale (by the regulator) of 6 GW of generation capacity by both PowerGen and National Power. The former introduced a lag between the contract and the actual exchange, thus mitigating the ability to exercise market power, particularly as more and more contracts were completed this way. The latter reduced the size of the largest gencos relative to the others, and thus their ability to control prices.

¹⁴ The genco and the purchaser commit to a contract with an agreed upon strike price prior to the exchange of goods. Once the actual pool price is known, the genco will reimburse the purchaser or vice versa.

Market dominance was significantly reduced. In 1989 National Power held 48 percent of the generation output while PowerGen held 30 percent (the balance being supplied by 4 other gencos). By 2000, National Power's share was down to 11 percent and PowerGen's to 15 percent (Littlechild, 2000).

Barriers to entry were lowered and new IPPs entered the market. In the five years from 1998 to 2000, 14 percent of the total generation output was supplied by new entrants (Littlechild, 2000).

4.3.1.4 Lessons for B.C.

By many accounts the restructuring of the U.K. electricity industry is considered as one of the most successful. A number of factors contributed to its success:

Phased implementation: It is clear that the deregulation of the electricity industry was methodically planned and phased-in over time and in the order required to support the transition. It started with putting in place the structure that would facilitate the transition to full retail competition, this transition itself taking 10 years to complete (starting in 1989 with choice for large industrial users and ending in 1999 with residential customer choice). During this time, the government and the regulator had time to monitor the progress and make adjustments to the plan as appropriate. These adjustments helped to mitigate some of the potential negative aspects identified in Chapter 3, including the union concerns over job losses (section 3.1.1.1). The longer time allows for a more natural adjustment of the workforce (e.g., through retirements) in response to the change, and a reduction in the risk of quality of supply degradation (section 3.3), since the regulator is more able to monitor the changing conditions of the electricity network.

Vertical unbundling and independence: By separating the generation, transmission and distribution system management from each other, the ability to exercise vertical market power (see section 3.2.4.2) was almost entirely removed. This was even taken a step further through the separation of the non-competitive (distribution wires) and competitive (marketing) functions of the distribution system; thereby removing any competitive advantages that would otherwise exist through the relationship with the distribution wires operator.

Method of regulation: The method of regulation employed in this case was the RPI-X method. The method used in North America by most regulators is rate-of-return regulation. The advantage of the latter method is that it allows stakeholders to be involved in the regulation process. The disadvantage is that few financial incentives exist to reduce operating costs. With the RPI-X method, the regulator determines how much productivity gain is expected over the regulatory time-period, and sets rates accordingly. Utilities have a strong incentive to reduce costs since any additional productivity gains beyond the factor X will increase their profits. Both the transco and distcos were regulated by this method and showed productivity improvements.

Strong regulator presence: The regulator clearly monitored the progression of the deregulation very closely, and acted swiftly and decisively, where required, to make course adjustments. An example is the action taken by the regulator to reduce market power, such as forcing the largest gencos to sell a large portion of their generation capacity. Another example was the introduction of the Market Abuse Licence Condition (MALC) (Littlechild, 2000) which provided guidelines on market abuse behaviours that were to be avoided. The five gencos most likely to have market power were required to incorporate the MALC into their licences. The regulator successfully carried out a number of investigations under this licence. The regulator was also strong in

implementing the government's social and environmental objectives (see section 3.4). This included an environmental action plan that addressed issues such as climate change levies and percentage obligation for renewables.

4.3.2 United States (California)

4.3.2.1 Factors Leading up to Deregulation

An account of the events leading up to the decision to deregulate the California electricity industry is shown in Table 4-3.

Table 4-3 Evolution of the California electricity industry (pre-deregulation)

Year	Event/Period	Discussion
Pre-1978	Vertically integrated monopolies	Electricity provided by monopoly organizations, either through privately owned utilities or public utilities. Utilities were vertically integrated and provided generation, transmission and distribution. All three aspects were subject to rate of return regulation.
1978	Public Utility Regulatory Policies Act (PURPA) established	PURPA was established at the federal level in response to an oil crisis in the 1970s. Its mandate was to promote renewable energy, and this led to the introduction of non-utility generators called qualifying facilities ¹⁵ (QFs) from which the utilities were forced to purchase some of their power requirements.
1980s	Development of QFs Reduced utility investment in generation	Contracts favoured QFs since terms were intended to reflect the utilities avoided costs. Large growth of QFs resulted. This showed that the development of IPPs was feasible.

¹⁵ Qualifying Facilities (QFs) include cogeneration facilities and small power production facilities, limited to 80MW in size, and built by private developers. QFs were intended to address the capacity shortfall in some of the states.

Year	Event/Period	Discussion
		At the same time, utilities' interests in developing new generation declined as a result of the strong regulatory risk of not being able to recover their costs.
1992	Energy Policy Act Review of industry	<p>The federal Energy Policy Act of 1992 encouraged competition and market mechanisms.</p> <p>An industry review was initiated by the California Public Utilities Commission (CPUC) in order to explore alternatives to the existing regulatory approach.</p> <p>The report recommended market-oriented reform, and provided four alternatives for consideration. Although none of these were implemented exactly, the closest alternative to what ultimately transpired recommended that utilities divest all of their generation, and compete with other retailers to obtain customers and procure generation for them.</p>
1994	Restructuring announcement	The CPUC announced its intention to restructure the electricity industry according to the alternative described in the previous row in this table, and that the cost of service regulation would be replaced with performance based regulation.

Source: Based on University of California Energy Institute (2002)

4.3.2.2 Implementation of Retail Competition

Following its restructuring announcement, the PCUC conducted an extensive hearing process aimed at engaging all stakeholders in the development of the restructuring plan. This process sought stakeholders' opinions on issues such as:

- The implementation of a pool, such as the one introduced in the UK during its restructuring, versus leaving the design and operation of a spot market to the marketplace itself; and

- The requirement that utilities be forced to divest themselves from all of their generation assets.

At the outcome of this process, the CPUC created two new entities that would be central to the operation of the new industry, namely; the Power Exchange and the Independent System Operator (ISO). The Power Exchange would run the spot market through transparent auctions. The purpose of this was to facilitate competition among gencos. Retail customers could choose to purchase power from a utility or directly from the gencos or wholesalers through bilateral contracts. This meant that utilities would purchase their electricity requirements from the spot market, with the benefits of competition being passed on to their customers. The ISO was responsible for the transmission network, specifically, ensuring non-discriminatory access and low cost service, as well as providing ancillary services. The ISO was to have no interests in any genco or consumer.

The CPUC also required the two utilities, SCE and PG&E, to divest at least 50 percent of their fossil-fuel generation assets. Financial incentives were used to encourage the divestiture. In addition, the decision was made to allow the existing gencos to recover their net stranded costs (see section 3.2.3) through a competition transition charge (CTC). The charge was calculated to recover all stranded costs and would expire when these costs were recovered or April 2002, whichever came first.

In 1996 the Governor of California passed the restructuring Bill AB 1890 that implemented not only the above changes, but also mandated a 10 percent rate cut for small consumers during the first four years of deregulation. It is believed that this decision was made in order to motivate political action to finalize the bill.

All consumers were allowed to switch to alternate retailers when the markets opened on April 1, 1998. Consumers would pay the distribution and transmission charges to their utility, as well as the CTC (until expiry) regardless of whether they stayed with their utility or chose a new retailer.

4.3.2.3 Result

Customers choosing to stay with their utility received their 10 percent rate reduction, and large customers' rates were frozen. Contrary to the optimism expressed by the CPUC, only a small number of consumers chose new retailers. The reason for this was that it was difficult for new retailers to offer lower prices than the already frozen rate.

The markets started before all controls and systems had been put in place. The Federal Energy Regulatory Commission (FERC) had not yet given the ISO the authority to charge market based rates for ancillary services¹⁶. The ISO's prices for these services were therefore less than the price offered by the Power Exchange for regular purchase of electricity. As a result gencos were not willing to offer their generators for this purpose. Gencos were allowed to receive market based rates in October 1998.

The Power Exchange prices appeared to be very vulnerable to price fluctuations. Prices started escalating significantly in June 2000 and by December 2000 had reached over 11 times the average price of December 1999 (Energy Information Administration, 2005). Since San Diego Gas and Electric's (SDG&E) stranded costs were eliminated by July 1999, its price freeze was removed and it was allowed to pass on these increasing prices to its consumers (the other utilities were not able to do this yet). When residential

¹⁶ Ancillary services included generation requirements that were needed to respond to emergency situations such as providing backup during generator failures. Gencos expect to receive a significantly higher price for these services than regular power sales.

retail prices had reached 16 cents per kWh, the California legislator established a ceiling of 6.5 cents per kWh (Energy Information Administration, 2005). In the latter part of 2000, the demand for power was critically close to the total available capacity. This raised the wholesale prices substantially. As a result of the retail rate cap, these price signals were not passed on to consumers, who therefore did not reduce consumption. This happened over the June 2000 to January 2001 time period, at the end of which, the Power Exchange suspended operations and the ISO, SCE and PG&E were insolvent.

4.3.2.4 Lessons for B.C.

California's failed attempt at restructuring its electricity market can be attributed to a number of factors:

Implementation strategy: In the authors view, the deregulation strategy was too hastily implemented. It was as though the policy makers wanted to get to the final state as quickly as possible. Firstly, there did not appear to be any consideration of the implementation of an interim stage, nor of a phased in approach, as in the case of the UK model. In the UK, the existing market players were first reorganised into the three components as described in section 4.3.1.2. These three components were allowed to "find their feet" first under governing ownership, and were then privatised and deregulated in phases. In California, the final market design appears to have been thought out on paper and then fully implemented. The risk with this approach is that it does not give the regulating or government bodies a chance to monitor and make course corrections along the path of reform. Secondly, the plan itself was implemented poorly, which is evident from the fact that the market was allowed to start even before all the regulatory and control structures were put in place. Had the implementation been slower

and more deliberate, under the watchful eye of the regulating body, the market vulnerabilities may have been spotted early and rectified prior to full operation.

Insufficient capacity planning (see section 3.3): A number of aspects contributed to an insufficient amount of power reaching consumers during the 2000-2001 crisis period. Firstly, demand for electricity had exceeded the growth in generation capacity availability. Following the decision to deregulate the market, uncertainty caused potential investors to avoid or postpone investment in generation. Secondly, as a result of demand growth in the neighbouring states, less supply was available for import. Finally, parts of the transmission network were also capacity constrained as a result of insufficient upgrades. This meant that fewer generator sourcing options were available since generator location was important (to avoid the constrained sections of the network). This shows a lack of sufficient capacity planning and investment on the part of the ISO, and may be attributable to the fact that it did not have sufficient influence over these decisions. One indication of this is the ISO's recommendation that utilities be granted more authority to enter into long-term purchase contracts, but this was not approved by the FERC until after the start of the crisis (Congressional Budget Office, 2001).

Inadequate price signals to consumers: As a result of the price ceiling imposed by the government, consumers of electricity did not see an increase in price at the retail level while the market was busy failing. The wholesale price, on the other hand initially did not have any price caps, and once these were implemented, they were soft caps, i.e., they could be exceeded under emergency conditions. Therefore, as the demand for electricity started reaching the available capacity, the wholesale prices paid by the utilities rose significantly, however, consumer demand did not decline; retail demand was completely inelastic with respect to wholesale prices. If the utilities had the ability to

pass on the changes in price to their consumers, demand would certainly have decreased as a result, and may have prevented the crisis from occurring.

Inadequate regulator / government involvement: Contrary to the UK example, the regulator and government agencies did not appear to be a strong guiding force in this deregulation. A number of situations point to this conclusion. As described under the previous comment, the FERC implemented a retail price ceiling, and a soft cap at the wholesale level, effectively decoupling the two markets. This may have appeared to be in the interests of the consumers, but was in fact shown to be the opposite. Also, the regulator (CPUC) was slow to implement long-term purchase contracts for the utilities. This meant that the full wholesale purchases by utilities were subject to the vulnerability of the market, and thus greater price risk. A mixture of long-term contracts and spot market purchases would have eased the financial burden on utilities significantly. Finally, there did not appear to be much investigation into the exercise of market power by the large gencos. Following the crisis, the California ISO claimed that market power was exercised during the crisis, estimating that gencos overcharged them by \$6.2 billion from May 2000 to February 2001 (California ISO, 2001).

4.3.3 United States (Texas)

4.3.3.1 Factors Leading up to Deregulation

The table below shows the significant events and periods leading up to deregulation.

Table 4-4 Evolution of the Texas electricity industry (pre-deregulation)

Year	Event/Period	Discussion
1941-1981	Texas Interconnected System (TIS)	Several utilities interconnected their networks in order to support the war effort by sending excess power to industrial companies on the Gulf Coast, and remained interconnected afterwards.
1970	ERCOT formed	The Electric Reliability Council of Texas (ERCOT) was formed to comply with North American Reliability Council (NERC) requirements. In 1981 TIS transferred all of its operating functions to ERCOT.
1975	PUC formed	The Public Utility Commission of Texas (PUC) was formed in order to regulate the rates of certain industries including the unincorporated electricity utilities.
1978	PURPA	See section 4.3.2.1.
1992	Energy Policy Act	See section 4.3.2.1
1995	Deregulation of generation	The Texas legislature voted to deregulated generation in order to develop a competitive wholesale market.
1996	ERCOT becomes an ISO	The PUC ordered ERCOT to become the first Independent System Operator in the U.S. Its mandate was to ensure equitable access to the grid by the Gencos.
1999	Retail deregulation approved	The Texas legislature passed the Senate Bill 7 (SB7) that called for the phased-in implementation of retail competition. Retail customers were to be able to choose their provider by 1 January 2002.

Source: Based on ERCOT, 2006

4.3.3.2 Implementation of Retail Competition

After the Bill to implement full retail competition was passed, ERCOT launched a full stakeholder engagement process similar to that of California's. Issues discussed during this process included rules around energy scheduling and dispatch, ancillary service, congestion management, billing and dispute resolution mechanisms.

As a result of the numerous hours of stakeholder engagement, a final market design emerged and was implemented as follows.

As with the previous two examples, the existing electric utilities in Texas were required to unbundle their generation, transmission and distribution, and retail components. The individual components, however, were allowed to remain under a single holding company. Both generation and retail became subject to competition while transmission and distribution remained regulated.

Contracts were obtained, through a competitive bid process, for providers of last resort (POLR) services. These service providers were, and still are, expected to supply power to consumers in areas where the retail electric provider (analogous to the retailer in Figure 2-2) was unable to continue services for any reason.

The PUC ran a consumer education program consisting of bill inserts, web site information, and telephone help lines, in order to educate consumers on how the competitive electricity market would operate, as well as how they could determine their choices.

A retail choice pilot program was initially launched in August of 2001 in order to test the operation of the new systems and market processes prior to implementation of full retail competition.

According to SB7, all gencos associated with former monopoly utilities needed to sell at least 15 percent of their installed generation capacity through auction. In addition, the Bill required that affiliates of regulated transmission and distribution service providers own less than 20 percent of the generation capacity within a service region. The reasons

for this regulation were to increase the available power for new entrants to the market, reduce opportunities for market power to be exercised, and promote competition.

The ten control centers serving the ERCOT region were consolidated into a single control area. This was done to facilitate efficient operations such as power scheduling and procurement of ancillary services to ensure reliability.

Another significant aspect of the market design was the introduction of “Price-to-Beat” rates. The purpose of these rates was to serve as the benchmark for consumers to make comparisons with available competitors’ rates while taking into account the products and services offered (for example, basic services would be expected to be equal to or lower than the Price-to-Beat, whereas bundled services or “green energy” would be expected to cost more). The initial Price-to-Beat rates included a 6 percent rate reduction (fuel price adjustments) for the six investor owned utilities (Central Power and Light, Reliant Energy, TXU SESCO, Texas-New Mexico Power Company, TXU Electric, and West Texas Utilities). The PUC can revise these rates twice a year based on changes to the price of natural gas. Consumers who did not choose an alternative supplier would remain with one of these six utilities, and receive the Price-to-Beat rates. These affiliated retail electric providers (REPs) are required to continue to provide services at the Price-to-Beat rates until December 31, 2006. Thereafter, their rates will not be subject to regulation.

Unlike the UK and California models, where a power pool was central to the balancing of supply and demand, Texas did not institute a power pool model. Instead, wholesale buyers and sellers are able to set up contracts with each other, without restriction, and trade through pre-existing markets. Market participants are able to use spot contracts and forward contracts, and manage risks through instruments such as

puts, calls and swaps. As the independent system operator, ERCOT provides system information and coordinates supply and demand only in the case of unplanned events such as generator failures.

Finally, SB7 made provision for electric utilities to recover a “true-up” balance in 2004 consisting of costs related to stranded assets, environmental controls, and other transition costs.

The competitive retail electricity market opened to most customers on January 1, 2002. Implementation was delayed in a few areas where fair competitive service could not be implemented.

4.3.3.3 Result

Since the opening of the market in 2002, 34 percent of residential, 29 percent of small non-residential and 72 percent of large non-residential consumers have switched from their native affiliated regional electric provider to a competitor (ERCOT, 2005). This represented 30, 75, and 73 percent of the total load supplied to residential, small non-residential and large non-residential consumers respectively. The total financial direct savings as a result of the retail competition were estimated at \$1.314 billion for 2003 (Perryman, 2004).

In 2000, investor owned utilities provided 297,298,634 megawatthours of electricity, or 79 percent of the Texas’ total requirement, while IPPs supplied the balance (80,443,731 megawatthours). By 2004, as a result of new generation investment and sale of utility owned generation, these statistics had almost reversed; IPPs supplied 298,244,982 megawatthours, or 76 percent while investor owned utilities supplied only 92,054,150 gigawatthours (Energy Information Administration, 2004c).

Also, as a result of the sale of utility owned generation, the largest individual percentage of sales by a genco in 2004 was by TXU Energy Retail Co LP, at 18 percent (Energy Information Administration, 2004c).

4.3.3.4 Lessons for B.C.

As can be seen from the results above, the Texas case is very much a positive one. The following lessons can be drawn from the experiences in Texas:

Strong, well considered and pro-competitive legislation: The well thought out Texas Senate Bill 7 contributed significantly to the success in the deregulation process. Its key provisions cover topics including stranded costs, market power, consumer safeguards, and environment and renewables. The timeframe to implement full retail competition was slow and deliberate. The PUC requested a bill in early 1997 to introduce retail competition. The bill was approved in 1999 with the date for competition set for January 2002. This generous timeframe gave all involved time to prepare. ERCOT consolidated the 10 different control centers and put in place the systems and structure required while the utilities used the time to unbundle their three lines of business.

SB7 promotes competition through its requirements that no genco can own or control more than 20 percent of the installed capacity located in, or capable of delivering power to, a single power region. In addition, capacity was made available to independent proponents by requiring the affiliated utilities to sell at least 15 percent of the entitlements to its installed generating capacity through auctions. These provisions also reduced the opportunity for generation market power (see section 3.2.4).

The Bill also promotes the development of renewable technologies (see section 3.4) through the establishment of a renewable energy credits trading program. Gencos

whose resource portfolios do not satisfy the minimum level of renewable energy are required to purchase energy credits in lieu of capacity.

Beneficial retail pricing model: The pricing model introduced in Texas promoted both price reductions and entry into the retail sector. The Price-to-Beat was initially set according to a 6 percent reduction. This calculation was performed to allow sufficient head room within the generation portion of the Price-to-Beat. Accordingly, new entrants would not be deterred by prices that were difficult to beat. In addition, the Price-to-Beat could be adjusted by the PUC for fuel cost increases/decreases, twice per year, thereby allowing the rate to follow the same cost drivers that face new gencos.

Financial tools available to manage risk: In the California case, utilities and retailers were required to purchase from the power pool, at the going wholesale rate. They were therefore completely at the mercy of the market, which was subject to large fluctuations in price. Texas, on the other hand, did not create a power pool. They left it up to the market to determine operating mechanisms. As a result, numerous hedging strategies were available to utilities and retailers, and they could manage their power requirements portfolio in the manner best suited to their levels of desired risk exposure. This flexibility created a more stable environment for buyers and sellers, which promoted new entry into the supply and retail markets as well as a more competitive environment. This should lead to price stability for retail customers as well.

Good environment for investment in generation assets: The regulatory process for the construction of new generation facilities has been streamlined in Texas. This has led to a transparent process that reduces the risk of investment in generation assets. As a result, generation capacity has increased significantly over recent years, going from 81,895 megawatts in 2000 to 101,104 megawatts in 2004, a 23 percent increase.

(Energy Information Administration, 2004c). In contrast, during the same time period, California's generation capacity increased by only 7 percent (Energy Information Administration, 2004c). This willingness to invest in generation assets combined with the streamlined regulatory process allows the market supply to more easily match the demand, thereby reducing the risk of market disequilibrium, as was the case in California.

5 APPLICATION TO B.C.'S ELECTRICITY SECTOR

This chapter draws from the analyses of the previous chapters and provides recommendations, in the form of specific action items, for policy makers in B.C. to consider in the design and implementation of a competitive retail electricity industry. It also shows the effect of each action item on the various stakeholders and issues mentioned in Chapter 3. These action items are organized under four distinct stages of restructuring, namely; design, legislate and motivate, implement, and monitor and enforce.

5.1 Design

Action Item 1: Separate the generation and retail components from each other and from the transmission and distribution components

In order to ensure that the competitive components (generation and retail) are given equal and fair access to the regulated components (transmission and distribution), they need to be disassociated from the operations of those groups. In practice this has been achieved in two ways, namely; 1) through complete separation to form a new company, or 2) through “firewall” separation within a single organization. It is easier to ensure independent operations and avoid conflicts of interest by choosing the first option. As discussed in section 2.2, the B.C. government has already allocated the management of the transmission assets to a different crown corporation (BCTC). This essentially leaves generation, distribution, and retail sales currently managed by BC Hydro. Under the current BC Hydro structure generation is already a separate line of business, however, the distribution line of business also manages the retail function.

In this action item, it is recommended that the retail function of BC Hydro be removed from distribution and placed in a separate group. This group should initially provide the retail function for all existing customers. Once retail is subject to competition, this group will become the “default provider”, i.e., it will continue to supply services to consumers who do not choose an alternate supplier. Ultimately this group should be allowed to compete with the other retailers, but only once sufficient competition has developed that regulatory bodies (see action item 9) are satisfied that market power cannot be exercised. The phasing is discussed in more detail under action item 13.

Since the generation line of business is already a separate entity within BC Hydro, it is recommended that this group remain within BC Hydro, subject to the sale of generation assets as outlined in action item 2.

Codes of conduct need to be in place such that the regulated components are not able to cross-subsidize the competitive components.

The result of this action item is the creation of an accessible transmission and distribution grid which will in turn reduce the barriers to entry and therefore promote a competitive market.

Action Item 2: Sell the generation assets

If market power is to be avoided, no single organization should own a significantly larger portion of the generation assets than its competitors. Ideally, the generation assets need to be well distributed amongst a good number of competitors. The higher the concentration of competitors, the greater the risk of market power being exercised. Since BC Hydro currently owns the majority of the generation assets in B.C.,

it should be mandated to sell, by auction¹⁷, a large portion of its generation power plant. It is important to note here that the people of B.C. will still receive the benefits of these generation assets even though they will be privately owned. This is explained further under action item 3.

It is recommended that no genco be allowed to own more than 20 percent of the total domestically required generating capacity. This would require BC Hydro to sell, over a period of time set by the provincial government (see action item 13), almost 80 percent of its generation assets.

The result of this action item will be to increase the available generation assets to entrants to the market, reduce opportunities for market power to be exercised, and promote competition.

Action Item 3: Ensure that the benefits of the heritage generation assets flow through to all consumers

As discussed in section 3.2.3, the cost of generation from heritage assets is lower than the cost of generation from new assets. Consumers in B.C. currently pay electricity rates based on the blended costs of these different generators. After the introduction of competition, consumers will be expected to pay whatever the market is demanding. As pointed out in section 2.4.5, this “competitive” price will approach the marginal cost of additional output (which is higher than the current blended cost). The new gencos that buy generation assets from BC Hydro will charge the market price. The province (shareholder), not the new gencos, would capture the benefits of the low cost generation through the sale of these assets at market value. BC Hydro would also need

¹⁷ Auctions are a very popular method for sale of generation assets since they transparently and reliably indicate the market value of such assets. This is useful in the determination of stranded costs/benefits (Cameron, Cramton, & Wilson, 1997)

to charge market price, even though it has the benefits of low cost heritage assets, otherwise consumers would not switch to competitors (see action item 4). Once again the province would capture the benefits of the low cost generation through increased profits. These benefits are known as stranded benefits as describe in section 3.2.3.

Since consumers currently pay less than market prices, it is likely that a culture of over-consumption of electricity exists in B.C. The re-design of the industry should attempt to move the “subsidised” price that consumers currently pay to the market price. However, if this results in substantially higher prices, consumers would resist and the process would likely be frustrated. The move towards market prices could be implemented over a period of time by allocating the stranded benefits to electricity users rather than to the people of B.C. in general. These stranded benefits associated with the heritage plant will need to be factored as a credit against consumers’ bills.

It is therefore recommended that, in order to ease B.C. consumers towards market prices, a stranded benefit credit should be applied to the distribution component of consumers’ bills (the distribution component would still be regulated, and therefore easier to apply the credit towards). The amount of this credit should be set equal to the net stranded benefit (the difference between the market value of generation assets and the amount of debt still owed on them) associated with all generation currently owned by BC Hydro, and be reduced to zero over a period of time.

The benefit of this action item is that electricity consumers in B.C. will be eased towards market prices by continuing to reap the benefits of the heritage assets over a period of time. Once the benefit is phased out, the current culture of over-consumption would likely be significantly reduced.

Action Item 4: Put in place a “default service” obligation

It is expected that not all consumers will switch to a new supplier when given the chance, and even those that do switch will do so at different times. Therefore, a mechanism needs to be put in place to accommodate these customers.

It is recommended that the retail group within BC Hydro be assigned the “default service” obligation, i.e., it will supply consumers that do not wish to switch. Further, consumers that choose to remain with BC Hydro should be charged a default rate. This default rate should consist of the sum of i) the transmission charge, ii) the distribution charge, offset by the stranded benefit credit (see action item 3), and iii) an energy (generation) charge. Since items i and ii are regulated services, they will be the same for all consumers regardless of whether they have switched to a competitive provider or remained with the default provider. For the competitive providers, item iii is not subject to regulation, and will therefore reflect market prices. However, for the default provider (BC Hydro), this component should initially be regulated in order to facilitate a smooth and successful transition to a fully competitive market. It is important to set the price for this component at or even slightly above the wholesale market price. If this is not done then competitive retailers would not be able to compete with the BC Hydro retail group for customers. After a period of time, once sufficient consumers have switched and it has been determined that the BC Hydro retail group has little opportunity to exercise market power, both the default service and the default rate should be removed.

In practice, the regulation of item iii above will be carried out through a small number of rate updates over the period of a year (typically twice per year in other jurisdictions). It is likely, therefore, that the default price may be lower than the market price at times and higher at other times. A mechanism should therefore be put in place

that will prevent customers from frequent switching to take advantage of this asymmetry. This type of frequent switching creates an unstable customer base and would discourage new competition. This could be prevented through contractual stipulations with the new provider.

The benefit of this action item is the provision of services for those who do not wish to switch. In addition, it provides a mechanism by which switching, or the introduction of competition, can be phased in over time. Finally, if the default rate is set correctly, it encourages new competitors to enter the retail market.

Action Item 5: Create a wholesale market system that encourages competition and investment

“[Wholesale electricity markets] must be designed as an integral central component of a successful restructuring and competitive program.” (Joskow, 2003).

As can be seen from the three case studies presented in Chapter 4, it is important that the retailers are able to manage the risk of volatile spot market prices. This is achieved through the implementation of bilateral forward contracts between the retailers and genscos. California did not allow these types of contracts, and as a result, the retailer was completely exposed to market price fluctuations. Both the UK and Texas allowed these transactions, which provided some stability, or at least the option for retailers to manage a portfolio of supply options (whether spot or contracts) based on their level of risk aversion.

It is therefore recommended that the market arrangements between buyers and sellers of electricity take place primarily through bilateral contracts. Further, it is recommended that the balance of the power requirements be provided through day-

ahead and real time markets as well as ancillary services managed by BCTC (see action item 9 for governance structure). The function of this market is to provide last minute generation needed to balance the system due to inaccurate demand estimates as well as unexpected generator or transmission network failures.

This action item will provide a transparent wholesale market with risk hedging capabilities. As a result, investors are more likely to enter the retail market. In addition, the transparency and risk control mechanism reduces the opportunities for exercising market power. Concerns discussed in section 3.2.4 are addressed by this action item.

Action Item 6: Ensure that any rate control mechanisms encourage competition

Action item 4 recommended that a default price be set for those consumers that do not switch to competitive suppliers. This is a form of rate control since the retailer is not able to change the price presented to these consumers. However, this retailer is expected to purchase power from the wholesale market at competitive, and thus changing, rates. This is a concern if the market price of generation gets significantly out of step with the default price, as was highlighted in the California case.

It is therefore recommended that the regulator (BCUC – see action item 9) monitor the changes in the price of inputs and ensure that the default price is updated accordingly (since the wholesale prices are driven by the same inputs).

The result of this action item is that consumers will more readily modify their consumption patterns based on the electricity prices. It will also ensure that the risk of wholesale price fluctuations is borne by the consumer rather than BC Hydro. Concerns discussed in sections 3.1.5.1 and 3.2.5 are addressed by this action item.

Action Item 7: Implement “provider of last resort” services

Since electricity is such a vital service (as discussed in section 3.1.2.3), it is important that consumers (particularly residential) continue to receive a service regardless of their “desirability” to a competitive retailer. Also, it is not appropriate for consumers to switch back to the default provider, for the reasons mentioned in action item 4.

Therefore, it is recommended that these consumers be served by a provider of last resort, as in the case of Texas. This service responsibility should be contracted through tender or auction

This action item ensures that all consumers are provided with an electricity supply. Concerns discussed in sections 3.1.2.3 and 3.2.5 are addressed by this action item.

Action Item 8: Ensure that the new structure is aligned with B.C.’s environmental and sustainability goals

Both the UK and Texas initiatives included environmental and sustainability regulations in the acts outlining the electricity restructuring. The reason for this is that a competitive environment does not necessarily consider negative externalities such as those associated with the environment and sustainability. In its 2002 Energy Plan, the B.C. government presented a plan for environmental responsibility and electricity conservation, including such issues as a voluntary goal for electricity distributors to acquire 50 percent of new supply from B.C. clean electricity, and the introduction of a new rate structure (B.C. Provincial Government, 2002). In addition, the government has announced that it is currently in the process of expanding this energy plan, placing a

greater emphasis on conservation, efficiency and innovation (B.C. Provincial Government, 2005).

It is recommended that the goals of the energy plan be reflected in the legislation instituting the restructuring of the electricity industry (see action item 10). This action item will ensure that the introduction of retail competition will not jeopardize the Province of B.C.'s environmental and sustainability goals. Concerns discussed in section 3.4 are addressed by this action item.

Action Item 9: Ensure an adequate governance structure is in place

A fully adequate governance structure is required in order to successfully introduce, monitor and regulate the various components of a new electricity structure. As shown in all three cases presented in Chapter 4, a strong governance structure allows swift and decisive action, and as a result, careful control over the direction that the market is heading. This is particularly important in the early stage of deregulation since anti-competitive behaviour is most likely to surface during that time. It is also important from an ongoing perspective to ensure that the systems are operating adequately, safely, and within the specified quality standards.

It is recommended that three organizations provide the governance role, namely; an Independent System Operator (ISO), a regulator, and the provincial government.

The ISO function should be carried out by the British Columbia Transmission Corporation, since most of the services are already provided by them. Their responsibilities will include transmission planning, provision of day-ahead and real time markets as well as ancillary services (see action item 5), and ensuring minimum safety and quality standards of the transmission network.

The regulatory duties should be carried out by the British Columbia Utilities Commission (BCUC). These would include regulating the costs and operations of the transmission and distribution components (BC Hydro), monitoring the wholesale markets for power abuse, anticompetitive behaviour and market manipulation, and adopting and enforcing rules related to retail competition such as customer protection, default rate determination, and legislated environmental and sustainability goals.

The role of the Provincial government is to ensure that adequate legislation is put in place (see action item 10), and to ensure that market failures are avoided.

The benefit of this action item is improved clarity on the roles and responsibility of the various governing bodies. Most of the concerns discussed in Chapter 3 are addressed by this action item.

5.2 Legislate and Motivate

Action Item 10: Announce and legislate the restructuring

A number of legislative acts will need to be changed in order to implement the electricity restructuring. However, it is important to choose the correct venue for announcing the intention to proceed.

It is recommended that the intention to deregulate and restructure parts of B.C.'s electricity industry be announced in an update to the Energy Plan. The purpose of the announcement is to firstly show that the government intends to proceed with deregulation, but more importantly to inform stakeholders of the benefits of such restructuring. This will be an important part of gaining acceptance by the various stakeholders (see action item 11).

Since the role of the regulator will change, the Utilities Commission Act will need to be amended to include the new responsibilities of the BCUC (see action item 9)

In order to formalise the change, the Province will need to create an electricity act specifically for this purpose. This act should clearly indicate the new electricity industry structure and the rules that will govern its operation, covering the following issues:

- Governance and power of regulatory and government bodies;
- Vertical separation of generation, distribution and retail within BC Hydro;
- Code of conduct rules between generation, distribution and retail;
- Timetable for implementation (see action item 12);
- Sale of the generation assets;
- Price cap mechanisms;
- Establishment of a default service obligation;
- Establishment of a “provider of last resort” service; and
- Rules for monitoring and curbing anti-competitive and market power behaviour (see action item 14)

This action item will ensure that an adequate legal structure, in support of the new industry structure, exists. Concerns discussed in sections 3.1.5, 3.2, and 3.4 are addressed by this action item.

Action Item 11: Sell the idea to stakeholders and the public

This is probably the most important action item since, if stakeholders are generally not happy with the idea of deregulating the electricity industry, it will be

exceptionally difficult to achieve a successful implementation. One of the more difficult stakeholders to convince will be the general public. Firstly, the public will not easily understand the benefits of retail competition, particularly as the prices fluctuate and reach levels higher than exist under regulation. The idea of de-regulation is easiest to sell if it leads to lower prices, however, this is unlikely to occur in B.C., because of the low “blended” cost of new and existing generation (see section 3.2.2), . The introduction of competition is, however, expected to reduce the rate at which prices are increasing (as a result of high economic growth in B.C. combined with high costs of new energy sources). In addition, B.C. is now a net importer of electricity (BC Hydro, 2006b), meaning that the current generating capacity is not sufficient to supply all of B.C.’s requirements. Substantial investment in new generation is therefore required (BC Hydro, 2006b). Competitive supply of these new resources, as well as the retail component associated with them, are likely to result in lower prices than if they were supplied on a non-competitive basis.

It is recommended that the Provincial government provide educational material and present workshops on the benefits of introducing competition outlining the issues mentioned above.

Since it is natural for the public, and stakeholders in general, to voice their displeasure if prices increase after the introduction of competition, it is important that policy makers recognise the pressures that will be on the government when this happens. The government should be made aware of the possible negative consequences of trying to satisfy consumers (voters and interest groups) through price controls (see section 3.2.5). It is thus important that consumers are aware of, understand, and generally accept the implications and expected changes as a result of electricity deregulation. Other stakeholders, such as suppliers, may be more educated

with respect to the implications of retail competition, but it is important to provide education to all stakeholders.

The benefit of this action item is an improved implementation plan, that takes into account the interests of all stakeholders, and greater acceptance of the plan by the stakeholders. Concerns discussed in sections 3.1 and 3.2.5 are addressed by this action item.

5.3 Implement

Action Item 12: Engage stakeholders in the specifics of implementation

It is important that the implementation team understand the effect that this change will have on all stakeholders, and design the implementation plan in a manner that will most effectively address these interests without jeopardizing the success of the industry restructuring. A successful stakeholder engagement process will go a long way to achieving mutual understanding of the issues and building trust between the players.

It is recommended that an extensive stakeholder engagement process be followed in order to help develop the specifics of the implementation plan. Such a process should cover topics such as implementation transition and timing, market rules, effect on employees, prevention of anti-competitive behaviour, provision of ancillary services, and sale of public generation assets.

It should be noted that, although this is a very important process, its purpose is limited to the detailed implementation and not the high level design of the new structure. One can learn from the California case where the design of the wholesale market came about as a result of stakeholder engagement. There were two significantly different views of how the market should operate, one side favouring a pool and the other

favouring bilateral contracts. The final design was arrived at through a series of compromises resulting in an extremely complicated set of wholesale electricity market institutions (Joskow, 2001). Concerns discussed in section 3.1 are addressed by this action item.

Action Item 13: Provide adequate time and phasing for implementation and allow for course corrections during implementation

The California case showed that a hastily implemented plan can have negative consequences. In that case, some systems were not in place at the official start of retail competition, nor had the plan been adequately phased in to ensure that the industry would operate without significant problems (see section 4.3.3.3). The disadvantage of implementing too quickly or not being flexible with the implementation schedule is that possible market failures will emerge quickly, possibly with drastic consequences. On the other hand, if implementation is phased in slowly, the implementation team will have the opportunity to monitor the progress of each phase and increase the opportunities for identifying and correcting potential failures before any damage is done.

It is therefore recommended that the implementation schedule make allowance for a phased implementation with sufficient time allocated to monitor the success of each phase. The following implementation phases are proposed:

- Restructure BC Hydro such that the retail and distribution functions are independently managed;
- Divest ownership of the generation assets over a period of time. The time period should be sufficiently long to allow the new gencos to effectively manage their plant. During the beginning of this phase BC Hydro should continue as the retailer,

purchasing electricity, on a non-competitive basis from the gencos at the default price determined by the regulator (see action items 3 and 4);

- Once it has been determined by the implementing team that sufficient generating capacity has been sold to various companies, thus ensuring competitive pricing, the market should be opened up to retail competition. Depending on the findings of the implementation team, this may have to be restricted to certain geographical regions initially. During this period BC Hydro should provide ancillary services at temporary rates as determined by the BCUC;
- Once sufficient generating plant has been sold to ensure that BC Hydro cannot exercise market power, contracts for ancillary and provider of last resort services should be tendered competitively;
- After this stage the market should be operating competitively in all aspects except for the default provider services provided by BC Hydro. The BCUC should monitor the market operations carefully for any anti-competitive behaviour (see action item 14).
- Once the market is operating effectively and efficiently on its own and a sufficient number of customers have switched to competitive suppliers, the default service should be discontinued and the BC Hydro retail group should be subject to competition.

The benefit of this action item is the decrease in the chances of market imperfections or failures as a result of an inadequately implemented plan. Concerns discussed in sections 3.1.1, 3.2.4, and 3.3 are addressed by this action item.

5.4 Monitor and Enforce

Action Item 14: Ensure that possible market failures are identified and corrected early

In all three of the cases presented in Chapter 4, it was found or suspected that market power was being exercised by some of the larger gencos. In one instance the UK responded by forcing one of the gencos to sell 6 GW of generation capacity (section 4.3.1.3). In Texas, a new rule was instituted by the Public Utilities Commission to “protect Texas customers during the transition to a fully competitive electric industry by improving operational efficiency, ensuring reliability, and maintaining reasonable prices in the wholesale market” (Texas Public Utilities Commission, 2004). Both of these reactions show a strong intolerance toward gencos exercising market power.

It is recommended that the BCUC implement adequate monitoring of the industry for any activities that may undermine the competitive operation of the electricity industry in B.C. Further, it is recommended that the Provincial government enact legislation that will empower the BCUC to take appropriate actions against organisations that exhibit market power behaviour and to implement rules that will prevent further occurrences.

Although this action item is ongoing, it is particularly important during the early stages of competition, where the ability to exercise market power is the greatest since there are likely to be a small number of large gencos.

The benefit of this action item is the promotion of fair competition. Concerns discussed in section 3.2.4 are addressed by this action item.

6 CONCLUSIONS

This paper has covered various aspects of the electricity industry that may be affected by, or have an effect on, the introduction of full retail competition into the industry. Although the market design aspects presented in the previous chapter may appear quite specific, this investigation has provided a broad overview of the issues, in many cases at the expense of the details. In order to design comprehensive policies covering the introduction of such retail competition, one would need to investigate in far greater depth, each of the specific aspects presented. The recommendations do, however, stand on their own as valid and applicable guidelines to the design of a good industry structure.

This paper has not attempted to take a position on whether the introduction of retail competition is the right thing to do for B.C.'s electricity industry, but rather to provide guidance on how to implement such changes if the decision was made to follow that route. If this is indeed the direction that policy makers in B.C. choose to take, then this paper shows that looking at other jurisdictions, where such a change has been implemented is very helpful in determining the industry design in B.C. It shows not only the advantages and disadvantages of different approaches, but also the consequences that can result. As the California case shows, these consequences could be quite severe, to the extent that a large industry can be crippled over a period of months. On the other hand, both the UK and Texas cases show that deregulation can achieve the desired policy goals if implemented correctly.

The success or failure of such an industry deregulation is dependant primarily on the quality of the new industry design, the way it is implemented, and also the amount of care that is taken to ensure its success before, during and after implementation. Policy makers would do well to consider all of these factors when deliberating over the introduction of competition in the retail supply of electricity.

APPENDICES

Appendix A

Table 6-1 Registered intervenors and the stakeholders they represent

Intervenor Representation	Utilities ²	IPPs	Suppliers	Industrial	Commercial	Residential	Residents	First Nations	Government
BC Sustainable Energy Association (BCSEA)							X		X
The Sierra Club of Canada, BC Chapter (SCCBC)							X		
Peace Valley Environmental Association (PVEA)							X		
Independent Power Producers Association of BC		X							
Brookfield Energy Marketing Inc.		X							
City of New Westminster							X		
Independent Power Producers of B.C.		X							
Columbia Power Corporation	X								
Green Island Energy Ltd.		X							
Catalyst Paper Corporation				X					
British Columbia Utilities Commission	X	X	X	X	X	X	X	X	X
ZE PowerGroup		X							
Joint Industries Electrical Steering Committee (JIESC)				X					
Peace River Regional District							X		
The BC Old Age Pensioners Organization et al. (BCOAPO)						X			
Line Contractors' Association of BC			X						
West Fraser Mills Ltd				X					
Cloudworks Energy Inc.		X							
Howe Sound Pulp and Paper Limited Partnersh				X					
Comstock Energy Inc.		X							
West Fraser Mills Ltd				X					
Terasen Gas Inc.			X						
FortisBC Inc.	X								
Eik Valley Coal Corporation				X					
World Federalists of Canada							X		
British Columbia Transmission Corporation	X								
Fraser Valley Regional District (FVRD)							X		
British Columbia Hydro and Power Authority	X						X		
Lone Prairie Community Association							X		
Independent Intervenor							X		
Commercial Energy Consumers of BC	5	8	3	7	2	2	10	1	2

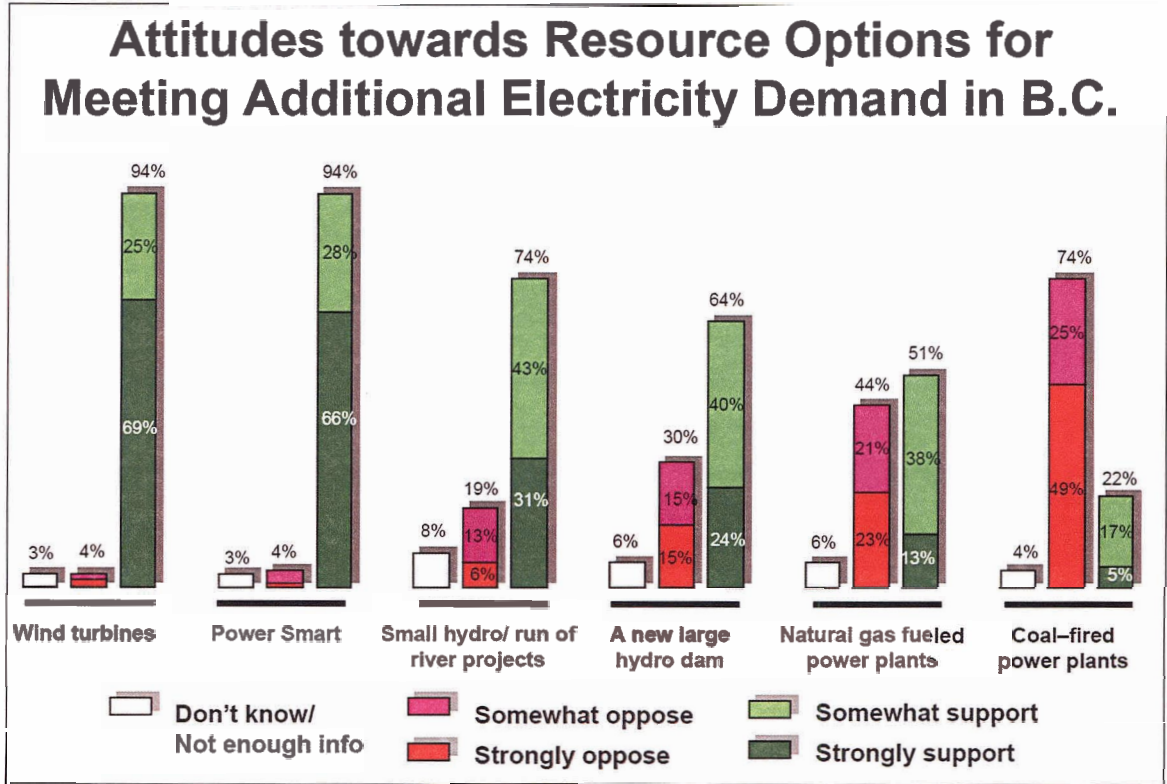
Notes

- 1) Based on the authors personal assessment
- 2) Utilities include BC Hydro, BCTC, Columbia Power Corporation and FortisBC

Source: Based on BCUC, 2006 and author's assessment

Appendix B

Figure 6-1 Extract from BC Hydro survey



Source: BC Hydro, 2005

REFERENCE LIST

- BC Federation of Labour. (2002). *Hands off Hydro campaign kicks off*. Retrieved July 13, 2006, from <http://www.bcfed.com/BFNews/E-Newsletter/Archives/ISSUE29.htm>
- BC Hydro. (2005). *Public opinion on emerging issues*. Retrieved July 7, 2006, from http://www.bchydro.com/rx_files/info/info33133.pdf
- BC Hydro. (2006a). *F2006/F2007 revenue requirements application*. Retrieved July 5, 2006, from http://www.bchydro.com/rx_files/info/info45426.pdf
- BC Hydro. (2006b). *2006 integrated electricity plan*. Retrieved July 2, 2006, from http://www.bchydro.com/rx_files/info/info43514.pdf
- BC Hydro. (2006c). *Electricity rates*. Retrieved July 10 2006, from <http://www.bchydro.com/policies/rates/rates759.html>
- BC Hydro. (2006d). *Aboriginal relations initiatives*. Retrieved July 5, 2006, from <http://www.bchydro.com/ard/initiatives/initiatives905.html>
- BC Hydro. (2006e). *Power smart at home*. Retrieved July 5, 2006, from <http://www.bchydro.com/powersmart/>
- BC Provincial Government. (2002). *Energy for our future: a plan for BC*. Retrieved July 5, 2006, from http://www.gov.bc.ca/empr/down/solutions_sept_27.pdf
- BC Provincial Government. (2005). *News release: B.C. updating energy vision with expanded plan*. Retrieved July 5, 2006, from http://www2.news.gov.bc.ca/news_releases_2005-2009/2005EMPR0048-000974.htm
- BCUC. (2006). *BCH - F2007-2008 revenue requirements*. Retrieved June 28, 2006, from <http://www.bcuc.com/ApplicationView.aspx?ApplicationId=108>
- California ISO. (2001). *What went wrong with California electric utility deregulation?* Retrieved June 25, 2006, from <http://www.caiso.com/docs/2001/04/25/2001042509454712472.pdf>
- Cameron, L.J., Cramton, P., Wilson, R. (1997). *Using auctions to divest generation assets*. Retrieved July 17, 2006, from <http://www.cramton.umd.edu/papers1995-1999/97elec-using-auctions-to-divest-generation-assets.pdf>
- Congressional Budget Office. (2001). *Causes and lessons of the California electricity crisis*. Retrieved July 5, 2006, from <http://www.cbo.gov/showdoc.cfm?index=3062&sequence=0#pt2>
- Department of Trade and Industry. (2005). *Quarterly energy price tables*. Retrieved July 15, 2006, from <http://www.dti.gov.uk/energy/statistics/publications/prices/index.html>
- Edison Electric Institute (2003). *Status of electricity competition in the states*. Retrieved July 4, 2006, from

- http://www.eei.org/industry_issues/electricity_policy/state_and_local_policies/state_restructuring_and_regulatory_policy/Competition_states_map.pdf
- Edison Electric Institute (n.d.). *History of the electric power industry*. Retrieved July 8, 2006, from http://www.eei.org/industry_issues/industry_overview_and_statistics/history/index.htm#structure
- Energy Information Administration. (1997). *Electricity reform abroad and U.S. investment*. Retrieved July 5, 2006, from <http://www.eia.doe.gov/emeu/pgem/electric/contents.html>
- Energy Information Administration. (2004). *Electric sales, revenue, and average price 2004*. Retrieved July 5, 2006, from http://www.eia.doe.gov/cneaf/electricity/esr/esr_sum.html
- Energy Information Administration. (2004). *Annual energy review 2004*. Retrieved July 5, 2006, from http://www.eia.doe.gov/emeu/aer/pdf/pages/sec8_9.pdf
- Energy Information Administration. (2004c). *Texas electricity profile 2004 edition*. Retrieved July 5, 2006, from http://www.eia.doe.gov/cneaf/electricity/st_profiles/sept05tx.xls
- Energy Information Administration. (2005). *Subsequent events - California's energy crisis*. Retrieved July 5, 2006, from <http://www.eia.doe.gov/cneaf/electricity/california/subsequentevents.html>
- Energy Information Administration. (2006). *International energy outlook 2006*. Retrieved July 5, 2006, from <http://www.eia.doe.gov/oiaf/aeo/index.html>
- ERCOT. (2005). *August 16, 2005 board of directors meeting material*. Retrieved July 7, 2006, from http://www.ercot.com/meetings/board/keydocs/2005/0816/Giuliani_-_Market_Operations_Presentation_%2808-16-05%29.ppt
- ERCOT. (2006). *History*. Retrieved July 7, 2006, from <http://www.ercot.com/about/profile/history/index.html>
- Hirsh, R.F. (2001). *Power loss: the origins of electric utility deregulation*. Retrieved July 3, 2006, from <http://www.history.vt.edu/Hirsh/KJT-screen.pdf>
- IBEW. (2004). *The power play*. Retrieved July 7, 2006, from <http://www.ibew258.bc.ca/powerplay.html>
- Joskow, P.L. (2001). *California's electricity crisis*. Retrieved July 2, 2006, from <http://web.mit.edu/ceep/www/2001-006.pdf>
- Joskow, P.L. (2003). *The difficult transition to competitive electricity markets in the U.S.* Retrieved July 8, 2006, from <http://www.aei-brookings.org/admin/authorpdfs/page.php?id=271>
- Littlechild, C.S. (2000). *A review of UK electricity regulation 1999-2000*. Retrieved July 2, 2006, from <http://www.econ.cam.ac.uk/dae/repec/cam/pdf/wp0026.pdf>
- National Audit Office. (2003). *The new electricity trading arrangement in England and Wales*. Retrieved July 2, 2006, from http://www.nao.org.uk/publications/nao_reports/02-03/0203624.pdf

- OFGEM. (2003). *Domestic gas and electric supply competition*. Retrieved June 28, 2006, from http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/3833_DCMR04july.pdf
- Perryman, M.R. (2004). *The Perryman report*. Retrieved July 10, 2006, from http://www.centerpointenergy.com/files/104789_perryman.0204newsletter.pdf
- Texas Public Utilities Commission. (2004). *PUC sets electricity enforcement guidelines*. Retrieved July 6, 2006, from <http://www.puc.state.tx.us/nrelease/2004/021804.cfm>
- University of California Energy Institute. (2002). *The history of electricity restructuring in California*. Retrieved July 10, 2006, from <http://www.ucei.berkeley.edu/PDF/csemwp103.pdf>
- Weimer, D.L., & Vining, A.R. (2005). *Policy analysis concepts and practices* (4th ed.). Upper Saddle River, New Jersey: Pearson Prentice Hall
- World Energy Council. (2005). *The benefits and deficiencies of energy sector liberalisation*. Retrieved July 5, 2006, from http://www.worldenergy.org/wec-geis/publications/reports/current_cls/ClELEC.asp#intro