Chapter 6

Electricity Market Regulatory Reform and Competition – Case Study of the New Zealand Electricity Market

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CHAPTER 6

Lessons from Electricity Market Regulation Reform in New Zealand: Vertical Integration and Separation

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All around the world, electricity market reforms involve various forms of unbundling previously vertically integrated state-owned or privately owned electricity monopolies. New Zealand is the only country in the developed world that has implemented forced ownership unbundling of electricity distribution and transmission activities from the rest of the electricity network. The Electricity Industry Reform Act 1998 (EIRA) strictly prohibited distribution businesses from being involved in either generation or retailing activities. However, the strict ownership separation between distribution and generation was relaxed not long after the enactment of this legislation. In 2010, the New Zealand government enacted the Electricity Industry Act 2010 (EIA), which revised the strict ownership separation between distribution and retail by allowing distribution back into retailing, and relaxed further the separation between distribution and generation by raising the threshold further for ownership separation between distribution and generation. This study will review the New Zealand reform experience, examine the market structures resulting from ownership unbundling, and evaluate the impacts of ownership unbundling on the performance of the electricity sector. It will also explore the rationale underlying recent reforms that allow re-integration, and to gauge the impact of the recent reforms.

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1. Introduction

All around the world, there has been market reform in the electricity sector. Common practices include the unbundling of previously vertically integrated monopolies, the introduction of wholesale and retail competition, the privatisation of former state-owned utilities, the regulation of the natural monopolies of transmission and distribution networks, and freedom of choice for electricity consumers.

The objectives of the reforms in the electricity sector have been to introduce competition to operations, such as electricity generation and electricity retailing; to regulate only the natural monopoly components, transmission and distribution, of the electricity network; to improve the efficiency of electricity utilities; to ensure the security and sustainability of electricity supply; and to encourage investment and innovation.

There are various forms (and degrees) of unbundling a previously vertically integrated electricity network. The four most common forms of unbundling are management unbundling, accounting unbundling, legal unbundling, and ownership unbundling. Among them, ownership separation is the strictest form of separation, while management the lightest form of separation.

New Zealand is the only country in the developed world that has implemented forced ownership unbundling of electricity distribution and transmission from the rest of the electricity network. The Electricity Industry Reform Act 1998 (EIRA) legislated unbundling, and there were several amendments to relax the strict ownership separation between distribution and generation. The enactment of the Electricity Industry Act 2010 (EIA) further reduced the extent of ownership separation between distribution and retail and generation by allowing distribution back into retailing and raising the threshold for ownership separation between distribution and generation.

This study will review the New Zealand reform experience and the impact unbundling had on our vertically integrated electricity network and the subsequent reforms allowing re-integration, to provide some learning experience for East Asia Summit countries.

This paper is organised as follows. Section 2 reviews the literature on vertical integration in electricity markets. Section 3 provides a snapshot of developments in the New Zealand electricity market since the 1990s. The main discussion is on the evolution of regulatory change in New Zealand. Section 4 describes the current electricity market in New Zealand while section 5 discusses the reforms since 2010 and section 6 provides our conclusion.

2. Vertical Integration

2.1. Literature Review

Perry (1989) defines "vertical integration" in two ways:

"*The entire output of the upstream process is employed as part or all of the quantity of one intermediate input into the "downstream" process, or Intermediate input into the "upstream" process*."[2]

Electricity sectors all around the world evolved into vertically integrated monopolies, which were either state-owned or privately owned subject to state regulation. Under this vertically integrated monopoly, the four components of electricity supply --- generation, transmission, distribution, and retail supply --- were integrated within a single electricity utility. Vertical integration can better harmonise these sometimes conflicting activities, facilitate efficient investment in the electricity network, and better adapt to changing supply and demand conditions over time (Joskow, 2006a; Williamson, 1985).

While the transmission and distribution activities are naturally monopolistic, generation and retail are potentially competitive. Electricity businesses with vertically integrated monopolistic transmission and distribution activities with potentially competitive generation and retail activities tend to have incentives to restrict the access of transmission and distribution facilities by non-vertically integrated generators and retailers, and lead to the foreclosure of the competitive activities and monopolisation in electricity generation and retail.

[2] Page 183, (Perry, 1989).

Unbundling can reduce the disadvantages that would otherwise exist for firms without ownership of transmission and distribution facilities. There are various forms (and degrees) of unbundling a previously vertically integrated electricity network. The four most common forms of unbundling are management unbundling, accounting unbundling, legal unbundling, and ownership unbundling. Among them, ownership separation is the strictest form of separation, while management the lightest form of separation.

Broadly speaking, ownership separation can stimulate innovation and efficiency in distribution and retail sectors, eliminate cross subsidisation, and limit the need for certain regulations that are difficult, costly and only partially effective, such as access regulation. On the other hand, ownership separation may: result in the loss of economies of scope from integration; increase the transaction costs between activities at different levels of operation; and reduce the adequacy of investment. It may also lead to some unexpected outcomes. Furthermore, implementing ownership separation involves significant cost and is difficult to reverse. Therefore, for policy makers considering ownership separation, the benefits and costs of ownership separation need to be balanced.

One unintended output of the electricity market restructuring is the re-integration of generation and retailing activities after the initial unbundling. This seems to make commercial sense as the supply risks inherent in the generation activities, and the consequent volatility in the wholesale price faced by both generators and retailers can be insured against by integrating generation and retailing. Standalone generation and retail businesses, especially smaller ones, are the most susceptible to volatile wholesale prices. It would be difficult to maintain profits without integration with each other. Thus, vertical integration allows both the retailer and the generator to manage risk in terms of commercial interest, and helps to avoid the double marginalisation problem as well. Of course, the cost of vertical integration between generation and retailing is also associated with costs, such as restricting the entry of new generators or retailers.

2.2. International Practice in Vertical Integration

Over the past two decades, countries around the world have been trying to liberalise their vertically integrated electricity sector and to introduce competition where possible.

Reforms typically started from either of the following two market structures:

- **Single fully vertically integrated monopoly**

A country's electricity supply comes from one state-owned vertically integrated electricity utility, operating in generation, transmission, distribution and retailing. This was the typical structure in most countries before their electricity market reform. For example, Electricite de France (EdF), a publicly owned monopoly in France; state-owned Enel in Italy, etc., operated at all stages from generation to transmission, distribution, and sales before market restructuring. EdF in France is still a vertically integrated public monopoly, even after the introduction of a series of reforms including the establishment of a wholesale market, allowing competition in retail, and the introduction of sector specific regulation.

- **Multiple vertically integrated regional monopolies**

There are two forms of regional vertically integrated regional monopolies. The first is that each region is supplied by one fully integrated firm. Each region is connected to one another. For example, operating at all stages of supplying electricity, there were nine vertically integrated private regional companies in Germany prior to the reform, and ten vertically integrated investor owned companies in Japan, each serving an exclusive area. Australia had the same structure; each state was served by a vertically integrated state owned electricity utility enterprise.

The other form involves some degree of vertical separation along the supply chain of electricity. For example, in England and Wales before restructuring, generation and transmission services were provided by a vertically integrated state-owned Central Electricity Generating Board (CEGB), while distribution and retail services were provided by 12 area electricity boards (AEBs). New Zealand had a similar structure before reform. Electricity Corporation New Zealand (ECNZ), and its predecessor Ministry of Energy, was responsible for generation and transmission, while 61 local electricity supply authorities (ESAs) were responsible for distribution and retail for exclusive areas. This structure has also been adopted as an

intermediate structure at the initial stage of an electricity market restructure, for example, in Turkey and Romania.

The main purposes of these reforms are: to introduce competition to a component of the industry where competition is possible; increase the sustainability of the market; and to secure electricity supply. The most common reforms include: the break-up of monopolies; privatising state-owned utilities; introducing a wholesale market; increasing the transparency of industry information; encouraging consumer switching; and regulatory incentives for transmission and distribution investment.

Because of the differences in starting points, restructuring strategy and restructuring progress, a number of electricity models coexist even for countries with highly developed reforms, and they are different from one another in terms of the degree of vertical integration and degree of openness to competition. On one hand, for example, in France, a vertically integrated public monopoly is still operating at all stages from generation to transmission, distribution, and retail. While in New Zealand, the previously vertically integrated state monopoly was completely unbundled with strict ownership separation between energy businesses (generation and retail) and line businesses (distribution and transmission). Several European Union countries, such as the United Kingdom, have adopted a similar form of market structure too.

However, up to until now, New Zealand has been the only country around the world that has had strict ownership separation between the energy businesses (generation, retailing) and line businesses (distribution and transmission). The Netherlands had ownership separation from January 1, 2011. Many European countries have other types of separation, such as management separation, legal separation and operational separation (see Table 1 for a summary of the different types of separation).

2.3. Empirical Evidence

A number of empirical research studies have investigated the impact of vertical integration, unbundling and market reform in general on the performance of the electricity market. The findings of these studies suggest that vertical integration is indeed associated with economy of scope; however, allowing competition in retail

and wholesale markets tends to improve firm efficiency and service quality and lead to higher productivity and consequently lower prices. The net impacts tend to be positive but moderate.

Table 1: Different Types of Unbundling across European Countries

Country	Type of Unbundling	No. of distribution businesses	Distribution businesses with less than 100,000 connections
Austria	Legal	138	n.a.
Belgium	Legal	30	20
Denmark	Legal	120	112
Finland	Operation	94	88
France	Management	166	160
Germany	Legal	950	900
Greece	Legal	1	0
Ireland	Management	1	0
Italy	Legal	170	n.a.
Luxembourg	Management	10	9
Netherlands	Legal	20	0
Portugal	Operation	11	10
Spain	Legal	308	300
Sweden	Legal	184	179
UK	Legal	18	3

Source: Skytte & Ropenus, 2005

Economies of Scope

Empirical evidence has generally found economies of scope for vertically integrated electricity utilities. Several empirical studies have considered the economies of scope that can exist for a vertically integrated electricity generation and 'distribution' business. The studies undertaken by Kaserman & Mayo (1991), Kwoka (2002), Piacenza & Vannoni (2004), Nemoto & Goto (2004), Meyer (2012), and Fetz & Filippini (2010) examined whether there were cost savings for an integrated generation and transmission and distribution (line) business versus a line business with no generation assets. All of them identified that there were cost savings for an integrated firm compared with a line business with no generation assets. These cost savings could arise from reduced transaction costs and better coordination.

However, these studies do not take into account the benefits associated with market liberalisation and increased competition. Douglas (2006) found cost savings at coal fired power plants in the eastern United States of 2-3% following the opening of transmission systems to wholesale power market competition in 1996 in regions with independent system operators. Steiner (2001) using data from 19 OECD countries has also found that the separation of generation and transmission is associated with higher capacity utilisation rates, although not associated with lower prices.

Price

In looking at the impact of unbundling on retail price, Bushnell, *et al*. (2008) found that had PJM[3] and New England markets been forced to fully unbundle (as happened in California), retail prices in those areas would have been significantly higher due to production inefficiencies. Hogan & Meade (2007) also found that generators tend to overstate their wholesale prices when there is unbundling, resulting in higher retail prices.

On the other hand, Florio, *et al.* (2008) examining the impact of reform on household electricity prices in 15 EU countries over the period 1978 and 2005, found that less vertical integration is associated with lower prices. Joskow (2006b) used time series econometrics to find that competitive wholesale and retail markets reduced prices (relative to their absence) by 5-10% for residential customers and 5% for industrial customers.

Quality

Nagayama (2010) analyses original panel data from 86 countries between 1985 and 2006 to identify the effects of different policy devices of power sector reforms on service quality performance indicators (installed capacity per capita, transmission and distribution loss). The research findings suggest that reform variables such as the entry of independent power producers (IPPs), unbundling of generation and transmission, establishment of regulatory agencies, and the introduction of a wholesale spot market are the driving forces of increasing generation capacity, as

[3] Pennsylvania, New Jersey, and Maryland in USA.

well as reducing transmission and distribution loss in the respective regions. Yu & Pollitt (2009) discuss the impact of electricity liberalisation on service quality by looking at the incidence of newspaper reported blackouts in Europe. They find that for the period 1998-2007, there is no evidence of a statistically significant increase in the number of newspaper reported blackouts correlated with the degree of liberalisation.

Market Power

Joskow & Tirole (2000) analyse the relationship between transmission rights ownership and market power and show that the ownership of physical transmission rights (such would be the case under vertical integration) increases the ability of generators to exercise market power through withholding transmission capacity. Davies and Price (2007), examining the impact of ownership unbundling in the United Kingdom energy market, found that the market share of vertically integrated utilities, in any one year, tend to be 8% higher than their non-integrated counterparts all else being equal. This indicates to some extent that vertically integrated utilities have advantages over non-integrated utilities.

Mansur (2007) in analysing firm behaviours within the PJM electricity market found two large net wholesalers increased anti-competitive behaviour through wealth transfer. However, he also found that vertical integration mitigates market power and limits distributional impacts.

Overall Performance

Pollitt (2009a) reviewed the electricity market reform in the European Union (EU) from the perspectives of sector performance and firm level performance. He concluded that the liberalisation has seen some notable market impacts, including increased EU cross-border trade, improvement in regulation, impressive labour productivity gains, and some price falls. However, the market reform is still incomplete, and the European Commission has significant competition concerns, including rising prices and the exercise of market power by incumbents. Furthermore, the social return to the reform is difficult to call but could be moderately positive.

In reviewing the electricity market reform in the United States, Joskow (2006a) concluded that there has been significant progress on the wholesale competition front but major challenges must still be confronted. The framework for supporting retail competition has been less successful, especially for small customers. Empirical evidence suggests that well-designed competitive market reforms have led to performance improvements in a number of dimensions and benefited customers through lower retail prices.

Several papers have looked at the impact of electricity market reform in developing countries. For example, Galal, *et al*. (1994) on Chile, Toba (2007) on the Philippines, Mota (2003) on Brazil, Anaya (2010) on Peru, Gao and Van Biesebroeck (2011) on China. These studies have all found moderately positive impacts.

3. New Zealand Electricity Market Reform before 2010

Starting from a classical publicly owned monopoly that undertook generation, transmission, distribution, and retailing activities in New Zealand, the electricity sector has been increasingly pushed to become more liberalised since the mid-1980s (Bertram, 2006). The restructuring started from the corporatisation, and privatisation in some cases, of state trading departments, the removal of statutory monopoly rights, and vertically unbundling transmission and distribution from the more contestable generation and retail components of the industry.

In April 1987, as part of wider economic liberalisation policies, the New Zealand government corporatized the New Zealand Electricity Department, which was a government department that controlled and operated almost all New Zealand electricity generation and operated the electricity transmission grid, and formed the state-owned New Zealand Electricity Corporation (ECNZ). Table 2 below gives a time line of the ECNZ from its establishment to its split.

Table 2: Split of ECNZ

Year	Changes
Apr-87	ECNZ was set up as a company under the State-Owned Enterprises (SOE) Act 1986
May-93	Transmission activity moves from ECNZ to "Transpower". Transpower was set up to run transmission in New Zealand.
Feb-96	Contact Energy commenced by acquiring some of ECNZ's generators
Jul-98	Electricity Industry Reform Act 1998 split ECNZ further into three state-owned generators: Genesis Power Ltd, Meridian Energy Ltd and Mighty River Power Ltd

Source: Author's own based on information in the text.

Prior to 1993, wholesale and transmission activities were controlled by ECNZ, while retail and distribution were controlled by 61 publicly owned holders of exclusive franchises. In 1992, the Electricity Act 1992 removed statutory exclusive retailing franchise areas. In May 1993, the government decided to separate transmission from ECNZ and set up a stand-alone transmission company, Transpower, to undertake transmission activities in New Zealand. In order to improve market competition in electricity generation in 1995, Contact Energy was set up as a state-owned enterprise, and started operation by acquiring generation assets from ECNZ since February 1996. Later on, in 1999, Contact Energy was sold by a public offering of shares.

During this period, the industry was subject to regulation under the Commerce Act 1986, together with the so-called "lighted-handed regulation" implemented since 1992, including the compulsory information disclosure and the threat of regulation. However, it soon became clear that greater transparency alone was not a sufficient check on monopoly power. The government became concerned that local electricity companies, vertically integrated at distribution and retail levels, had the incentives and the ability to use their market power in distribution to restrict competition in retail. The government was also concerned that the gains from lower wholesale prices would be captured by distributors rather than passed through to consumers.

To mitigate those concerns, the Electricity Industry Reform Act 1998 (EIRA) was enacted with the objectives of improving efficiency and consumer welfare through increased competition in generation and retail markets and preventing cross subsidisation of generation and retailing from lines businesses. EIRA prohibited

common ownership of electricity distribution and either electricity retailing or electricity generation businesses (other than minor cross-ownerships). Under EIRA, ECNZ was split into three competing state-owned generators (Genesis Power, Meridian Energy and Mighty River Power), and the vertically integrated distribution and retail businesses were required to achieve full ownership separation no later than 31 December 2003. However, not long after the implementation of EIRA, rules around ownership separation were relaxed and distribution businesses were allowed to own small distributors of renewable generation. Table 3 shows the changes in the generation market.

Table 3: Generation Market Structure Changes

	Mar-98		Jun-99
	Capacity Share		Capacity Share
Contact Energy	26%	Contact Energy	25.10%
ECNZ	63%	Mighty River (SOE)	14.30%
		Meridian (SOE)	30.00%
		Genesis (SOE)	19.20%
Other Generators	4%	Other Generators	5.80%

Source: Ministry of Economic Development, 1998; 1999.

The benefits expected from ownership separation were as follows:

- It could help to better expose the monopoly lines businesses to closer scrutiny by users and other market participants."
- The lines businesses would become stand-alone entities, with their operations becoming more open to the consumer - in the same way that Transpower has become more transparent since it was separated from ECNZ in 1994.
- It would encourage the amalgamation of retail businesses, which would achieve greater efficiencies and offer stronger competitive choices to consumers.
- It would encourage the amalgamation of lines businesses to achieve lower costs and provide better services to users.

However, some cost consideration of the distribution and supply ownership separation should be taken into account as well, such as one-off transaction costs, loss of economies of scale and the risk of less investment in generation.

The reform promoted a wave of mergers between generators and retailers. This kind of vertical integration is known as a "gentailer" in New Zealand. Between 1998 and 1999, the majority of integrated electricity businesses[4] retained their distribution business and sold their retail business, while generators saw the business opportunities and expanded into the retailing business. A list of approximate activities are presented in Table 4.

Table 4: 36 Integrated Electricity Businesses' Separation Activities during July 1998 to April 1999

	Electricity Retail	Distribution	Generation
Trust power	✓	✗	
Trans Alta	✓	✗	
Central Electric	✓	✗	
Wairoa Power		✗	✗
King Country Energy	✓		
Waitomo Energy Services		✓	
Another 30 integrated business	✗	✓	✗

Notes: (1) "✓" means integrated business retained this part of business
(2) "✗" means integrated business divested this part of business
(3) King Country and Waitomo Energy Services swapped their assets

After the separation of contestable retail and generation businesses from natural monopolistic transmission and distribution businesses, the remaining issue was how to regulate prices charged by transmission and distribution businesses. Following a Ministerial inquiry into the electricity industry, the Commerce Act 1986 was amended in August 2001 to provide a targeted control regime for electricity lines businesses.

Under the regime, businesses were only subject to control if they crossed either of the two thresholds of performance. The two thresholds are a specified CPI-X price path and a specified reliability and consumer engagement criteria. The X factor was set differently for different businesses based on a benchmarking analysis of relative business productivity and profitability.

[4] Integrated electricity: electricity distribution business also has either generation business or retail business or both.

The aim of this amendment was to improve the performance of the electricity distribution networks; improve the effectiveness of competition; and provide for more efficient regulation. This regime applied to lines businesses until 2008 when it was replaced by the current more heavy-handed Default/customised price path regulation in 2008, which is based on a bottom up building block analysis.

4. Current Electricity Market in New Zealand

As the result of the restructuring in the late 1990s, the current New Zealand electricity market is split into the following areas: administration and market clearing, regulation, generation, transmission, distribution and retailing.

4.1. Electricity Generation

Electricity in New Zealand is largely generated from hydro, gas, coal, and geothermal resources, of which hydro accounts for more than 50% of the electricity generated. Electricity is produced at generation stations and supplied at high voltage to the national grid at grid injection points (GIPs). There are around 40 major electricity generation stations connected to the grid.

In New Zealand, there are currently five major generation companies: Contact Energy, Genesis, Meridian, Mighty River Power and Trust Power. These five companies generate over 93% of New Zealand's electricity; the biggest three supplied 74% of New Zealand's electricity. There are also some smaller generators - mostly 'cogeneration' associated with major industrial processes, accounting for 7% of New Zealand's electricity. Four of the five major generators were the "babies" of ECNZ, products of the split of ECNZ by the government in the late 1990s.

The split of ECNZ into competing electricity suppliers increased competition in the electricity generation sector. As an indicator of market concentration, the HHI index in the generation sector has decreased from more than 8,528 in 1996 before Contact Energy was split from ECNZ to less than 2,200 now.

However, in the 15 years since 1996 there have been no major new generation entrants into the generation market apart from the ECNZ "babies", which itself is an indicator of the existence of high entry barriers in generation. Consequently, the five

major generators may have significant market power. In fact, since early 2000, there have been constant complaints of generators abusing their market power or engaging in anti-competitive activities, which has led to the investigation of wholesale electricity market by the New Zealand Commerce Commission, New Zealand's competition and regulation authority.

4.2. The Wholesale Market

The New Zealand electricity wholesale market is a place where the electricity supplied by generators meets the demand from retailers. Formed in 1996, it was initially a voluntary market, and the market rules were developed by the market participants rather than by a regulatory body or government. Since 2003, the government began to formally update the market rules and the market switched from being a voluntary market to a mandatory one.

All electricity generated is traded through the central pool, with the exception of small generating stations of less than 10MW. Bilateral and other hedge arrangements are possible, but function as separate financial contracts.

Electricity is traded at a wholesale level in a spot market. Service providers manage the market's operation under agreements with the Electricity Authority. Transpower, in its role as System Operator, manages the physical operation of the market.

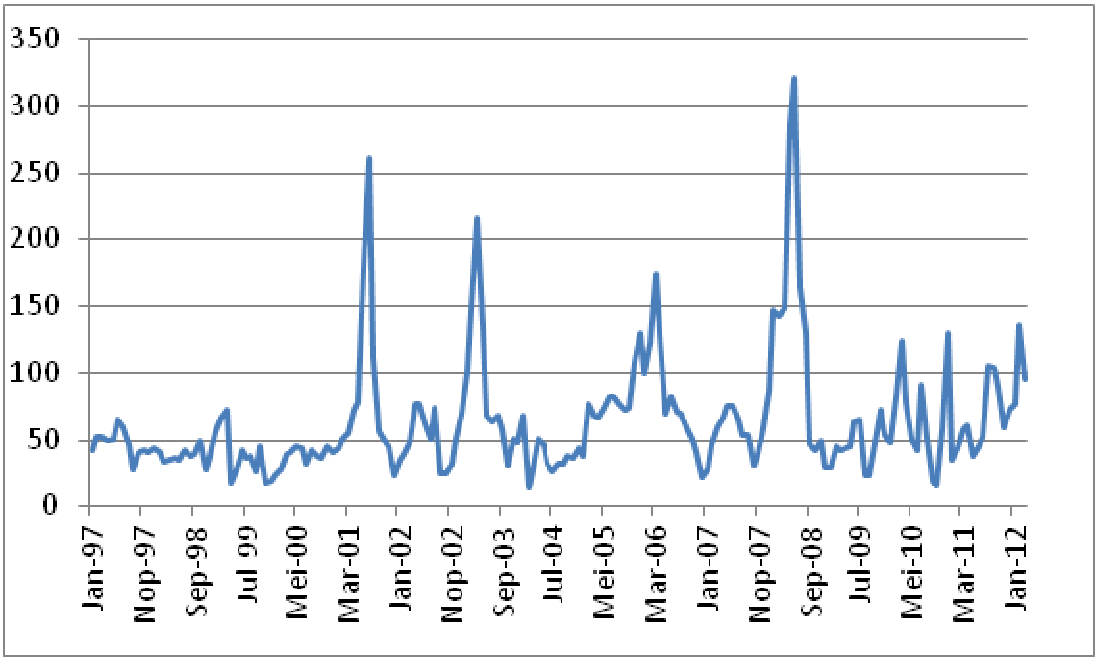
The wholesale market operates every day on a continuous basis in 30-minute trading periods; there are 48 trading periods per day. Generators submit generation offers to the system operator, indicating for each period how much electricity the generator is willing to supply, and at what price. Likewise, electricity purchasers must submit bids to the system operator, indicating the amount of electricity they intend to purchase.

Once all offers and bids have been received and finalised for a particular trading period, the system operator issues actual dispatch instructions to each generator on how much electricity it is required to generate and/or other required actions.

For each trading period, the pricing manager determines the single price to be paid to the generators for all electricity supplied. This price is determined by the price of the marginal generator required to meet demand for a given trading period.

Electricity spot prices can vary significantly across trading periods, reflecting factors such as changing demand (e.g. lower prices in summer when demand is subdued) and supply (e.g. higher prices when hydro lakes and inflows are below average). In July 2001, April 2003, and June 2008, the consumption weighted average wholesale price went over NZD 200/MWH, more than four times as that in normal times. Figure 1 below shows the monthly consumption weighted average wholesale price.

Figure 1: Consumption Weighted Average Wholesale Price ($/MWH), Jan 1997-Mar 2012



Source: Electricity Authority, 2012a.

Spot prices can also vary significantly across locations, reflecting electricity losses and constraints on the transmission system (e.g. higher prices in locations further from generating stations).

It is worth noting that pricing in the wholesale market is essentially short term marginal pricing, which may not provide sufficient incentives for the security of energy supply. In fact, the extreme level of wholesale prices in June 2008 indeed sparked concern about energy security.

4.3. Transmission

The electricity transmission system connects generators to the local distribution networks, who transmit high voltage electricity from GIPs at generation stations to GXPs (Grid Exit Points). At GXPs, transformer substations reduce the electricity voltage for distribution through local distribution networks to end-users.

The New Zealand transmission network consists of two subsystems, one in the North Island and one in the South Island. The two subsystems are connected by a High Voltage Direct Current link. This makes possible the export of electricity from the South Island, where 60% of the electricity is generated, to the North Island, where the demands for electricity are predominantly located.

Transpower, a State-Owned Enterprise (SOE), owns, operates and maintains the transmission network. As owner it provides the infrastructure of electric power transmission that allows consumers to have access to generation from a wide range of sources, and enables competition in the wholesale electricity market. As System Operator, under contract with Electricity Authority, it manages the real-time operation of the network and the physical operation of the New Zealand Electricity Market.

Like the electricity distribution network, transmission is also subject to regulation under the Commerce Act 1986. This moved from the price and quality threshold regime under Part 4A of the Commerce Act 1986 before 2008, to the current Default/Customised price – quality path regime.

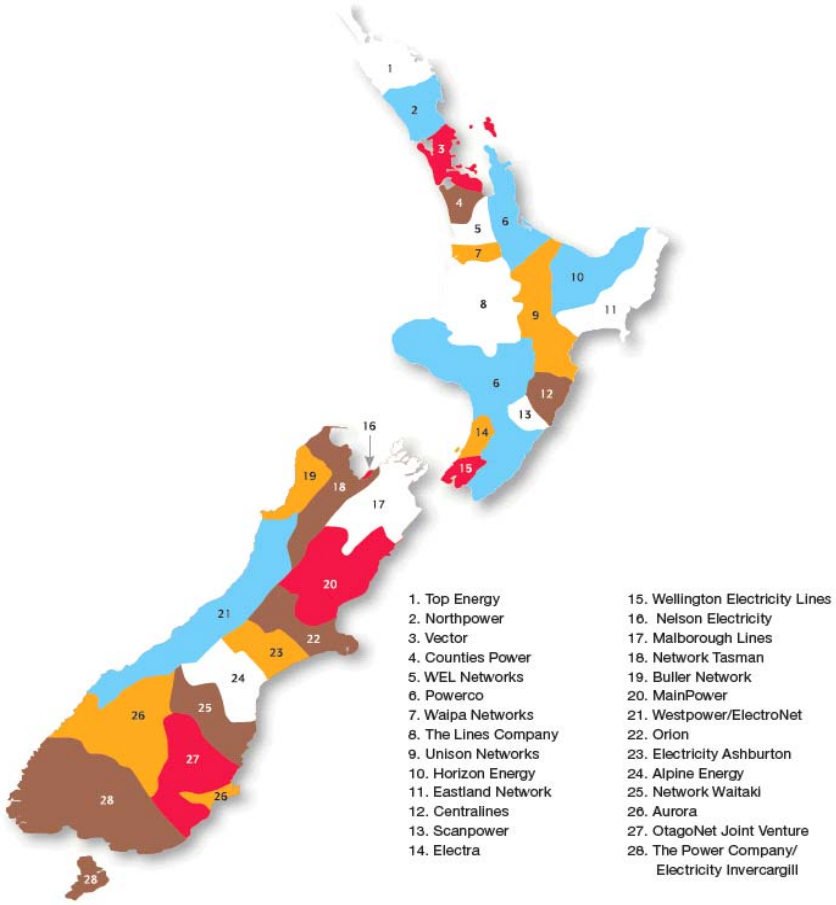
4.4. Distribution

There are 28 “large electricity lines businesses” in New Zealand. They range in size from around 5,000 electrical connections to nearly 500,000 connections. Other entities also provide electricity distribution services as part of their normal activities. Included among these are airports, ports, and large shopping mall operators.

Figure 2 shows a map of the 28 Electricity Distribution Businesses (EDBs). While most EDBS are located only in one region, PowerCo’s distribution businesses are located in two regions (see number 6 in the map). Between 2003 and 2008, Vector’s distribution businesses also operated in two regions, Auckland (number 3) and Wellington (number 15). In 2008, Vector sold its distribution business in

Wellington, which they acquired from United Networks in 2003, to Hong Kong-based Cheung Kong Infrastructure (CKI), which formed Wellington Electricity.

Figure 2: Map of Electricity Distribution Businesses in New Zealand



Source: Electricity Networks Association, 2012.

4.4.1. Structure

These EDBS were created in 1998 following the corporatisation of the 61 local electricity supply authorities (ESAs) under the Energy Company Act 1992, the consolidation by merger and acquisition thereafter, and the forced ownership separation of retailing businesses from the operation of distribution networks under the Electricity Industry Reform Act 1998. The Electricity Industry Act 2010 revoked the forced ownership separation to some extent.

The ownership of distribution companies is a mix of publicly listed companies, shareholder trusts, community trusts and local body ownership. Each company tends

to have defined geographic areas of activity. Through acquisitions of other distribution companies, several now operate in a number of discrete areas. Distribution companies do not have exclusive legal territorial franchises.

The normal Commerce Act provisions apply to the mergers of distribution companies. The test is whether the merger will lead to a "significant lessening of competition". It is hard to argue that the merger of two geographically distinct monopoly distribution companies would lessen competition, as there is none; therefore, there is little if any constraint on mergers in the sector. As there are economies of scale in the provision of distribution services, the non-commercial nature of much of the ownership probably explains why there have not been more mergers.

4.4.2. Regulation

EDBs are subject to regulation under the Commerce Act 1986, which has gone from:

- the light-handed regulation (mandatory information disclosure combined with the threat of price control since 1992), to
- CPI-X style price and quality threshold regime under the Part 4A of the Commerce Act 1986 since 2001, which is in fact a screening mechanism to identify EDBs whose performance may warrant further examination through a post-breach inquiry and, if required, control by the Commerce Commission, to
- the current more heavy-handed Default Price-quality Path (DPP) and Customised Price-quality Path (CPP) under Part 4 of the Commerce Act 1986. EDBs that meet the 'consumer owned' criteria set out in the Commerce Act 1986 are exempted from this type of regulation.

4.4.3. Performance

There are a few studies examining the performance of EDBs' and the impacts of regulation on EDB's performance in New Zealand. However, the results are not conclusive.

Bertram and Twaddle (2005) analysed the trends in the price-cost margins of the EDBs between 1991 and 2002. They found that price-cost margins had increased during the period of "light-handed regulation". As a result, the allowed profit under light-handed regulation had exceeded that allowed under rate-of-return regulation by

$200 million. They concluded that New Zealand's experiment with light-handed regulation was not successful.

However, Bertram and Twaddle's (2005) estimation of allowed revenue under rate-of-return regulation would have been much higher without the light-handed regulation. Because they implicitly assumed the costs under rate of return regulation were the same as the costs under light-handed regulation. In fact, the costs under light-handed regulation would be lower due to its stronger cost reduction incentives. Therefore, at best, the conclusion from this paper is that light-handed regulation was not so effective as to allow consumers to share the benefits of efficiency gains.

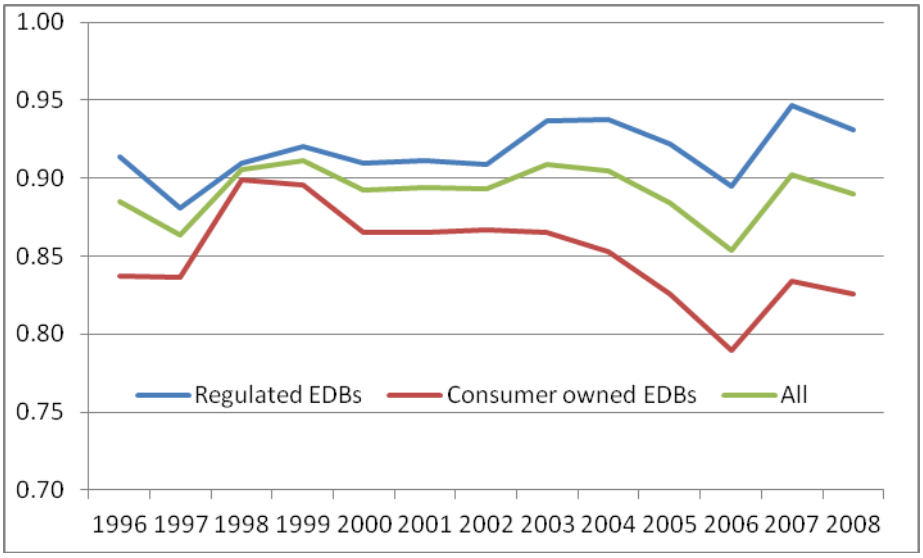
Nillesen and Pollitt (2008), studying the effect of ownership unbundling in electricity distribution in New Zealand, suggested that there was a sharp reduction in unit operational costs between 1998 and 2001, but that these seemed to be increasing since 2003. Economic Insights (2009) has also found that Total Factor Productivity (TFP) in EDBs had increased from 1996 to 2003, but had fallen in each of the years after 2003, which coincided with the implementation of the threshold regime.

We have examined directly the efficiency of EDBs by a benchmarking exercise using Data Envelopment Analysis (DEA) method. The data we used for this exercise covered the period between 1996 and 2008. In this study, we use electricity throughput, customers and the network length as outputs, and OPEX and fixed assets valued using Optimised Deprival Valuation (ODV) methodology as inputs. However, we do not have service quality information.

We estimated the technical efficiency scores of individual EDBs for the period 1996 and 2008. The results are in Figure 3.

This suggests that over time the EDBs' average efficiency remained constant. However, there is a divergence of efficiency between EDBs that are regulated under the current Commerce Act, regulated EDBs, and the EDBs that are mainly consumer owned and are exempted from regulation. While the regulated EDBs have improved their efficiency, consumer-owned EDBs have lagged behind. This may suggest that ownership changes have played a part too.

Figure 3: Efficiency Scores (Constant Return to Scale), 1996-2008



Source: New Zealand Commerce Commission, 2012a.

Improving and maintaining the quality of electricity distribution services is another objective of regulation. The most common quality measures for electricity networks are outages. There are three outage indicators, which are monitored under regulation: SAIDI (System Average Interruption Duration Index – minutes per connected customer), SAIFI (System Average Interruption Frequency Index – interruptions per connected customer), and CAIDI (Customer Average Interruption Duration Index – minutes per customer interrupted). Figure 4 to Figure 6 show the development of SAIDI, SAIFI, and CAIDI over the period between 1995 and 2011.

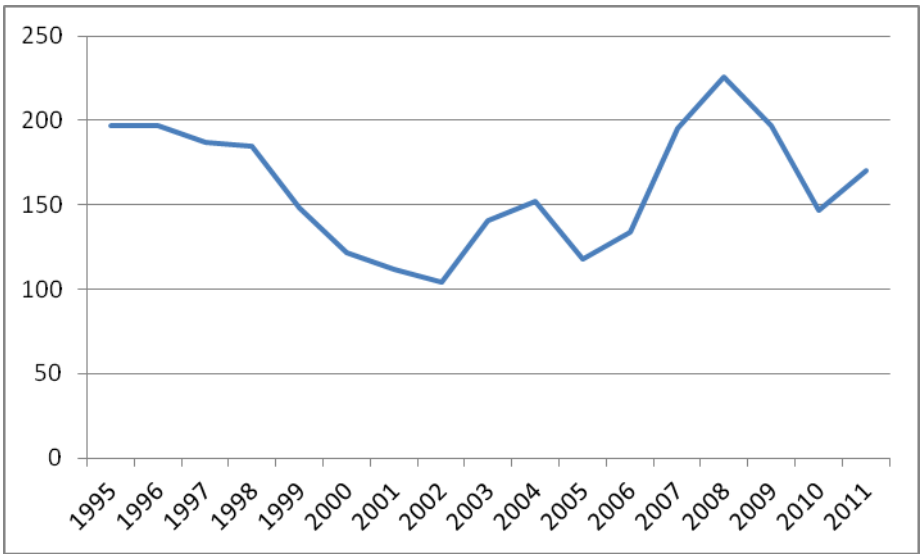
Following the unbundling, both SAIDI and SAIFI experienced sharp decreases up until to 2002. However, since 2003, SAIDI has demonstrated sharp increases especially in 2007 and 2008. At the same time, SAIFI has been increasing gradually. While remaining stable before and after the unbundling, CAIDI increased sharply in 2007 and 2008. Although it has decreased since 2009, it has not decreased to the level it was before 2007.

4.5. Electricity retail market

Electricity retailing involves the supply of electricity to residential and small commercial and industrial customers. Electricity is purchased from the wholesale market. The electricity purchased may come from its own generation arm of a vertically integrated gentailer or another generator that has supplied into the

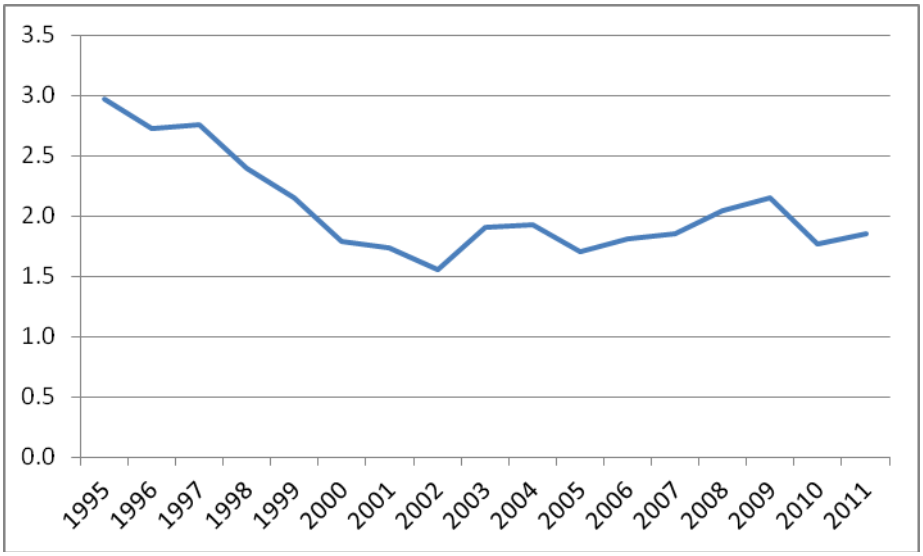
wholesale market. Retailers pay distribution companies for distribution and transmission services.

Figure 4: kWh-transmitted Weighted Average SAIDI, 1995-2011



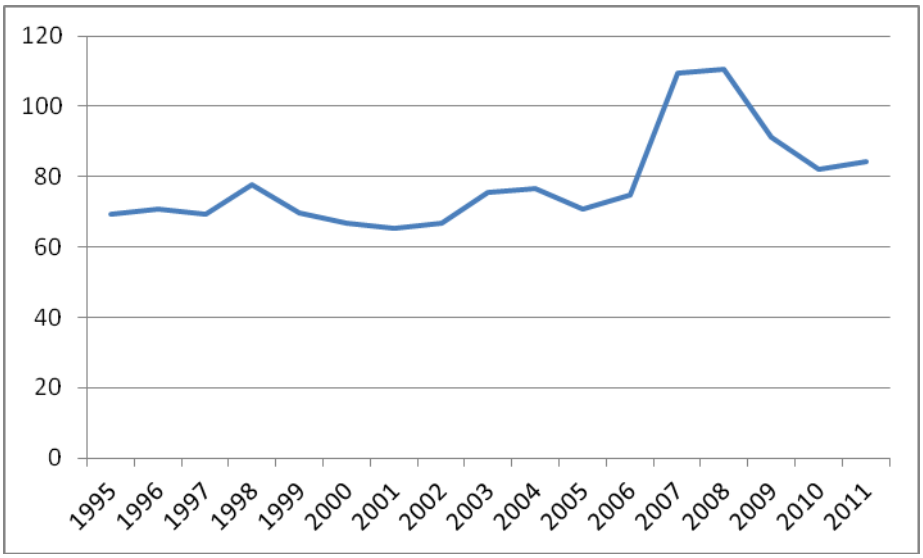
Source: New Zealand Commerce Commission, 2012b.

Figure 5: kWh-transmitted Weighted Average SAIFI, 1995-2011



Source: New Zealand Commerce Commission, 2012b.

Figure 6: kWh-transmitted Weighted Average CAIDI, 1995-2011



Source: New Zealand Commerce Commission, 2012b.

4.5.1. Retail Market Structure

Currently, there are five major retailers. All of them are vertically integrated gentailers, and they are all major generators too. These five companies account for 96% of the electricity purchased from the wholesale market, while the remaining 4% is purchased by a number of small retailers.

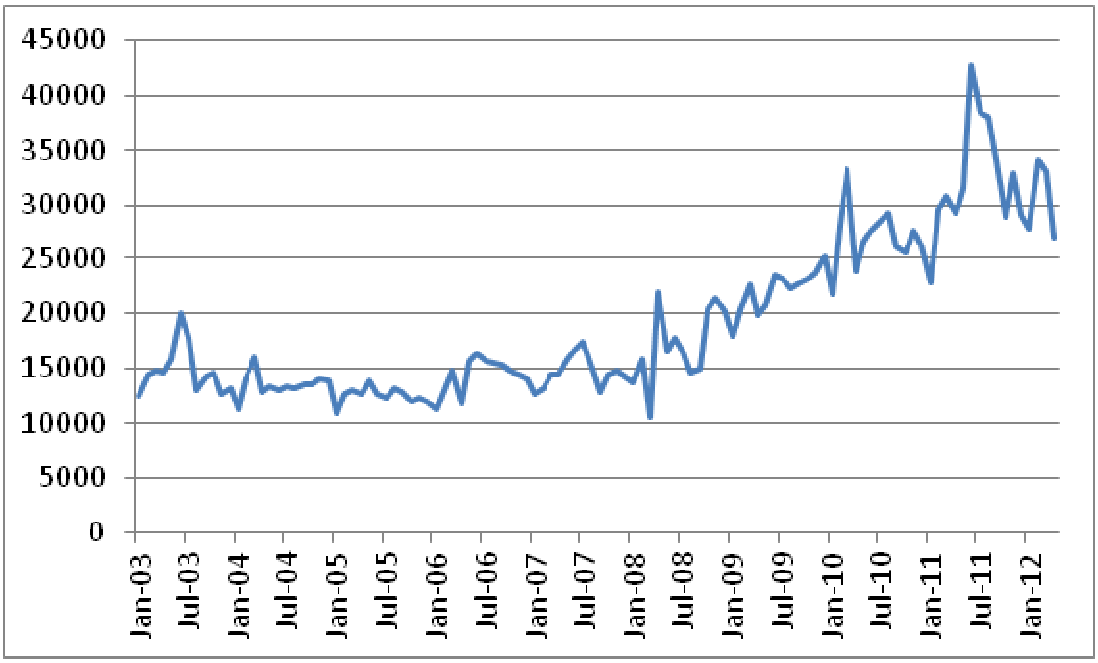
Under the forced ownership separation between distribution and other electricity businesses in 1998, most of the distributors chose to retain their distribution businesses and divest their retail businesses. The five major generators, realising the benefits of having retail businesses, quickly snapped up these retail businesses, together with their customer bases, and formed the vertically integrated gentailers.

As a result of this wave of divestment and acquisition, the number of retailers decreased from 36 in 1998 to 11 in 1999/2000. The number of retailers further reduced to 10 and 9 in 2001 and 2003 respectively. At the same time, the HHI index in the retail has increased from around 700 in 1998 to more than 2,200 in 2010. Electricity retailing has been gradually concentrated to big retailers, with the top three firms capturing more than 70% of the retail market.

Thus said, there are indicators showing greater competition between retailers, which leads to better deals for customers, especially since 2008. One such indicator

is the number of customers switching. Figure 7 shows the monthly number of consumer switch for the period between January 2003 and April 2012. Before 2008, the number of consumers switching stabilised at around 14,000 per month; since 2008, this number has increased to more than 25,000 per month by April 2012.

Figure 7: Customer Switching, Jan 2003- Apr 2012

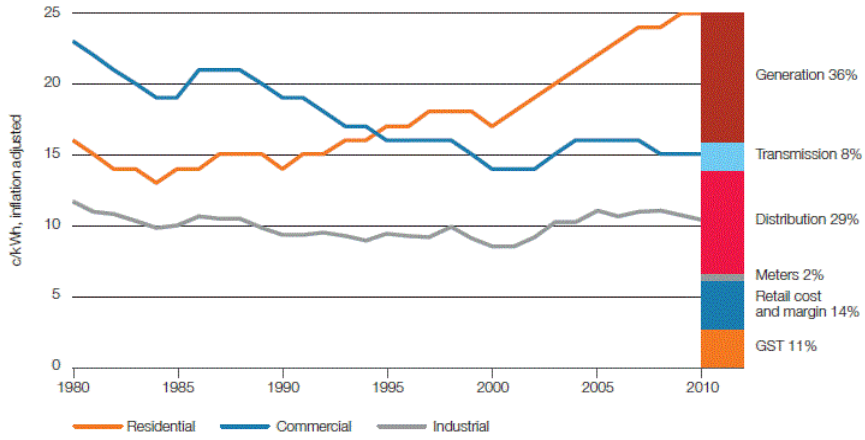


Source: Electricity Authority,2012b.

4.5.2. Electricity Prices

Figure 8 shows the retail electricity prices for the period between 1990 and 2009. For the first 2-3 years after ownership unbundling in 1998, retail prices fell in all three sectors, with the commercial sector experiencing the biggest reduction. However, since the early 2000s, all three sectors have experienced retail price increases, with the biggest price increase in the residential sector. Compared to the residential retail price in 2000, the residential price in 2009 has nearly increased by 50%. After an initial increase between 2001 and 2003, the commercial retail price has been relatively constant.

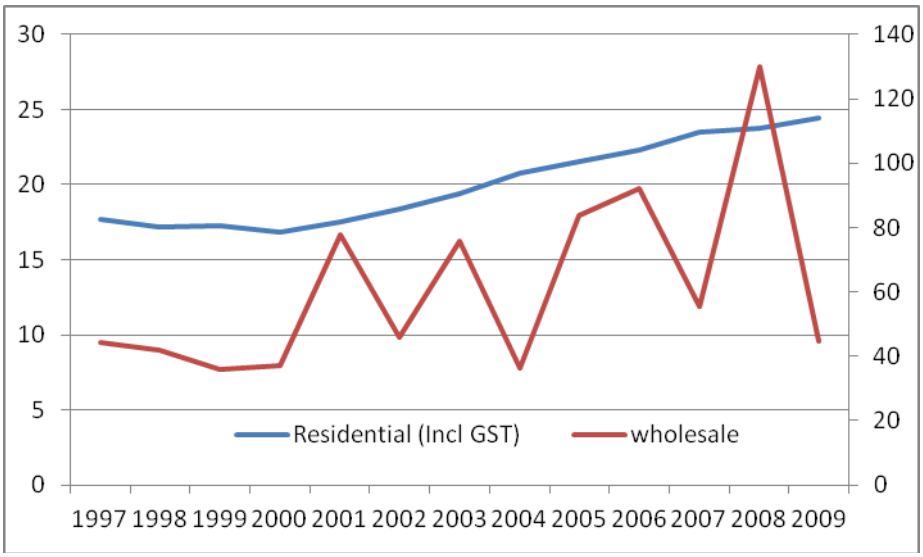
Figure 8: Retail Electricity Prices (Cents/kWh at 2009 price), 1990-2010



Source: New Zealand Ministry of Economic Development, 2012.

However, the increase in retail prices may be due to increases in wholesale prices, which is the most important component of retail prices. See Figure 8 for the composition of the retail price. Figure 9 shows a comparison of retail residential price vs. a consumption weighted average wholesale price. We can see that increases in the wholesale price are almost completely passed through to the retail price.

Figure 9: Retail Residential Price (c/kWH) and Consumption Weighted Average Wholesale Price ($/MWH), 1997-2010



Sources: New Zealand Ministry of Economic Development, 2012; and Electricity Authority, 2012c.

In 2010, New Zealand enacted a new electricity industry act, the Electricity Industry Act 2010 (EIA), in response to the concerns raised and recommendations proposed in a series of electricity industry investigations and inquiries. This has started another round of reform in electricity sector.

4.6. Electricity Market Investigations and Inquiries

Since the mid-2000s, there have been several investigations and inquiries to investigate the different aspects of performance of the electricity market, which eventually lead to the reform in 2010.

4.6.1. Commerce Commission Investigation

In August 2005, the Commerce Commission after receiving an allegation of market power and complaints about high wholesale and retail prices, and noting the low number of competitive activities in the wholesale and retail markets, decided to investigate whether there was collusion or anti-competitive behaviour in the electricity wholesale market that contravened the Commerce Act 1986.

Professor Wolak from the University of Stanford led the investigation and it was completed in 2009. The investigation concluded that the four main generators have substantial market power in the wholesale market, and have exercised this market power to earn market rents estimated conservatively to be $4.3 billion over the period January 2001 to July 2007, which were gradually passed through in higher prices to end customers.

The usual suspect for the cause of high prices, transmission constraints, was found not to be the predominant factor in explaining the high prices. The investigation also suggested that the current wholesale market mechanism may provide insufficient incentives to address the issue of supply adequacy.

4.6.2. Electricity Commission Market Design Review, and Other Reviews

In 2007, The Electricity Commission (EC) initiated the Market Design Review to identify what changes could be made to the electricity market to improve its performance. The Review identified five areas of concern:

- pricing and competition (especially in the retail market)

- energy affordability issues
- the effectiveness of the energy-only spot market design
- demand-side participation
- availability of market information.

In July 2008, the EC released an Options Paper for consultation, which presented possible options for addressing concerns identified in the Issues Paper, and proposed future actions.

In 2008, in response to the high profile outages and extremely high wholesale market prices experienced during the dry season, the EC initiated another review to assess the experience of dry year risk management with respect to the winter of 2008 and to identify options to improve the energy security policy framework. The Review highlighted issues with the security of electricity supply.

In 2009, Business New Zealand, an industry lobby organisation, commissioned LECG to look into regulatory and governance issues. This report also made recommendations on how to improve the regulatory and governance structure of the electricity market.

4.6.3. Ministerial Review of the Electricity Market

While there are issues common to the above-mentioned investigations and reviews, each review had its own focus and made different recommendations about the same issue. In order to have systematic review of the electricity sector, the New Zealand Cabinet decided on 30 March 2009, to conduct a Ministerial Review of the electricity market to examine electricity market design, regulation, and governance issues.

The Review was conducted by the Ministry of Economic Development together with a panel of independent experts (ETAG)[5] appointed by the Minister of Energy and Resources. The Review identified issues and made recommendations on five aspects of the electricity sector:

- wholesale and retail, and competition in the wholesale and retail markets
- security of electricity supply
- costs of electricity supply
- governance and regulation of the electricity sector

[5] Electricity Technical Advisory Group.

- implementation of proposals.

In summary, the ETAG report contained a range of findings about the New Zealand electricity market:

- New Zealand has sufficient generation capacity, but the current market structure does not allow that capacity to be managed efficiently in dry winters
- in particular, some market participants may not manage dry winter risks, because they can shift costs to consumers through public conservation campaigns at no cost to themselves
- the electricity retail market lacks competition, particularly outside the main centres
- the transmission system is still vulnerable due to lack of investment
- electricity governance arrangements are unsatisfactory.

The Review made 29 recommendations to address these issues. In relation to wholesale and retail prices and competition in the wholesale and retail markets, which are of particular interest to the current paper, the Review identified that transmission constraints, the absence of a liquid energy hedge market and the vertical integration of generators and retailers all act as barriers that deter the entry of new retailers, especially independent retailers, to the electricity market.

The Review recommended allowing lines businesses back into retailing, along with some restrictions.

The main argument for allowing distribution back into retailing is that it would encourage more retail competition, especially in smaller and remote areas where there is only weak retail competition. In these areas, lines businesses, which are generally trust-owned, may be 'natural' new entrant retailers because they have existing relationships with customers, familiarity with the energy sector, local presence, and brand recognition. Although many distributors may not be interested in getting back into retailing, the sheer prospect of new entrants may improve the performance of incumbents. This recommendation has further reduced the extent of the strict ownership separation between lines businesses and energy supply businesses enforced under the EIRA 1998.

However, there are some risks associated with allowing distributors back into retailing, including:

- the possibility of a vertical integrated regional monopoly, encompassing generation, distribution, and retailing

- distribution businesses may discriminate against their retail competitors accessing its distribution network
- independent retailers may be reluctant to enter the market as they have to deal with the distribution business, which is also their retail competitor.

The Review proposed allowing distribution back into retailing, subject to:

- retaining the existing provisions, the thresholds for ownership separation, and corporate separation and arm's length rules, specified in the Electricity Industry Reform Act 1998
- prohibiting a retail business, owned by a lines business, from buying the customer base of an existing retailer.

4.7. Electricity Industry Act 2010 and its Potential Impacts

In 2010, as a result the Review's recommendations, the Electricity Industry Act 2010 (EIA) was enacted. The EIA not only allows distribution businesses back into retailing but also increases the thresholds for ownership separation, and for corporate separation and the application of arm's length rules. By increasing the thresholds for ownership and corporate separation, the EIA provides further incentives for distributors to invest in generation to ensure security of supply; this reflects the idea that lines companies may be better placed to invest in generation than other investors.

The EIA came into effect on November 1, 2010. As the EIA has only been in effect for a year and half, it is still too early to examine its impact. We will only discuss the possible market structures under the EIA here. When discussing these, we will keep in mind that the purpose of the EIA is to enhance electricity market competition in far and remote areas, and to resolve energy security problems arising from transmission constraints. The Electricity Industry Act 2010 may potentially lead to diverse and complicated forms of vertical integration, as described below:

Full vertical integration between generators, distributors and retailing with some restrictions

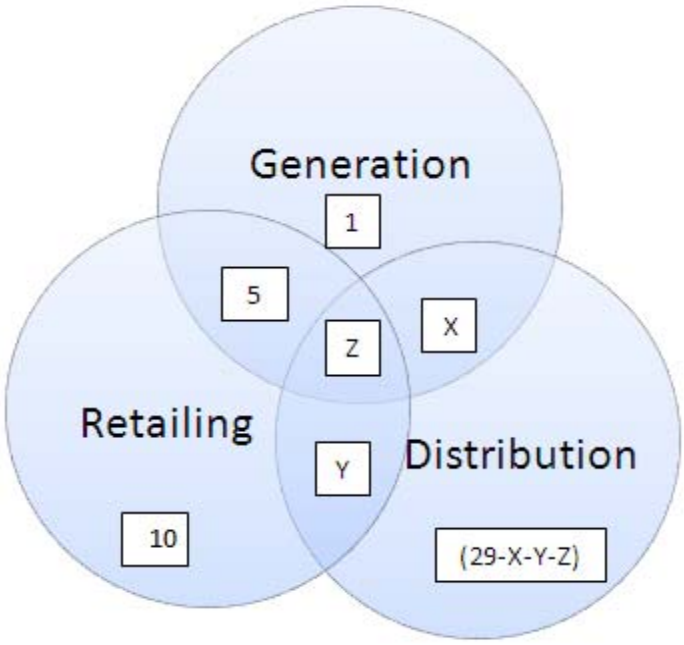
According to the EIA Act 2010, this can only happen when EDBs own a generator with a capacity less than 50 MW and it is not connected to the national grid, and operates a retailer that only sells 74 MW electricity annually. We assume the market is going to have **Z** numbers of such full integration (see Figure 10).

Vertical integration where an electricity corporation is involved in generation and distribution

The generator can be distributor generators and have a capacity less than 50MW. An EDB can also own a generator with a capacity up to 250 MW regardless of whether it connects to the national grid or not. However, under this scenario, it requires corporation separation. We assume the market is going to have **X** numbers of such partial integration (see Figure 10).

Vertical integration can occur where an electricity corporation is involved in retailing and distribution, and/or where a retailer that retails less than 75 GWH annually is connected to the distributor's local network. We assume the market is going to have **Y** numbers of such partial integration (see Figure 10).

Figure 10: Potential Vertical Integration in New Zealand



According to the above analysis and from the perspective of the current regulatory change for EDBs, the potential market structure for New Zealand could possibly turn out to be like that shown in Figure 10. As transmission remains operating as a state-owned monopoly, vertical integration will only happen between

generation, distribution and retailing. It is possible to have **X** number of vertically integrated corporations between generation and distribution, **Y** number of vertical integrated corporations between retailing and distribution, and **Z** number of full vertical integration. This stand-alone distribution would be '29-X-Y-Z'.

Considering our discussion above and compared to ETAG's proposal, the capacity restrictions are tougher in the EIA. The Act may create a market structure with some large players along with a number of smaller players. In this way, the large-scale energy suppliers can provide services nationally, and smaller scale energy suppliers can serve the regional markets cost effectively. Both scenarios are in a relationship of competition and compensation. All in all this might lead to a cost-efficient system.

5. Conclusion and Policy Implications for East Asian Countries

In this paper, we have discussed the reform experience in New Zealand's electricity sector and have summarised the objectives, the reform methods, and the outcomes of the two reforms in the Table 5.

The experience of reform in New Zealand suggests:

First, the reform process is long term and on-going. New Zealand started its market reform of the electricity sector in the mid-1980s by corporatising the activities formally administered by a government department, then in 1998 introduced complete ownership unbundling of the formally vertically integrated electricity utilities and established a wholesale market; and for the past 15 years has been fine tuning the structure.

Second, there are both costs and benefits associated with vertical integration and unbundling. Market restructure designs need to balance the costs and benefits associated with it. Empirical studies suggested that the forced ownership unbundling did lead to efficiency and quality improvements, high TFP growth, and reduction in retail prices, immediately after the unbundling. However, the impact of unbundling on competition may have been limited and temporary especially after 2003. Since

2003, retail prices have been rising, TFP has been falling, and service quality has been falling too.

Table 5: Electricity Reforms in New Zealand

	1998 reform (EIRA 1998)	**2010 reform (EIA)**
Reform objectives	• encourage competition in generation and retail • improve efficiency of the network components (transmission and distribution) • prevent cross-subsidisation of generation and retailing from EDBs	• increase retail competition, especially for remote areas • encourage competition in the wholesale market • improve security of supply • encourage investment in generation
Methods	• ownership separation of distribution from retail and generation • regulation of distribution and transmission businesses • wholesale spot market	• allowing distribution get back into retail • privatising state-owned generators • relaxing the restraints on distributors investing in generation
Market structure and performance	Structure: • 5 vertically integrated gentailers • 28 EDBs and 1 Transmission under regulation Performance: • the impacts of unbundling may be limited, especially after 2003: • lack of competition in retail • high retail price for residential customers • gentailers have exercised their market power • energy security However: • quality improved	• will depend on the investment incentives • may create vertical integration of generation, distribution, and retail • may create regional monopoly in generation and retail, as well as in distribution

Source: Authors' own preparation according to account in the text.

Furthermore, the unbundling does not seem to have facilitated greater competition in electricity generation sector, which has been the subject of several anti-competitive complaints since 2003. In the retail sector, the creation of vertically integrated gentailers probably didn't improve the competition situation in retail. After the initial decrease, the retail price, especially for residential customers, increased sharply. The five dominant gentailers had significant market power, and this led to higher wholesale prices especially in the dry season. Re-bundling may provide a solution to the problems resulting from unbundling. It may increase economies of scope, increase the incentives for investing in distributed generation, reduce transaction costs, encourage retail competition, and provide choices for retail customers. However, there are risks associated with it that need to be taken seriously, such as the possible creation of a regional monopoly, which may deter the entry of new retailers and discourage retail competition, an objective the newly enacted EIA meant to promote.

Third, well intended market reform may lead to unintended outputs. One unintended result from the ownership unbundling is the integration between generation businesses and retail businesses, may have given generation businesses market power in generation that advantaged their retail businesses.

Finally, in response to the concerns of inadequate competition in retail and generation markets and the concerns of security of electricity supply, New Zealand government enacted the Electricity Industry Act 2010. This new act relaxes the restrictions on ownership separation between distribution and retail and generation by allowing distribution back into retailing and raising the threshold for ownership separation between distribution and generation. This new policy provides incentives for the distribution businesses to invest in generation and retail. However, it may also create vertically integrated electricity utilities, encompassing generation, distribution, and retailing. This impact of this reform is still too early to assess.

Currently, electricity market reforms in East Asian countries are at different stage. The experience and the impacts of the ownership unbundling and the recent reversal to allowing bundling may provide useful lessons for East Asian countries. The New Zealand experience indicates the potential benefits of ownership unbundling but also the dangers of unintended consequences. Policy makers should

take care in using ownership unbundling to achieve the objectives of market reform in the electricity sector.

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