

In this chapter we describe the main actors in any electricity system, noting where New Zealand's arrangements involve differences, at even this fundamental level, from systems overseas. Having established the cast we then describe the relationships between these actors in power terms, taking power to mean more than just physics, although acknowledging that the physics of electricity supply significantly affects these power relationships. This construction sets up a theme that recurs throughout this book, namely that electricity restructuring fundamentally affects the political economy of electricity supply, not just its economics.

Such a construction highlights questions of market power, governance and regulation, in both static and dynamic terms. In turn these questions turn on notions of industry centralisation and decentralisation, or, in other words, the degree to which the industry's course is centrally or competitively determined. They are also affected by the industry's experience, with the balance of decision-making power being contingent on how well the industry handles, or is perceived to handle, challenges such as winter hydro shortages. How these questions are resolved fundamentally affects the incentives of private-industry participants to make the large, long-lived and irreversible investments that reformed electricity systems rely on to sustain security of supply and the level of competition required to make the reforms work. Such themes are previewed at the end of the chapter, where we look ahead to the rest of the book.

INTRODUCTION

The Importance of Electricity

In New Zealand, as in other developed economies, we are all at least partially captive to electricity. While alternative fuels are available for some purposes, modern lifestyle, commerce, and industrial processes (not to mention our reliance on telecommunications) dictate that we rely on reliable, high-quality electricity supply for conveniences and services that we either cannot, or will not, do without. This is not to bow to the argument, often cited, that the provision of electricity is an “essential service”, or that electricity is an “essential good”. Such arguments overlook the fact that food, for example, is an essential good; yet no sensible suggestion is made these days for state ownership of all farms or supermarkets. To the extent that electricity is special, this is not why.

Historical Supply Approaches

Given the current state of technology, the importance of electricity inevitably implies a reliance on typically large organisations that generate, transmit, distribute, and retail electricity from its source to where it is demanded. Historically these large organisations have not been subject to the forces of competition, or have characteristics that make

such competition either impossible or unlikely. As such, concerns about monopolistic behaviour in the electricity sector have either been seen as an obstacle to change or been resolved by parking the relevant concerns in state or local government ownership. Through such ownership it has been possible to impose obligations for security of supply, but where this was successful (and the results have been mixed) it has come at the cost of over-investment in capacity at consumers' or taxpayers' expense, and at times involuntary interruption to supply.

The experience with such arrangements, internationally, has not been altogether satisfactory. While in New Zealand electricity prices tended to remain at the lower end of the range when compared with other developed countries, this reflects the country's access to a relatively high share of hydro-electric power (rather than thermal generation) that has considerable sunk capital costs but low marginal operating costs, and does not tell us what that price should have been. It also reflects an historical subsidy from New Zealand taxpayers who funded the development of the country's state-owned electricity system even though for many years the state-determined price of electricity was less than that required to justify such investments on strictly commercial terms. As in other countries, political involvement in pricing and investment decisions and the growing awareness of inefficiencies in the sector eventually came to be regarded as obstacles to the nation's economic and social progress.

Winds of Change

In the 1980s New Zealand, like Great Britain, embarked on a radical programme of economic reform.¹ Driven by political opposites – a Labour government in New Zealand and Margaret Thatcher's Conservatives in Britain – the two countries, like many later, shared similarities in their reform agendas. Fuelled by a need to reduce the government budget deficit, a desire to see state-owned business activities set on a more commercial footing, and the use of market-based mechanisms rather than politically driven state planning, the electricity sector found itself among those facing transformation. Aspects of the sector that had formerly been considered to involve intractable problems of monopoly found themselves subjected to new understandings about competition and the abuse of market power. Improvements in technology not only changed the means of electricity production and delivery, but also enabled new means to organise, monitor and coordinate the operations of the industry. It is from these origins that the current New Zealand electricity system emerged.

Purpose of this Book

This book presents an appraisal of current institutional arrangements in the New Zealand electricity sector against the backdrop of its contemporary reforms. By contemporary it is intended to mean the current reforms that had their genesis in a radical shake-up of the New Zealand economy after a market-minded Labour government took office in

¹ See Evans *et al.* (1996).

1984. This is to be contrasted with the various other reforms experienced in the sector since its inception in the 1880s, in the main involving increasing concentration of the ownership and control of key areas of the sector in central government. By taking a comparative approach it should be possible to discern which of those institutional or structural arrangements in New Zealand distinguish it from other electricity systems worldwide, and to assess therefore the extent to which general lessons can be drawn from the New Zealand experience (or from overseas experience for New Zealand).

While the contemporary reforms have sought to place greater reliance on market mechanisms to determine electricity pricing and influence future investments in the sector – displacing a measure of political influence over these matters in doing so – caution is required in describing these reforms as “deregulation”. The reality is that ongoing political interest in the electricity sector is inevitable, and so political input into the nature and evolution of the sector – regulation by name or effect – must be expected to play a continuing, albeit changing role. As such, this appraisal of the contemporary reforms should be thought of as an exercise in political economy and cannot be purely based in economics, as this would leave a fundamental driver of the reforms as externally determined and unexplained.

Analytical Criteria

An appraisal based in political economy requires various analytical criteria. These include the usual concepts of economic efficiency, both static and dynamic, referring to whether reform of New Zealand’s electricity sector has improved the nation’s “welfare” (respectively, contemporaneously and over time) – allocating resources in the best way and to where they are best used. Equity considerations are unavoidable, as who benefits from the reforms is a key driver of any further reform, given the political interest in the sector, and an obvious yardstick against which they can be measured. To some these are the only relevant considerations. Attention is also paid to how the reforms have affected the power of the various agents in the sector to make decisions that best affect themselves, touching on questions of governance as well as ownership and regulation, all of which can be expected to influence the likely evolution of the industry.

LEAD ACTORS IN A MODEL ELECTRICITY SYSTEM

The lead actors in any electricity system typically fall into five main classes. The first comprises electricity **consumers**, which can be further decomposed (generally by annual energy consumption) into sub-classes of consumers such as residential, commercial and industrial. These consumers, particularly at the residential level, buy their energy from electricity **retailers**, which may be stand-alone enterprises or incorporated in other parts of the supply chain, and which might engage in other activities such as energy trading or hedging. In purchasing electricity, consumers typically must connect to electricity generators via power lines and associated equipment owned and operated

by **distribution** companies. In turn distribution companies typically connect to a long-distance **transmission** grid, comprising high-voltage power lines and associated equipment to which the source of electrical energy – the **generators** – ultimately connect. Variations on these themes are possible, for example, with industrial consumers connecting directly to the grid, or distributors having generation capacity of their own, but as a model it captures much of the electricity sector’s character.

In sharing much of this model New Zealand can be compared with other developed countries, although the makeup of the system has some distinguishing features. First is a relatively high dependence on hydro-electric rather than thermal generation, which offers the advantage of renewable energy but suffers from variable river inflows and low storage capacity. Second is the nature of the grid – being long, skinny and sparse and generally wheeling power from generation concentrated in the south of the country to demand concentrated in the north. Third is winter-peaking demand rather than summer, reflecting demand for heating rather than air-conditioning, as is more often the case elsewhere and complicating electricity provision because hydro-lake inflows are relatively low in the winter. Fourth is a relatively high electricity intensity (i.e. the share of electricity consumption as a ratio of national output), in part reflecting the fact that one industrial user – the NZAS aluminium smelter located at Tiwai Point in Southland – alone accounts for around 15% of annual electricity consumption. Finally, the New Zealand electricity system is geographically isolated, with no capacity to import power from other countries in times of need, or to export it for gain.

“POWER” IN THE ELECTRICITY SECTOR

More than just Physics

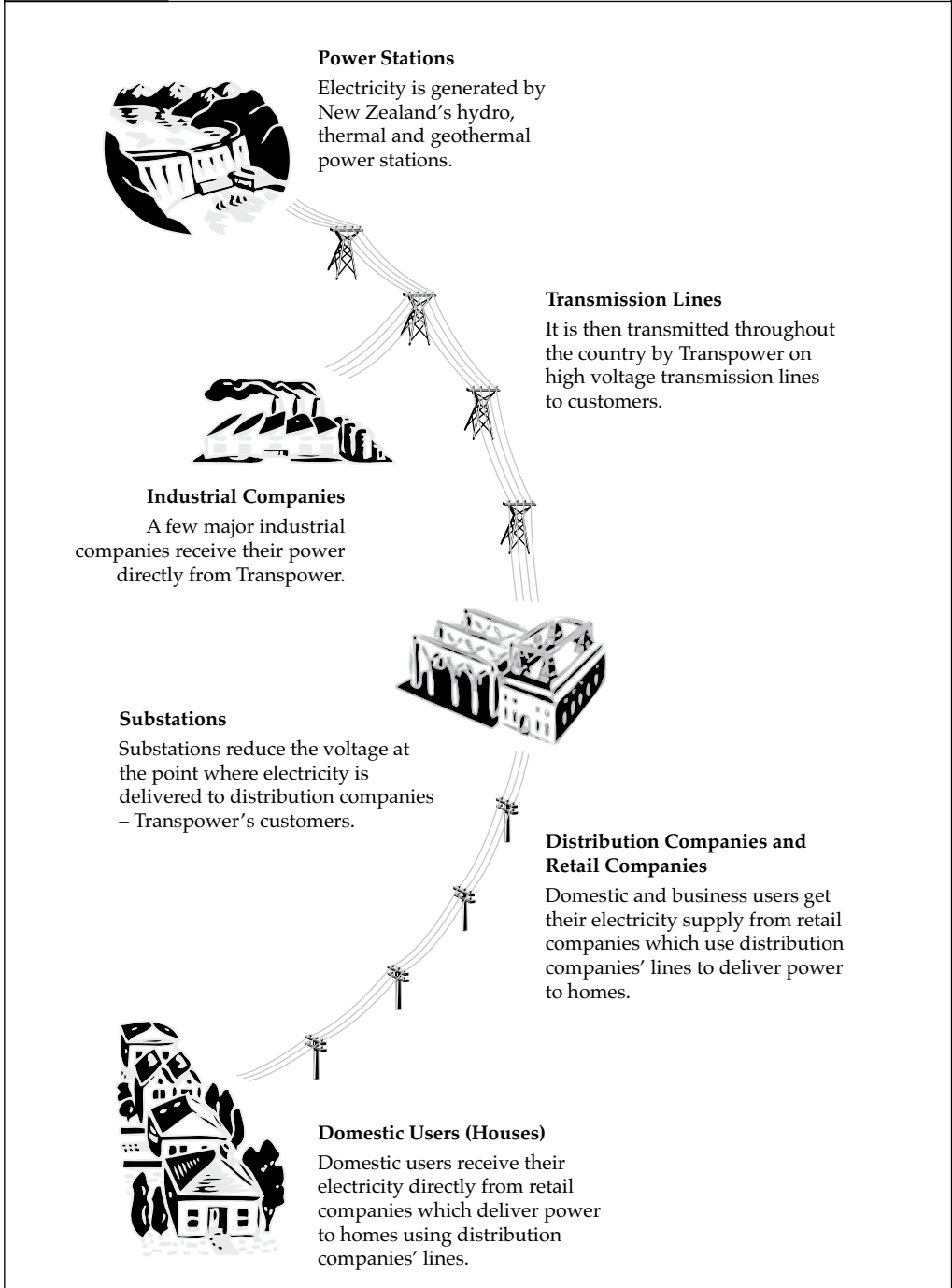
To say that electricity is about power is both tautology and insight. Any consideration of the electricity sector naturally demands that attention be paid to the physics of electricity and issues that, if not unique, remain points of distinction between it and other industries. Chapter 2 explores these points in some detail, but for now it is sufficient to note that electricity cannot be stored, its flows cannot be easily directed, and the actions of any one member of an electricity system can have consequences for all others. In economic terms electricity supply involves “externalities”, problems of “commons”, “public good” attributes, and in general an inability to match physical flows with contracts for both supply and usage. These issues pose challenges for replacing administrative approaches to electricity supply with more market-oriented forces.

Role of Technology

Technological innovations, however, have led to changes in both the physics and economics of electricity. As well as the usual improvements in efficiency and information technology that we take for granted in any industry, the electricity industry is enjoying the development of new technologies that affect its makeup. Greater efficiencies

FIGURE 1.1

Main Electricity Sector Actors in New Zealand



Source: Transpower (2003).

in thermal generation, such as combined cycle gas turbines (CCGT), affect the cost structure and hence output price of new generation capacity as it is developed to meet an ever-increasing demand. Advances in information technology allow the coordination of separately owned generators and transmission, and give rise to the potential for electricity users to monitor and change their consumption in response to short-term changes in electricity price. Similar advances mean it is also now possible to coordinate countless bids and offers for the real-time provision and demand for electricity so as to determine what price simultaneously satisfies all sellers and buyers, giving us a “spot” market price for electricity – a possibility that a few years ago could only be dreamt of. Greater use of DC (instead of AC) interconnections and networks, and advances in switching technologies, allow increasing control of actual power flows, better aligning physical and contractual flows. Finally, advances in technologies such as co-generation and wind-powered electric turbines are making feasible smaller-scale generation investments, and assist with a move towards distributed generation that locates supply closer to its demand and thereby mitigates the costs and monopoly issues associated with long-distance electricity transmission and distribution.

Some Other Types of Power

All of these technological innovations – affecting the physics of power in the electricity system – also give rise to the potential for changes to the other types of “power” in the system. In this context power can refer to market or monopoly power in generation, transmission or distribution – in other words the power of industry participants (including politicians) to manipulate prices, quantities or qualities to their advantage and potentially to the detriment of overall social welfare, both now and over time. Allied to this notion of power is the ability of consumers to decide which supplier they wish to purchase electricity from, or to change their consumption patterns in response to price changes (whether in terms of short-term usage decisions, selling surplus power via power exchanges, or longer-term decisions such as choice of appliances or energy efficiency measures). A third notion of power is to do with who controls the evolution of the industry, affecting the risks and incentives of all those contemplating investment in the sector.

Importance of the Ability to Set Electricity Prices

Central to these notions of power is the wholesale electricity market, an important element of which is the spot market. As in most countries, it is only very recently that New Zealand has enjoyed a stand-alone spot market that determines the price of electricity at any point in time. Being able to determine the price of electricity is clearly a key power to be enjoyed in any modern economy. If the price is too high, consumers are paying more than they should for their energy with a corresponding depression of economic activity that is reliant on electrical energy, and there is an incentive to over-invest in new capacity. If the price is set too low, then those who have funded investments in the electricity system in effect subsidise those who use electricity. This leads to over-consumption, underinvestment in new capacity, and artificial stimulation of sectors that rely on it.

It is therefore not surprising that for most of the history of New Zealand's electricity system political involvement in electricity pricing has played a prominent role. When governments control electricity generation and transmission – and hence the wholesale price of electricity – they have at their disposal a powerful policy instrument with which to stimulate or retard economic development, affecting industries, regions and, from their perspective most importantly, voters.

All of us are to some extent reliant on electricity, and electricity bills are a significant and ever-present reminder of this fact. Not all of us have access to alternative energy sources such as gas and, even when we do, the capital cost of installing alternative or dual-fuel use equipment can be prohibitive, and in any event it will not eliminate the need for electricity. You can't run your television on gas. If generation technology were so cheap and efficient that we could each use solar panels or our own gas, wind or co-generation turbine whenever electricity prices spiked then our reliance on large generators, a national grid and local distribution companies would be reduced, but we are not there yet. Hence, for as long as voters, commerce and industry need electricity and have limited ability to influence the price at which it is delivered, politicians will be interested in the price of electricity.

Before a true wholesale market for electricity developed in New Zealand, electricity pricing was essentially a politically driven process that led to relatively low electricity prices, taxpayer subsidisation of electricity infrastructure, and periodic jumps in prices as corrections were required.² Investment in electricity capacity was driven by supply considerations at a centrally planned level, resulting in over-investment in capacity at the taxpayer's expense. Funding by taxation itself can cause economic inefficiencies, but in addition inefficiencies in electricity investment and pricing meant that even when prices paid by consumers (as opposed to their true costs) were low, they might have been lower still if industry players had better information, incentives and capacity to act (in which case security and quality of supply might also have been enhanced).

Influence of Electricity Prices on Consumer Conservation and Efficiencies

Consumers had little incentive to conserve electricity or invest in energy-efficient technologies because they were not required to bear the true costs of delivering that electricity. Indeed, to the extent that they were charged prices that did not cover the true cost of electricity, consumers were effectively encouraged to over-consume electricity and invest in energy-inefficient technologies. This position was buttressed by the development of the large Maui gas field that, because gas cannot be economically exported, precipitated (on an international basis) a low price for thermal energy.³ In the first 10 years of this period, government sought to encourage investment in energy-

² In 1978, for example, the wholesale electricity price – known then as the bulk supply tariff – was increased by 40%. One such cause for corrections was the temptation for governments to freeze electricity prices as a means to influence national price inflation, a measure that could only be sustained for short periods.

³ At least for the 1979-2002 period. For a history of the Maui gas contract see Willis (1998).

intensive industry, reflecting the take-or-pay nature of the Maui contract, while at the same time it continued with the development of additional hydro-generation capacity.

Shifting Power amongst State Sector Electricity Actors

The 1980s' programme of economy-wide reform included the corporatisation of generation and transmission, resulting in devolution by degree of electricity price-setting power to state-owned commercial enterprises operating at arm's length from central government. While such moves resulted in significant efficiencies and for a time mitigated the political temptation to influence electricity pricing, it was not until 1996 with the advent of a wholesale electricity market that the power to set electricity prices was placed in the hands of electricity market participants, and even then with qualifications. In this sense the New Zealand electricity sector witnessed a dramatic shift in "power", although recent reforms have significantly reversed this shift.

Control of the Wholesale Electricity Market

Debate about the efficacy of the wholesale electricity market has continued since its inception. Concerns persist that the price-setting process is dominated by a handful of generators who are argued to possess considerable ability to manipulate power prices, if only under certain circumstances such as when hydrological reserves are low and/or when transmission constraints arise. This is despite a radical reconfiguration of the generation sector away from the all-but-complete dominance by the single, former state-owned generation company. Related concerns have been expressed that the evolution of the wholesale electricity market – until recently governed by rules hitherto developed by industry – favours incumbent generators, now **gentailers** both producing and retailing electricity. In contrast with the former arrangements under which the state-owned generation and transmission companies were responsible for ongoing security of supply (however unsuccessful they were in achieving that goal), the lack of any industry players being responsible for such security under the reformed electricity system has given rise to calls for intervention, particularly in the light of two winter power "crises" precipitated by lack of reserves and growing demand.

Consumer Choice

Gentailer dominance of the industry is also regarded by some as a key obstacle to electricity consumers attaining the "power" to better control when and how they use electricity, and from whom they buy it. Until the introduction of "deemed profiling", effectively forced by government in 1999 and allowing electricity suppliers to trade customers without needing to introduce new metering technology, and despite the lifting of "franchise area" supply monopolies in 1994 which limited competition for energy supply, domestic electricity consumers are argued by some to have had limited scope to change electricity supplier to secure their preferred energy pricing. Without greater consumer power or external intervention it has been argued that the industry has little incentive to help consumers to shop around for the best deal, know when best

to switch their appliances off so as to reduce their energy bill, or find ways to use power more efficiently.

Market Power in Transmission and Distribution

Market power concerns are not confined to gentailers, however, with both the transmission and distribution sectors attracting considerable ongoing attention. While technological change and changes in understandings have seen a worldwide rethink of the assumed monopoly nature of electricity generation, transmission and distribution are typically relegated to the monopoly “too-hard basket”. Since it is not economic to replicate transmission grids or electricity distributors’ “poles and wires”, and bypass of these is considered weak, it is regarded as inevitable that grid users and electricity consumers will be captive to the operators of such facilities and therefore vulnerable to monopoly exploitation. The past response relied mainly on public ownership in conjunction with regulation of some degree to attenuate the consequences of any such monopolistic behaviour – such as central government ownership of transmission and information disclosures. A current political aversion to privatisation has resulted in key options for reform in these sectors being taken off the agenda. Instead, where such measures have proven or simply been perceived to be inadequate, the preference has been for heavier regulation such as the threat of, or actual, price control.

Industry Governance and Development

The “power” to shape the evolution of the electricity sector in New Zealand is arguably the most significant, and one which until recently has hung in the balance. Despite domination of the sector by state-owned generators and transmission, and the importance of government policy in shaping the overall development of the sector, New Zealand has enjoyed a number of important initiatives that have been “market-led” and free of political interference or intervention. Most notable was the development of the wholesale electricity market as the product of initiatives taken by industry players rather than central government, giving rise to industry-determined governance arrangements shaping the development of wholesale market rules (and hence the all-important wholesale electricity price-setting mechanisms). It is this power that has recently been sequestered by central government, in moves that appear to represent a radical departure from the broad thrust of previous reform in the sector, and current reform in other countries. Indeed, it is more generally a reversion towards those pre-dating the state-sector restructuring of the 1980s.

Combined with recent government moves to take a firmer hold over transmission pricing and investment, these other moves by government to take control of the evolution of the electricity sector will have important ramifications for the incentives and ability of other parties to plan and implement required investments in the sector. While such intervention can be argued to resolve real ongoing issues in the sector, such as frustration at the pace at which competition has developed at the consumer level, and consumers’ vulnerability to deliberate or unnecessary exploitation by distribution

companies, these moves are not without costs. A question now faced is whether they subtly but significantly affect the risks and incentives of industry players to respond to the needs of the industry. If they do so badly, it is possible that the import of the reforms will be lost and the New Zealand electricity sector will revert to a distorted reflection of its pre-reform self.

A LOOK AHEAD

The chapters that follow present discussions on a smorgasbord of issues relevant to the contemporary reforms of the New Zealand electricity sector, with three scene-setting chapters leading the presentation. Chapter 2 deals with the technicalities of electricity markets, both in terms of the complicating physics and the abstractions involved in marrying the physics of electricity with the economics of markets. Chapter 3 provides a snapshot of the New Zealand electricity system, describing each of its major components. In Chapter 4, New Zealand's electricity reforms are outlined, against the backdrop of reforms in other states and countries. Chapter 5 gives a brief overview of New Zealand's electrical reform history.

Attention then turns to the selected contemporary "hot topics". As a form of "event study" the electricity-sector responses to successive winter power crises are examined in Chapter 6, with particular attention to the contrasting roles of involuntary demand curtailment and surging wholesale electricity prices in resolving the crises. Viewed against history, the fact of these crises does not fault the reforms, since similar episodes occurred pre-reform, and the reformed industry's response to these crises illustrates the efficacy of the reforms. In a related vein, the issue of encouraging a greater demand-side response to changing electricity prices is then discussed in Chapter 7. In reforming sectors worldwide this is regarded as one of the "holy grails" of reform, offering many potential benefits – if it can be achieved. These benefits include reduced market power, decreased capacity requirements, and greater security of supply. The problem is that there are good reasons why the horse might not want to drink, having been led to the water. Many consumers prefer not to vary their electricity demand in response to changing supply conditions, and are prepared to pay a price – an "insurance premium" – to not have to think about their supply. Future innovations are discussed that may offer consumers the encouragement they need to alter these preferences.

The next three chapters can be regarded as three different angles on the same question. How can welfare-enhancing competition be encouraged and sustained in a reformed electricity sector over time? Chapter 8 addresses the role of industry governance, and the relative merits of centralised and decentralised decision-making. For much of the past 20 years New Zealand has tended to charge industry participants with determining optimal industry evolution within the context of broad policy goals and light-handed regulation. More recently it has reverted towards the more centralised, administrative model in place before the reforms. This change in direction is predicted to enjoy little

success in terms of its stated objectives, and seriously undermines the effectiveness of otherwise useful decentralised initiatives.

Chapter 9 turns to defining and addressing the “evils” of market power and gaming observed in reformed electricity systems worldwide. Market power of some degree is argued to be inevitable in any electricity system, be it state-owned monopoly or privatised oligopoly, as is the issue of strategic behaviour by market participants. The ideal of “perfect competition” is not even close to attainable and is not therefore the relevant counterfactual, and so market power is not an automatic indicator of reform failure. Regulatory responses to these issues are considered in this light, with the costs of regulation emphasised as well as their benefits, and alternative approaches suggested. New Zealand’s recent shift from light-handed to heavy regulation is critically appraised.

Finally, encouraging investment in a reformed environment is discussed in Chapter 10. For generation, the goal of ensuring that capacity is able to meet ongoing demand is cast in a light more appropriate to reformed sectors. For example, the value placed on supply security by consumers is identified as an important driver of investment, which is to be contrasted with universal supply obligations of old. The difficulties in encouraging transmission investment are then noted, including the problem of investment impasses when generation and the grid are separately owned, given substitutability and complementarities between generation and transmission (and demand-side responsiveness). The centrality of grid investment to the evolving competitive topology of the sector and facilitating investment is identified. Possible solutions are proposed and weighed, including the use of customer or regulated private ownership, with the pitfalls of poor decisions emphasised. Current policy settings are likely to impede private investment in the New Zealand electricity sector, reinforcing the reversion towards centralised control and state ownership.

In many ways New Zealand’s reforms have been in the mainstream of those internationally; in others, and more recently, divergences are emerging. By the conclusion of this book in Chapter 11, the reader should have a sense of not only the nature and course of New Zealand’s reforms in time and space, but also of the efficacy of New Zealand’s solutions to issues that confront those debating reform in electricity systems worldwide.

