Evidence on the Impacts of Regulatory Incentives to Improve Efficiency and Service Quality

Report to Vector Limited

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Acronyms and Abbreviations

AER	Australian Energy Regulator
CAPM	Capital asset pricing model
CI	Customer interruptions
CIS	Capital expenditure Incentive Scheme
CML	Customer minutes lost
COLS	Corrected ordinary least squares
The Commission	Commerce Commission (New Zealand)
CPI	Consumer Price Index
DEA	Data envelopment analysis
DPCR	Distribution Price Control Review
DPP	Default Price-quality Path
EBITDA	Earnings before interest, tax, depreciation and amortisation
EBSS	Efficiency Benefit Sharing Scheme
ECM	Efficiency Carryover Mechanism
ESC	Essential Services Commission (Australia)
GSL	Guaranteed Service Levels
GSS	Guaranteed Standards Scheme
IFI	Innovation Funding Incentive
IRR	Internal rate of return
IQI	Information Quality Incentive
LCN	Low Carbon Networks fund
NEL	National Electricity Law (Australia)
NER	National Electricity Rules (Australia)
NSW	New South Wales (Australia)
Ofgem	Office of the Gas and Electricity Markets (United Kingdom)
Ofwat	Water Services Regulatory Authority (United Kingdom)

OPA	Overall Performance Assessment
ORG	Victorian Office of the Regulatory General (Australia)
R&D	Research and development
RAB	Regulatory asset base
RCV	Regulatory capital value
RPI	Retail Price Index (United Kingdom)
SFA	Stochastic frontier analysis
SPA IMs	Input Methodologies for Starting Price Adjustments
STIPS	Service Target Performance Incentive Scheme
TFP	Total factor productivity
WACC	Weighted average cost of capital
WPD	Western Power Distribution (United Kingdom)

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Executive Summary

The Commerce Commission (the Commission) is currently finalising the input methodologies that will define the price-quality path for electricity distribution businesses and gas pipelines in New Zealand. Vector has engaged Castalia to evaluate the available evidence on how the model of price-quality regulation being implemented by the Commission can create appropriate incentives for regulated suppliers to improve performance.

We find that regulatory settings change the way suppliers behave. To harness supplier behaviour in ways that achieve regulatory objectives, regulators in Australia and the United Kingdom have moved beyond the incentives originally found in the RPI-X approach to setting prices. Effective regulators have put in place specific incentives that reward regulated suppliers for outperforming benchmarks, while penalising poor performance. A direct result of these incentive schemes is that rates of return can vary amongst regulated suppliers and relative to the regulator's prescribed weighted average cost of capital (WACC)—with the returns of efficient suppliers able to exceed the regulator's estimate of the industry WACC and the returns of inefficient suppliers being lower than the regulated WACC.

The evidence presented in this report is drawn from countries that have more than 20 years of experience with the application of incentive-based regulation. The evidence from the United Kingdom and Australia is particularly relevant because New Zealand's recent Commerce Act reforms have moved our regulatory regime closer to the orthodox price-setting approaches applied in those countries. The findings in this report highlight the very real risk New Zealand could end up with a regulatory regime that was applied overseas in the 1990s, rather than the substantially improved form of incentive-based regulation now found in the countries that we want to emulate.

The evidence shows that effective regulators overseas have adjusted regulatory settings to achieve three important characteristics (explained further under the subheadings below):

- Balanced incentives
- Stable incentives
- Targeted incentives

Supplier incentives to reduce costs must be balanced by service quality incentives

Modern regulatory approaches try to align each supplier's incentives with their customers' interests—recognising that the regulator will always have less information on which to seek to achieve this objective than regulated suppliers. One important area where supplier and customer interests may diverge is in the quality of service provided. It is clearly not in consumers' interests to have service quality degraded to reduce costs, although this incentive may in fact be provided by RPI-X regulation. Nor is it desirable to simply 'lock in' existing service quality of each regulated supplier, regardless of what customers want or where suppliers sit relative to comparable businesses.

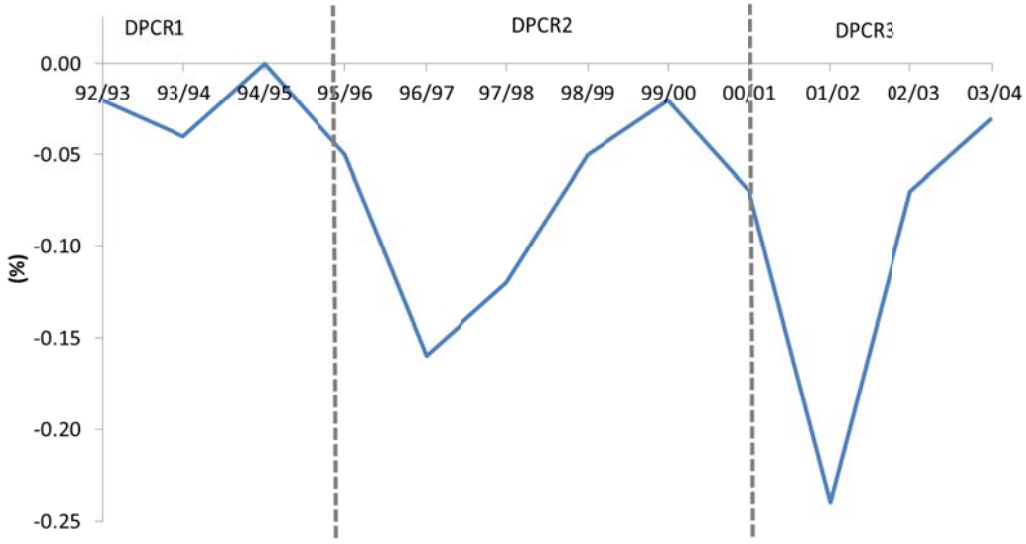
Regulators overseas have developed simple but effective quality incentives to balance out the legitimate desire to reduce costs. These incentives include penalties for breaching quality targets, but crucially also reward companies for providing better service than expected. The maximum revenue at risk under quality of service schemes in Australia and the United Kingdom is between 1-5 percent of annual revenues—providing a potential source of additional revenue, without encouraging inefficiently high service quality.

Stable incentives are needed to encourage efficient outcomes

From the perspective of long-run efficiency, a five-year regulatory period is an artificial and arbitrary timeframe for making decisions. As a result, supplier decisions that are designed specifically to exploit variations in the incentives applying at different points in the regulatory period will not necessarily be in the long-term interests of consumers.

The evidence from overseas clearly shows that regulated suppliers act differently when the strength of regulatory incentives changes within and between regulatory periods. Electricity distribution companies in the United Kingdom and New South Wales have initially lowered their operating costs following regulatory reviews, and then reversed these costs savings later in the regulatory period. These changes have been made in response to both the declining reward for efficiency over the regulatory period under RPI-X, and because the later years were used as the base-year for resetting prices in the next regulatory period. This clear trend is shown in the graph below, and provides some of the most direct evidence that regulated suppliers respond to regulatory settings.

Figure ES.1: Growth in Real Operating Expenditures in the UK Distribution Sector



Source: International Handbook of Economic Regulation (2006), Figure 8.3

The experience in the United Kingdom also highlights that incentives have been strengthened by regulators over time. In the electricity distribution sector, the proportion of cost savings that regulated suppliers are allowed to retain has increased from between 20-40 percent in DPCR4 (2005-2010) to between 30-53 percent in DPCR5 (2010-2015). The recent 20-year review of the RPI-X regime in electricity also increased incentives by extending the regulatory period from 5 years to 8 years—allowing regulated suppliers to retain the benefits of any efficiency gains for a longer time period. This change will be applied from DPCR6 (2015-2020) and is designed to enable investments in low carbon technologies to be recovered by suppliers, ensuring that financial incentives in the regulatory regime do not hold back investment. The regulatory period has also been extended in the United Kingdom water sector by allowing the most efficient suppliers to retain efficiency gains for an extra year (a total of six years).

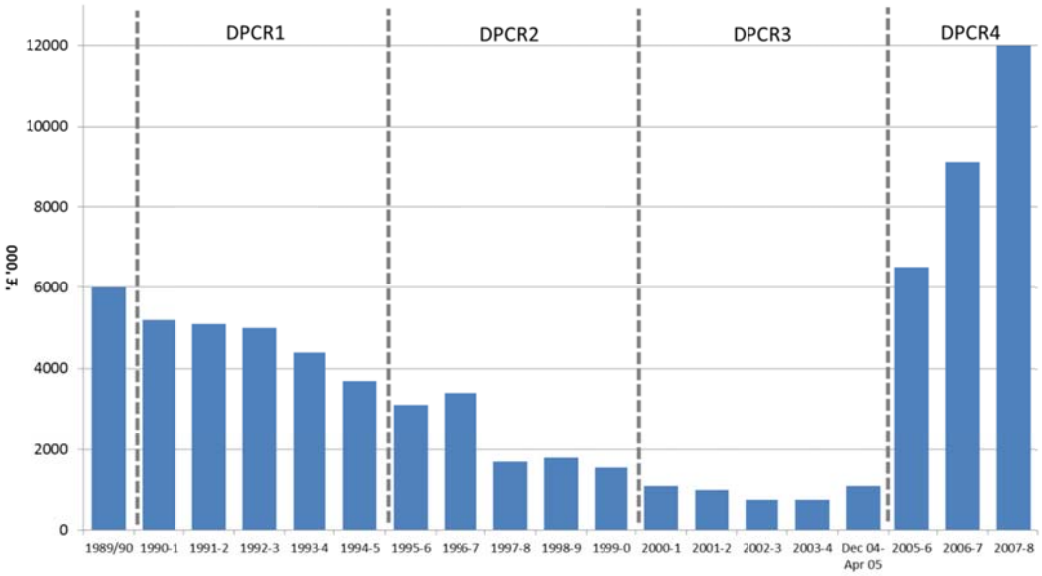
Regulators overseas target incentives to stimulate innovation and investment

Innovative investments have a different risk profile than investments traditionally made by regulated networks (and reflected in the regulatory asset base). The timeframes for

realising the benefits of innovation can be longer than for more conventional investments, and the profile of benefits can also be quite different. Regulatory treatment of the costs of innovation clearly influences whether regulated suppliers will make investments with these characteristics. In countries where the regulator and the general public expect regulated suppliers to be highly innovative (such as the United Kingdom), specific incentive mechanisms have been introduced to share investment risks between the suppliers and their customers. These regulatory mechanisms make the risk profile for innovative investments more comparable with the returns governed by the regulated cost of capital.

By evaluating specific investments that have been made in the United Kingdom (but not to our knowledge in New Zealand), we can conclude that these incentives work. For example, investing in research and development (R&D) of technology to lower the costs of fault detection is unlikely to be financially viable under a simple application of RPI-X. This technology has proven to be economic in the United Kingdom (and elsewhere), but the costs and risks of R&D are not sufficiently compensated within a single regulatory period. To target this type of innovation, the energy regulator in the United Kingdom has established a fund that meets 80 percent of the R&D costs of eligible projects. The results of this regulation are obvious from the graph below—R&D spending by electricity distribution companies in the United Kingdom has increased ten-fold since regulatory incentives were introduced, reversing the previous decline in R&D spending under RPI-X.

Figure ES.2: R&D Spending in the UK Distribution Sector



Source: Ofgem Working Paper 2, RPI-X@20

Incentives mean that supplier's rates of return will vary

A simple application of RPI-X regulation might lead to an expectation that all regulated suppliers in a particular industry will earn the regulated cost of capital, but no more. In fact, regulators in the United Kingdom and Australia fully expect rates of return to vary across regulated suppliers within each regulated industry. This is the practical effect of operating RPI-X with good incentive properties—suppliers are expected to earn more than their cost of capital when performance exceeds forecasts.

As shown in Table 6.1, regulated suppliers in Victoria frequently earn profits that are above the regulator's estimate of WACC. In the 2001 price review, the regulator expected all distribution suppliers to earn more than the WACC benchmark, and all suppliers generated even higher actual returns. The 2006 price review presents a more mixed picture of performance—with the regulator only expecting one company (United Energy) to earn more that the WACC benchmark.

Table ES.1: Returns Earned by Victorian Distributors (2001-2010)

	2001 Price Review (2001-2005)		2006 Price Review (2006-2010)	
	Forecast	**Actual**	**Forecast**	**Actual**
WACC Benchmark	6.8%		5.9%	
CitiPower	9.2%	11.9%	5.9%	8.9%
Powercor	8.5%	10.6%	5.3%	9.2%
SP Ausnet	8.4%	10.2%	5.5%	5.0%
Jemena	7.3%	8.9%	5.2%	8.6%
United Energy	7.7%	11.0%	6.2%	7.5%

Source: ESC Comparative Performance Reports 2005 and 2009

Varying rates of return are more consistent with the results observed in competitive markets. Good performance should be rewarded with higher rates of return, and poor performance should result in lower rates of return, on average. The evidence from the United Kingdom and Australia shows that this trend is observed—better performing companies earn higher rates of return, while poor performers are not as profitable. This dynamic is central to achieving better industry performance over time, as superior management teams, governance arrangements, and ownership structures prevail for the overall benefit of consumers.

What does the evidence on incentives mean for the Commission?

The evidence on the evolution and performance of incentive-based regulation overseas provides some important lessons for the Commission in completing the input methodologies. Although some of these measures may require changes to existing methodologies, we believe most incentives mechanisms can be applied through the Starting Price Adjustment Input Methodologies in a way that is low-cost, but effective.

- **Stronger service incentives.** The regulatory framework should include measures that reward suppliers for maintaining or improving service quality. The SAIDI and SAIFI targets for electricity distribution in the December 2010 DPP determinations, for example, are unlikely to provide the incentives needed to ensure a consistent balance of cost and quality incentives. A system of penalties and rewards capped at a proportion of supplier revenues would significantly improve incentives to provide quality service, and would not need to be complex.
- **Rolling incentives.** Rolling incentives should be included in the Default Price-quality Path (DPP) and could be included in the relevant input methodologies relatively easily. Rolling incentives if applied would result in time consistent incentives that would encourage suppliers to behave

efficiently. The Commission has previously proposed not to apply rolling incentives to the DPP and we would urge the Commission to reconsider this position.

- **Explicit investment incentives.** Regulatory settings are likely to stand in the way of efficient investment, particularly where the risks of investing are high and the payback period for the investment is relatively long. Allowing suppliers to retain the benefits of investments for longer periods (for example through a staggered approach to sharing benefits previously proposed by Vector)[1] could address this barrier. Alternatively, explicit measures could be developed to reduce the risks borne by suppliers for innovative investments.
- **Rates of return.** The Commission should adopt an approach to adjusting starting prices that rewards good performance through returns above the Commission's estimate of the industry's cost of capital. This outcome is adopted as an explicit target under incentive-based regulation overseas, and is more consistent with the outcomes observed in workably competitive markets in New Zealand. Under this approach "excessive" returns would only be earned at some margin above the cost of capital.

While each of these measures would improve incentives to improve efficiency, they are unlikely individually to be sufficient to provide the incentives found in workably competitive markets. The Commission therefore needs to ensure it provides a comprehensive package of incentives to regulated suppliers to improve efficiency, invest, and innovate. The evidence from overseas strongly suggests that the overall package should place greater emphasis on providing the right incentives to suppliers than has previously been suggested by the Commission, and relatively less emphasis on "excessive" profits.

[1] Vector, "Submission to Commerce Commission on the Setting of Starting Pricings for Gas Pipeline Businesses under the Initial Default Price-Quality Path," (26 September 2011), at paragraphs 32-104, and Vector, "Submission to the Commerce commission on Initial DPP for GPBs Draft Reasons Paper, 19 December 2011*",* at paragraphs 61-87.

1 Introduction and Background

. The price-quality regulation under Part 4 of the Commerce Act 1986 was amended in 2008 to move New Zealand closer to the orthodox approach to regulating natural monopoly infrastructure applied in the United Kingdom, Australia, and elsewhere (commonly known as "incentive-based regulation"). Part 4 explicitly requires the Commerce Commission ("the Commission") to regulate in a way that ensures regulated suppliers have incentives to invest, innovate, improve efficiency, and provide services at a quality that reflects consumer demands (section 52A(1)(a)-(b) of the Commerce Act). This report examines the evidence from overseas on how the Commission might best achieve these outcomes.

The need to provide incentives to suppliers is balanced by other objectives in Part 4 to share efficiency gains with consumers, and to limit the ability of suppliers to earn excessive profits (section 52A(1)(c)-(d) of the Commerce Act). The combination of these objectives means the Commission may place relatively more or less emphasis on providing incentives to regulated suppliers.

This section describes the purpose of this report and how our work relates to the Commission's current task of finalising the input methodologies. Applying international evidence on the evolution and impacts of incentive-based regulation is not straight-forward. However, we believe the Commission is unlikely to strike the right balance between the objectives listed in section 52A of the Commerce Act without understanding how the incentive-based regulation applied overseas has overcome similar challenges.

1.1 The Purpose of this Report

This report examines how the model of price-quality regulation being implemented by the Commission can create appropriate incentives for regulated suppliers to improve performance. This enquiry is prompted by the gap between the model of incentive-based regulation being implemented by the Commission, and the models applied by regulators in similar jurisdictions today.

The objective of this analysis is to help the Commission implement a modern regulatory regime that achieves the objectives set out in the Commerce Act. The overall lesson from overseas experience is that the incentives built into an "RPI-X" price path alone will not achieve expected cost, quality, and investment outcomes.[2] The regulatory regimes that serve as a model for the New Zealand regime have, without exception, evolved towards a more complete regulatory system that explicitly provides strong incentives to suppliers.

This report investigates how regulators overseas have departed from "pure" RPI-X regulation

This report answers the following questions on price-quality regulation as applied in Australia and the United Kingdom—countries that have served as a model for New Zealand, and which have a longer track record of implementing price controls:

- **How has the regulatory treatment of incentives for efficiency and investment evolved over time?** We investigate how regulatory systems have changed as regulators gain a better understanding of how incentives change supplier behaviour.

[2] RPI-X is the formula applied in most regimes that apply incentive-based regulation, where prices are allowed to increase at the rate of inflation (RPI), less some "X factor" to account for productivity gains. This price regulation actually takes the form of CPI-X in Australia because inflation-proof bonds are linked to CPI.

- **What are the components of an effective system of regulatory incentives for efficiency and investment?** We examine the measures that regulators overseas have put in place to provide incentives for efficiency and investment in the network, focusing on the how those measures are directed and what they have achieved.
- **What does the evidence tell us about the impacts of incentives?** We draw on the findings in regulatory decisions, academic research, and industry data to draw conclusions about the link between supplier incentives, behaviour, and industry performance.

The body of this report answers these questions by examining the impact of incentives on efficiency gains, service quality, and investment. The appendices to the report separately present our research on the evolution of regulatory incentives in the electricity distribution sector in Victoria, Australia, and the electricity distribution and water sectors in the United Kingdom.

Drawing the right lessons from international experience is not straight-forward

While there are numerous examples of regulatory approaches around the world that try to provide incentives for investment and efficiency, gathering compelling evidence of their impacts is difficult because:

- **The counterfactuals are difficult to assess**—When drawing conclusions from the evidence in any particular country, it is not possible to observe what would have happened if the regulatory approaches were different.
- **It is not possible to control for all differences**—When applying the lessons learned from any particular country to the situation facing another country, factors that influence outcomes other than regulation complicate the picture. The broader policy environment, ownership models, and underlying drivers of cost and demand all differ from country to country.

Despite these challenges, we believe it is important for the Commission to draw upon overseas evidence. The international evidence used in this report comes from regulatory systems that have been in place for many years—providing a base of evidence that should be valuable to the Commission in determining the best approach for New Zealand. Ignoring this evidence would effectively put New Zealand in the position faced by a pioneer in incentive-based regulation—which clearly it is not.

Previous efforts have been made to learn from international experience as part of the process of developing the input methodologies. For instance, the Commission engaged overseas experts that have direct experience designing, reviewing and critiquing regulation in the United Kingdom—Michael Pollitt, Martin Cave, and George Yarrow all commented on earlier proposals made by the Commission.[3] However, these efforts focused quite narrowly on issues of asset valuation and cost of capital practices overseas. While these regulatory tasks will affect supplier incentives, a similar effort is now needed to understand the overall set of regulatory incentives to improve efficiency and promote efficient investment.

[3] Yarrow, "Review of Input Methodologies (Electricity Distribution Services, Gas Pipeline Services and Airports) Reasons Paper," (14 December 2010); Pollitt, 'Input Methodologies: Expert Review of the New Zealand Commerce Commission's Draft Decisions and Reasons for Electricity Distribution Services and Gas Pipeline Services," (July 2010); and Cave, "Input Methodologies, Expert review of Reasons Papers of the New Zealand Commerce Commission relating to Electricity Distribution and Gas Pipeline Services and to Airports," (December 2010).

1.2 The Commission's Input Methodologies

This report is prepared at a time when the design of price-quality regulation in New Zealand is being finalised. The Commission is completing the set of input methodologies that will determine how prices are adjusted and returns are generated by suppliers. The Commission should draw on the experience of overseas regulators, such as the United Kingdom and Australia, in the application and evolution of incentive-based regulation. The Commission's application of Part 4 should reflect how regulation is practiced today in those jurisdictions. As we demonstrate in this report, current regulatory practice is quite different from the regulation that applied when incentive-based regulation was first introduced overseas.[4]

The Commission has already finalised input methodologies relating to cost allocation, asset valuation, taxation, and the cost of capital. The Commission is now developing Input Methodologies for Starting Price Adjustments (the SPA IMs), and expects to release a draft determination on the SPA IMs in May 2012. The Commission's Issues Paper on the SPA IMs placed very little emphasis on supplier incentives.[5] Much of the discussion on incentives in the Issues Paper focuses on the prospect that suppliers might have adverse incentives to game the regulatory process. This report deals with supplier incentives to improve efficiency, invest, and innovate—an explicit objective of Part 4 of the Commerce Act. Many of the incentives discussed in this report could be applied through the SPA IMs, and the timing of this report aims to inform this decision-making process. Additional incentives could also be applied as part of more regular decisions made by the Commission.

One important feature of the Commission's input methodologies is that the default price-quality path (DPP) is supposed to be a low-cost regulatory process. The evidence from overseas therefore needs to be interpreted alongside an expectation the DPP will not impose high costs on the regulator and/or regulated suppliers. However, the low-cost nature of the DPP regulatory process does not change the fundamental need for incentives. In fact, the way suppliers respond to incentives will be even more important in a low-cost regulatory system that provides less independent scrutiny of suppliers' costs and investment decisions. For the DPP to achieve its purpose and intent, the Commission will need to build incentives into the regulatory approach, instead of relying on more detailed regulatory methods commonly used overseas (such as independently reviewing supplier business plans).

To highlight the very real differences between approaches that might be used in New Zealand with the evidence from overseas, we contrast international experience with approaches previously proposed by the Commission to adjust starting prices. This shows how an approach of adjusting starting prices to set forecast revenues equal to forecast costs without considering incentive effects would put New Zealand regulation outside international norms and best practice. Applying the international evidence to New Zealand also suggests a number of simple, low-cost ways the required incentives could form part of the SPA IMs. For example, submissions made to the Commission on its

[4] We note that the Commission has recent experience drawing on the experience of the regulatory practices developed overseas. The Commission has been applying aspects of the Publicly Available Specification (PAS) 55 used in the United Kingdom to ensure that rigorous asset management tools are applied to information disclosures.

[5] Commerce Commission, "Additional Input Methodologies for Default Price-quality Paths: Process and Issues Paper," (December 2010) at paragraphs 162-168.

Process and Issues Paper point out that a "staggered" SPA could be introduced without any additional data or regulatory cost.[6]

1.3 Outline of this Report

The remainder of this report is structured as followed:

- Section 2 provides some brief background on how incentive-based regulation has evolved overseas—from an initial reliance on the incentives provided by the RPI-X price cap, towards a more specific and direct set of incentives.
- Section 3 presents evidence on the direction of incentives overseas, and how regulators have successfully moved away from a short-term focus on cost reduction to balance suppliers' incentives with a focus on maintaining and improving service quality.
- Section 4 presents evidence on the importance of stable incentives, clearly illustrating how suppliers alter their behaviour to respond to any changes in the strength of incentives.
- Section 5 explores the challenge of providing suppliers incentives to invest and innovate. We explain why this has been perhaps the single greatest challenge faced by incentive-based regulation, and we describe how regulators overseas have addressed this challenge. Two real-life examples are presented to show that a simple RPI-X approach is not likely to achieve the type of investment and innovation required to meet consumers' long-term interests.
- Section 6 reviews the impacts that balanced, stable, and targeted incentives have on supplier rates of return, and how regulators overseas have created systems that reward suppliers financially for good overall performance.

The appendices to this report present brief case studies summarising evidence on the impacts of supplier incentives in the Victorian electricity distribution sector (Appendix A), the United Kingdom electricity distribution sector (Appendix B), and the United Kingdom water sector (Appendix C). Each case study separately considers operating, capital, and service quality incentives and concludes with our interpretation of how the evidence in each case study could be applied to New Zealand.

[6] Electricity Networks Association, "Submission on Additional Input Methodologies for Default Price-Quality Paths," (27 January 2012); and Vector, "Submission to Commerce Commission on Additional DPP IMs Process and Issues Paper," (27 January 2012).

2 Evolution of Incentive Regulation Overseas

The theoretical rationale for incentive-based regulation is well-known. By moving away from a regulatory approach that directly links a regulated supplier's prices and profitability to its actual costs, incentive-based regulation encourages suppliers to improve efficiency and incur lower costs. Benefits are then transferred to consumers over time through downward pressure on prices.

This report focuses on the evidence from overseas on how well this objective has been achieved in practice, rather than on the theoretical rationale itself. However, the evolution of the theory that underpins incentive-based regulation helps with the interpretation of the evidence presented in this report. We find that this evolution broadly consists of two stages—an initial stage of implementing RPI-X in a "classic" form, and a later stage of developing more specific and targeted approaches to provide supplier incentives.

This section also asks why experienced regulators have not stuck with the generalised incentive effects of RPI-X. What did they see that prompted them to introduce specific investments—in some cases to strengthen the incentives of RPI-X, in other cases to offset them? We find that the effort and cost of developing additional mechanisms is needed to provide balanced, stable, and targeted incentives.

A "classic" RPI-X approach was applied overseas in the 1980s and 1990s

At the start of the 1980s, the mainstream model for regulating natural monopolies (such as electricity, water, and gas infrastructure) was "cost plus" or "rate of return" regulation. This form of regulation had been developed in the United States of America and applied by public utility commissions for several decades. Dissatisfaction with this model had developed because:

- The incentives in this form of price regulation were thought to result in over-investment or "gold-plating" of assets (known as the Averch-Johnson effect)[7]
- Annual tariff increases were needed to recover rapidly changing costs due to high levels of inflation and oil price shocks in the 1970s. Large cost overruns on nuclear plants were also being passed on to electricity customers.

In 1983, the concept of 'incentive-based regulation' in the form of RPI-X emerged as a theoretical alternative to rate of return regulation.[8] This form of regulation was introduced in the United Kingdom initially as part of the privatisation of British Telecom, and then in later electricity and water privatisations.

Other jurisdictions picked up the United Kingdom's RPI-X model of regulating natural monopoly infrastructure and faithfully adopted it. The State of Victoria in Australia was an early adopter of incentive-based regulation, initially applying an exact copy of the United Kingdom approach. The literature that compares the results of incentive-based regulation with rate of return regulation overwhelmingly finds the implementation of "classic" RPI-X has led to lower costs.[9]

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[7] Averch and Johnson, "The Behaviour of the Firm Under Regulatory Constraint", *American Economic Review*, (December 1962).

[8] Littlechild, "Regulation of British Telecommunication's Profitability," London, Department of Industry, (1983)

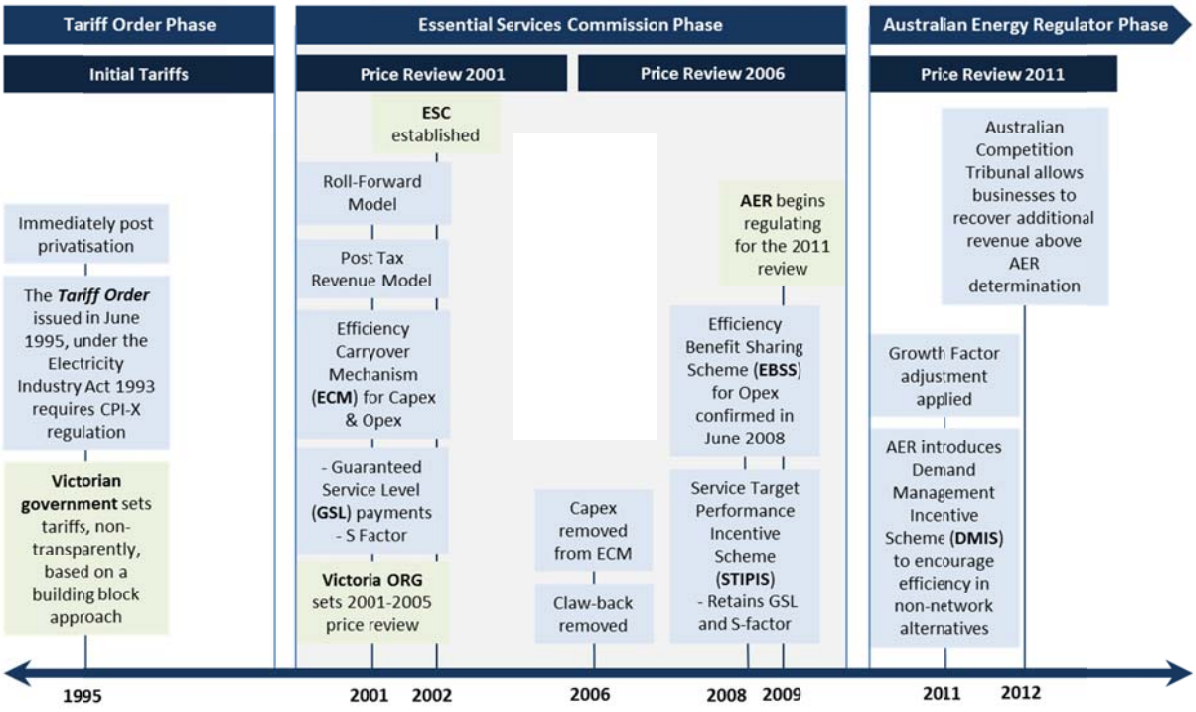
[9] Jamasb and Pollitt, "Incentive Regulation of Electricity Distribution Networks: Lessons of Experience from Britain," *Energy Policy* 35 (2007); Joskow, "Incentive Regulation in Theory and Practice: Electricity Distribution and Transmission Networks," CEEPR, (September 2005); Giannakis et. al. "Benchmarking and Incentive Regulation of Quality of Service: An Application to UK Electricity Distribution Networks," *Energy Policy* 33 (2005).

Modern approaches to RPI-X incorporate specific incentives

The initial focus in designing and applying incentive-based regulation was on the 'new' incentive properties of RPI-X, and protecting against sliding back into 'traditional' rate of return regulation. The regulators in the United Kingdom and Australia later realised that—although incentives under RPI-X are better than under rate of return regulation—these incentives need to be developed further to achieve regulatory objectives. These regulators have accordingly designed regulatory approaches with quite different incentives than found in early attempts to implement RPI-X.

The evolution in the design and application of incentive-based regulation is illustrated in Figure 2.1, using the example of the electricity distribution sector in Victoria, Australia. This timeline identifies when particular incentive mechanisms were put in place and how they have been adjusted over time. The clear trend has been to expand the number and coverage of specific incentive schemes to supplement the incentives designed into the RPI-X approach. The Initial Tariff Order applied from 1995 applied a "classic" form of RPI-X. The 2001 Price Review then allowed efficiency gains to be carried over into the next price review period, and applied specific service quality incentives. The Australian Energy Regulator has since applied these specific incentive approaches across the entire country, and has introduced new incentives for demand management.

Figure 2.1: Evolution of Price-Quality Regulation in Victoria's Electricity Sector



The same trend is observed in the United Kingdom electricity and water sectors (see the timelines presented in Appendix B and Appendix C). Electricity distributors in the United Kingdom (known as Regional Electricity Companies or RECs) originally operated against a broad incentive to beat the regulator's cost forecasts. These companies now respond to a total of 15 specific incentive mechanisms, covering operating expenditure, capital expenditure, and service quality.

What does the evolution of incentive-based regulation mean for the Commission?

The evolution of incentive-based regulation overseas strongly suggests adopting the form of RPI-X regulation that was applied in 1995 will not suit New Zealand's current circumstances. Regulators overseas have tried the approach of relying on "classic" RPI-X incentives, and the regulators that we study in this report (the Australian Energy Regulator, Ofgem, and Ofwat) have all revised their approach to include additional mechanisms that provide greater incentives to improve efficiency. The overseas evidence suggests a classic RPI-X approach that confines rewards to regulated suppliers based on a relatively short regulatory period does not provide sufficiently strong enough incentives to improve efficiency.

The fact that regulators overseas have changed their approach provides evidence in itself of the importance of incentives to improve efficiency. Well-regarded regulators overseas, such as Ofgem and Ofwat, are acutely aware of the value of predictable regulation. Regulatory systems need time to function properly, and assessing the effects of regulation is only possible in a stable regulatory environment. Yet these regulators have been so convinced of the need to provide strong incentives to improve efficiency that they have changed the way they operate economic regulation by introducing additional incentive mechanisms at the potential cost of regulatory stability. .The evolution of regulation overseas indicates the Commission particularly needs to ensure that the input methodologies provide:

- **Balanced incentives.** RPI-X by itself does not provide any incentives to maintain or improve service quality, and may provide opportunities for suppliers to increase returns by substituting capital expenditure for operating expenditure. An effective set of regulatory incentives encourages suppliers to manage their operating and capital expenditure in a way that delivers services at the quality that customers demand.
- **Stable incentives.** A simple application of RPI-X leads to a gradual weakening of the strength of incentives over the course of the regulatory period. Suppliers change their behaviour to respond to this varying incentive power. Good regulatory design should provide time-consistent incentives that only reward suppliers for outcomes that are in the long-term interests of consumers.
- **Targeted incentives.** RPI-X does not distinguish between different forms of investment, even though the risk profile of innovative investments may be quite different from traditional utility capital expenditure. Where regulators believe innovation is in the long-term interests of consumers, specific incentives schemes are needed to make such investment financially viable.

The following sections of this report present evidence on each of these characteristics. We describe how regulators overseas have come to recognise the importance of these characteristics, and we show how incentives have changed the behaviour of regulated suppliers.

The evolution of incentive-based regulation does not mean that numerous or complex incentive schemes are needed. To the contrary, simple approaches tend to work better. New Zealand is fortunate to be in a position to learn from the experience overseas as the input methodologies are developed. While numerous incentive schemes have been added incrementally to RPI-X in the United Kingdom for example, the input methodologies give the Commission an opportunity to provide these incentives as part of a coherent package.

3 The Direction of Incentives: Achieving Balanced Incentives

Incentive-based regulation has been introduced because policy makers and regulators believe that allowing suppliers to retain some of the benefits of improved performance will motivate suppliers to deliver better outcomes for customers over the long-term. As described in Section 2, the approach to providing these incentives has evolved under the umbrella of RPI-X regulation.

One particular area of evolution is the direction of incentives. Early regulatory approaches did not explicitly consider how best to balance operating expenditure, capital expenditure, and service quality incentives. Modern regulatory tools seek to align each supplier's incentives with their customers' interests—recognising that the regulator will always have less information on which to make decisions than regulated suppliers. This evolution has occurred because regulated suppliers seek out greater efficiency gains where the rewards are greater—the direction of incentives matters for achieving efficiency gains.

For example, if service quality could be easily monitored and policed by regulators, then incentives to cut costs and invest less might not be a major concern for regulators. However, monitoring and enforcing quality is inevitably imprecise, and there can be a time-lag between the causes of degraded service and customer impacts. Without incentives directed at service quality, a general RPI-X approach will not encourage suppliers to provide service that reflects consumer demands. The service quality incentives currently in the DPP and input methodology determinations focus on ensuring that quality does not decline—rather than providing incentives to improve service quality over time.

The following sub-sections present evidence on how balanced incentives for service quality and cost reductions are provided overseas.

3.1 Evidence on Balancing Cost and Quality Incentives

Two particular features of regulated markets make it difficult to replicate the service quality outcomes found in competitive markets:

- **The lack of customer pressure to improve service.** In the absence of regulatory incentives to maintain or improve service quality, suppliers may be able to increase their returns by degrading service quality. In competitive markets, the opposite outcome is typically observed—suppliers generally increase their returns by improving service quality because high-quality producers are able to attract demand and increase market share.
- **The incentive to transfer quality risks back to customers.** For example, it may be possible to operate networks with less redundancy if consumers are willing to share quality risks (in other words, if the cost of system redundancy is not worth the reduction in risk). Regulated suppliers have no incentive to carry their share of risk: they will generally be better off increasing redundancy and passing costs on to consumers. This way they unload all the risk, and consumers pay for all of it.

The evidence presented below suggests that good regulatory systems overcome these challenges through penalties and rewards that maintain the incentives on quality service throughout the regulatory period. These mechanisms mean regulated suppliers are able to increase their returns by improving service quality.

Service quality incentives in Victoria balance other incentives to reduce costs

Changes in service quality can provide a signal to regulators about whether operating and capital cost savings are in fact efficiency gains, as opposed to unsustainable deferrals. A tendency to defer required maintenance or capital upgrades will eventually lead to a decline in network reliability and service standards. However, inefficient cost deferrals may only impact on observed service quality after a substantial time lag—creating a risk that regulated suppliers might benefit (at least in the short-term) from behaviour that is not in consumers' interests.

In Australia, the Australian Energy Regulator (AER) has recognised that a simple application of RPI-X does not achieve a set of incentives that balances cost savings and service quality, stating that:

> *Where the regulator would like a firm to pursue multiple objectives, the power of the incentives to pursue these different objectives should be balanced wherever possible. For example, if the incentive to maintain service standards is weak, introducing high powered expenditure incentives increases the risk that the firm will cut service standards in order to reduce expenditure.*[10]

In Victoria, the Tariff Order that applied from 1996-2000 contained no explicit incentives to improve quality of service. In the 2001 Price Review, the Essential Services Commission (ESC) put two service incentive arrangements in place to balance the incentives that the distributors have to reduce costs with the need to maintain or improve service levels. The ESC then strengthened these incentives in the 2006 review:

- **The S-factor scheme.** The S-factor scheme financially rewards or penalises distributors for their performance against a subset of average service reliability targets. This is done through the price control formula [(1+CPI)(1-X)S]: the service term (S) allows tariffs to increase in years after actual reliability performance has exceeded the target. Conversely, tariffs will decrease after actual reliability has been below the performance targets. The ESC increased the incentive (and penalty rates) for the S-factor scheme in 2006, and expanded the performance indicators included in the scheme. The ESC also excluded impacts on service levels from events that were deemed to be beyond the control of the distribution business.
- **The Guaranteed Service Levels (GSL) scheme.** The GSL scheme requires distributors to make an automatic payment of A$80 to customers that consume less than 160 MWh per year if they experience a level of reliability below an established threshold. In 2006, the ESC increased the level of payments four-fold, and expanded the circumstances when penalties were imposed.

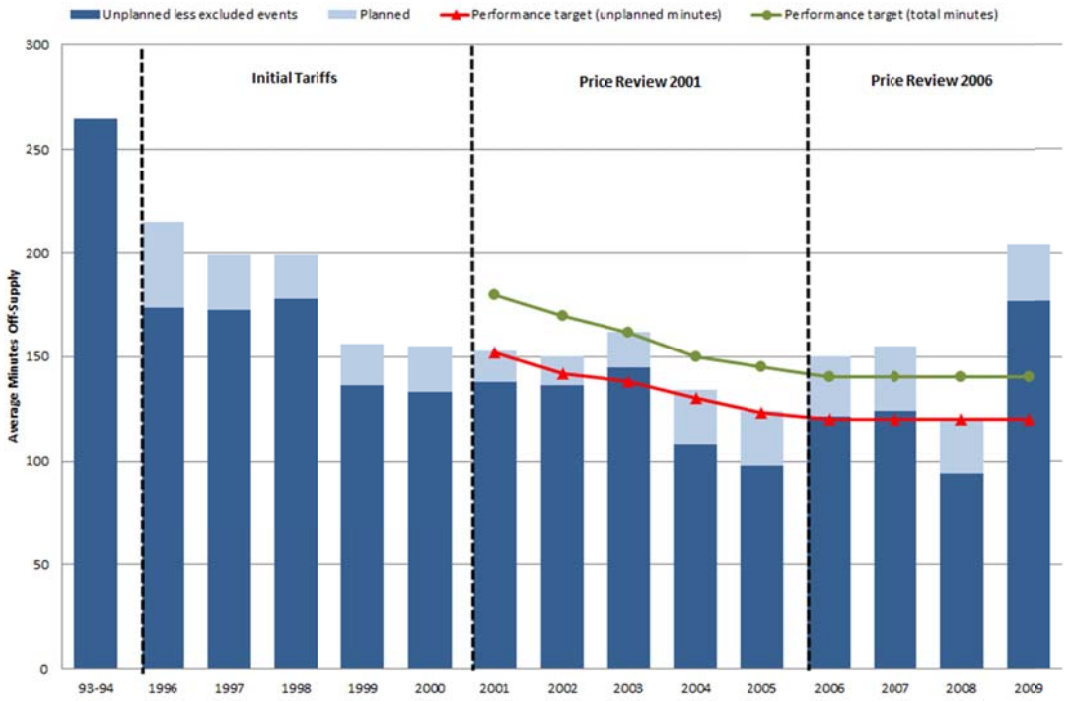
The AER has adopted the approach of the S-factor and GSL scheme in its national Service Target Performance Incentive Scheme (STPIS). The AER has also increased the amount of revenue at risk under the STPIS from ±3 percent to ±5 percent—providing the distribution businesses in Victoria with opportunities to further increase revenues for outperforming service expectations.

As shown in Figure 3.1, reliability (as measured by average minutes off supply per customer) has steadily improved from 1996-2008. Unplanned outage levels have fallen by almost 50 percent, and total minutes of outage have been maintained around the target

[10] AER, "Final Decision Electricity Network Service Providers: Efficiency Benefit Sharing Scheme," (June 2008), at page 3.

level of less than 150 minutes per year. This result deteriorated in 2009 due in part to extreme weather conditions—drought, high temperatures and record peak demand—leading to higher failure rates from overloaded transformers and load shedding (primarily on one network, SP Ausnet).

Figure 3.1: Average Minutes Off Supply Per Customer



Source: Adapted from AER, Victorian Electricity Distribution Businesses Comparative Performance Report for Calendar Year 2009, (December 2010)

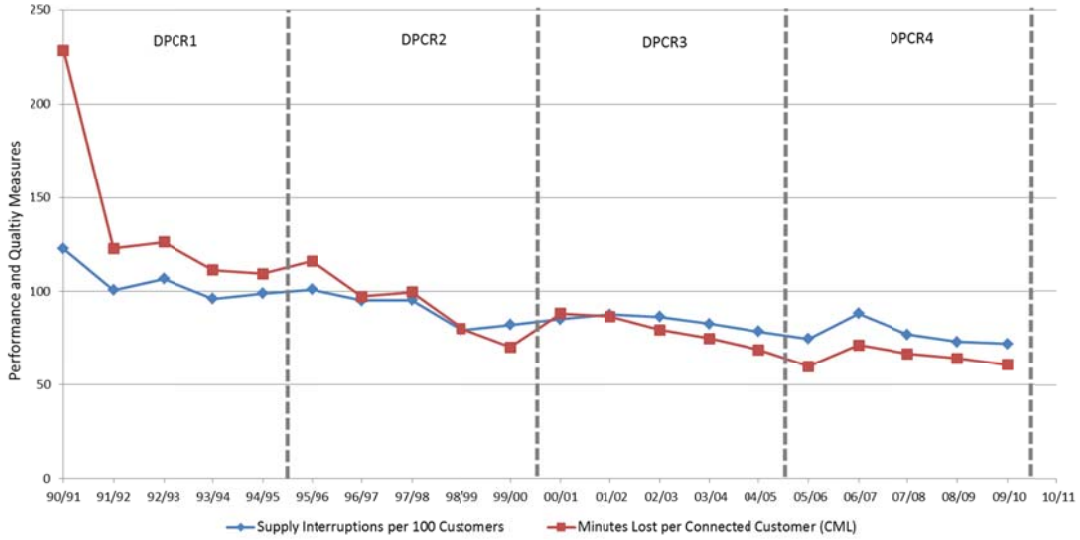
Service monitoring has been supplemented with financial incentives in the UK

Service quality indicators have been monitored by Ofgem since RPI-X regulation was first introduced to the electricity distribution sector in the United Kingdom in 1990. To give the regulator's service expectations force, financial incentives were introduced in April 2002 (part way through the Distribution Price Control Review 3, DPCR3) to improve quality of service.

Figure 3.2 illustrates changes in service quality throughout the first four regulatory periods (DPCR1-4), as measured by the frequency and duration of supply interruptions. Substantial improvements in early years were followed by a levelling out of improvements from around 2000. In the first three years after financial incentives for service quality were introduced in 2002, the businesses achieved a 16 percent drop in both the number of customer interruptions (CI) and the customer minutes lost (CML).[11] Service interruptions increased in 2006-2007, and have since returned to previous levels with a gradual decline in interruptions.

[11] Ofgem, *Electricity Distribution Price Control Review: Final Proposal*, 2004.

Figure 3.2: Measures of Interruptions to Supply



Note: Bad weather throughout 2006/07, including storms in December 2006 and January 2007, caused increased interruptions in supply.

Source: Ofgem, "Electricity Distribution Annual Report" 2009-10; Offer, "Report on Distribution and Transmission System Performance", 1997/98; Jamasb and Pollitt (2007) at p6176

The proportion of each supplier's revenue that is at risk under the scheme is 1.2 percent for customer interruptions, and 1.8 percent for customer minutes lost. Over the four years from 2005-2009, SSE Southern was able to earn an additional £30 million by exceeding its performance targets. In contrast, another supplier, CE YEDL, was required to pay close to £12 million in penalties.

Financial incentives have also been introduced in the UK water sector. In that sector, the total impact on each supplier's revenue is limited to +0.5 percent and -1.0 percent. This reflects customer concerns over price increases, lower willingness to pay for improved service, and because it is more in line with a competitive market where companies must continually strive to outperform their competitors.[12]

How does the evidence on balancing cost and service incentives apply in New Zealand?

The objectives of Part 4 are explicitly linked to meeting customer expectations of service quality. We would therefore expect service quality incentives in New Zealand to reflect:

- An expectation that customers will receive better value for money over time—meaning quality will not be degraded simply to reduce costs
- The willingness of customers to pay more to improve service quality, or to accept lower quality service for lower prices
- An expectation that service quality will be relatively consistent throughout the regulatory period.

The evidence from overseas suggests a well-designed regulatory system of penalties and rewards is needed to translate customer expectations into reality. Regulation should provide incentives to achieve true efficiency gains—not simple cost-minimisation.

[12] Ofwat, "Putting Water Consumers First – The Service Incentive Mechanism," (2010), at pages 15-16

As noted by Dr. Michael Pollitt, the Commission's current input methodologies do not explicitly balance costs and service quality:[13]

> *A somewhat surprising aspect of the Reasons papers continues to be that they do not discuss the output measures with which the input costs are associated… Customer services can vary (e.g. the number of customer minutes lost per year in electricity or the degree of undergrounding to avoid visual amenity losses). There is no explicit discussion of this in the Reasons papers.*

The Commission should consider whether the approach it has proposed for the electricity distribution and gas pipeline DPPs of penalising suppliers for breaching targets on SAIDI/SAIFI for electricity distribution and Emergency Response Times for gas (based on historical levels) achieves the right balance of incentives.[14] The approach applied in the input methodologies appears to make an implicit assumption that existing service quality levels for each regulated supplier are optimal. Historical service levels will only provide appropriate targets if they accurately reflect consumer demands.

In our view, the wide range in historical SAIDI and SAIFI performance across New Zealand's electricity networks means that customers are unlikely to be receiving an optimal balance of price and quality in all areas. It is unlikely that consumers in different parts of New Zealand have very different price-quality preferences.[15] Unfortunately, consumer surveys are unlikely to provide useful insights to help set regulatory service quality targets. Consumers will typically claim to have a low willingness to pay for better service. Revealed behaviour is also not helpful because consumers will generally continue to use electricity when prices and service quality increase, even though they would prefer to spend their money in other ways.

An approach that would improve the balance of incentives would provide both rewards and penalties for service performance. For example, in addition to penalties, the input methodologies could include a simple financial reward for exceeding the SAIDI/SAIFI limits in any year—capped at some proportion of the supplier's revenues (overseas experience suggests that between 3-5 percent is appropriate). This reward would ensure regulated suppliers have incentives to improve quality until the cap is reached, regardless of their previous performance against their targets. It would also provide suppliers with an ability to increase their returns by improving service quality, which is more consistent with the outcomes observed in competitive markets.

3.2 Evidence on Balancing Operating and Capital Incentives

Regulated suppliers are able to trade-off some operating and capital expenditures. This means regulatory regimes that reward cost savings of one type, and not the other, lead suppliers to change their spending profile to maximise returns.

The potential for regulatory incentives to favour operating expenditure or capital expenditure has been acknowledged in Australia and the United Kingdom, although solutions have not been widely implemented. For example, the Australian Energy Regulator planned to apply the Efficiency Benefits Sharing Scheme (EBSS) to both

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[13] Pollitt, "Input Methodologies: Expert Review of the New Zealand Commerce Commission's Draft Decisions and Reasons for Electricity Distribution Services and Gas Pipeline Services," (July 2010)

[14] Commerce Commission, "Consolidated Input Methodologies," (April 2011), section 9

[15] A recent study of electricity consumers in New South Wales, Australia found that overall willingness to pay for more reliable electricity service was relatively similar across different customer groups. See Morrison and Nalder (2009), "Willingness to Pay for Improved Quality of Electricity Supply Across Business Type and Location", *The Energy Journal*, Vol. 30, No. 2, 117.

operating expenditure and capital expenditure to reduce the prospect of distortionary trade-offs being made by suppliers. However, this has not happened because the AER is unable to differentiate between capital expenditure efficiencies and deferrals.[16] Similarly, the different incentives that apply to water suppliers in the United Kingdom for operating and capital expenditures continue to create the potential for distortions. In that sector, suppliers are rewarded for closing part of the gap between their own performance and the most efficient firm—potentially making suppliers previously classified as less operationally efficient, more likely to direct their spending towards capital.

Cutting-edge regulatory approaches set prices based on total expenditure

The clearest evidence on the ability for suppliers to trade-off operating and capital expenditures comes from the electricity distribution sector in the United Kingdom. Operating efficiency improvements in the sector during the 1990s gave rise to concerns that suppliers were in fact substituting capital expenditure for operating expenditure to increase their returns.

The regulatory system originally treated these different expenditures quite differently. Suppliers' capital expenditure proposals were scrutinised by the regulator (and its consultants) and generally reduced to show the value of the regulatory review. In contrast, operating expenditure was set with reference to efficient industry benchmarks.

The different treatment of operating and capital expenditure gave rise to concerns at Ofgem that suppliers would gradually increase their capital expenditures (and consequently their regulatory asset base), while at the same time reducing their operating expenditure levels. These concerns were amplified when all 14 suppliers asked for substantial increases in capital expenditure in DPCR4 (2005-2010)—company forecasts for required capital expenditure in DPCR4 were 49 percent higher than what had been spent throughout DPCR3.[17]

To address this concern, in DPCR5 (2010-2015) Ofgem eliminated any distinction between capital and operating expenditure under an approach known as the Information Quality Incentive (IQI). The IQI combines both sets of costs into one pot, with 15 percent of the pot treated as "fast" money (like operating expenditure) and 85 percent treated as "slow" money (like capital expenditure). The same incentive rate is applied to this total expenditure forecast, using the sliding-scale approach adopted in DPCR4 (2005-2010). The sliding scale allows companies to choose the power of incentive that best suits their business. This approach allows the companies to select:

- Lower expenditure forecasts with higher-powered incentives, allowing companies to retain a larger proportion of any under-spending, and
- Higher expenditure forecasts with lower-powered incentives, meaning that companies would be allowed to spend more but would retain a smaller proportion of the benefits of under-spending against forecasts.

Under the IQI, suppliers can choose to keep between 30-53 percent of any under-spending against total expenditure forecasts in present value terms. The companies have chosen incentive rates towards the higher end of the scale, and from 2010-2015 will keep between 45-51 percent of any efficiency gains achieved. This suggests that suppliers are confident about their ability to control costs, and expect to continue to achieve

[16] AER, "Final Decision: *Efficiency Benefit Sharing Scheme*," (June 2008), at page 10

[17] Ofgem, "Electricity Distribution Price Control Review Final Proposals," (2004) at page 84

efficiencies above the real operating cost reductions realised since incentive-based regulation was first introduced.

How does the evidence on balancing operating and capital cost incentives apply in New Zealand?

The Commission has acknowledged (as part of the process of setting information disclosure requirements) that a trade-off between operating and capital expenditure probably exists. In particular, the Commission appreciates that "a supplier that incurs higher opex in maintaining assets at a reasonable level may appear less efficient than another supplier that follows a strategy of minimising maintenance spend and then replacing assets (i.e. incurring relatively more capex, but less opex)".[18]

However, the input methodologies to date have not included any measures that respond to suppliers' ability to take advantage of this trade-off. Given this problem has not been solved in other countries that have more experience with incentive-based regulation (such as Australia), this is perhaps not surprising. However, in many respects the approach now used by Ofgem to forecast total costs and set price caps based on "fast" and "slow" money would be ideally suited to a DPP. By applying this approach, the Commission would need to set efficient total expenditure forecasts for each EDB, and then apply a consistent assumption across the industry on the timeframe for recovering those total costs.

[18] Commerce Commission, "Information Disclosure: Approaches for Understanding EDB and GPB Efficiency," (October 2011), Section 5.

4 The Time-consistency of Incentives: Achieving Stable Incentives

Maintaining consistent incentives throughout the regulatory period ensures regulated suppliers' decisions are not distorted to better fit with regulatory timeframes. From the perspective of long-run efficiency, a five-year regulatory period is artificial and arbitrary. Supplier decisions that are designed specifically to exploit variations in the incentives that apply at different points in the regulatory period will not necessarily be in the long-term interests of consumers. The evidence from overseas clearly shows that regulated suppliers act differently when the strength of regulatory incentives change within and between regulatory periods.

The solution to this problem is relatively simple: apply rolling incentive mechanisms to maintain constant incentives. Dr. Michael Pollitt's comments on the Commission's December 2010 Input Methodologies clearly support this approach:[19]

> *The introduction of a rolling incentive mechanism to avoid distortions in the strength of the incentive across a price control period is very important. The absence of such a mechanism skews cost reduction initiatives to the early years of the price control (and raises certain input costs if all regulated companies make investments in the same year) and results in declining incentive power as the end of the price control period approaches.*

The power of incentives has changed over time beyond a simple RPI-X approach, and real operating costs have continued to fall

As described above, the "classic" RPI-X approach provides incentives through the ability of suppliers to retain any differences between forecast and actual costs until the next regulatory price review. Regulators in the United Kingdom and Australia have had several opportunities to consider whether this incentive alone is sufficient to achieve their regulatory objectives. Four price reviews have been completed in the United Kingdom electricity sector (DPCR2-5), and three have been completed in Australia. At each review, these regulators have adjusted the ability for regulated suppliers to earn more by improving their efficiency. Although these regular changes are not ideal from the standpoint of regulatory predictability, regulators were clearly convinced of the need to change.

In Victoria, the major addition to the treatment of efficiency gains beyond RPI-X is the Efficiency Carryover Mechanism (ECM) (the forerunner to the Australia-wide Efficient Benefit Sharing Scheme (EBSS)). The ECM was introduced in 2001 and allows regulated suppliers to retain the benefits of efficiency gains in part of the next regulatory period, extending the period of time available to suppliers to repay their efforts to improve efficiency. This mechanism applies to cost overruns as well as cost savings. This means that if a business has a negative carryover amount (actual costs in any year were greater than forecast), this amount is applied to the revenue requirement in the next price determination. This strengthens supplier's incentives to beat cost forecasts because any over-spending reduces future profits.

The AER has explicitly considered what it believes to be a reasonable reward for improving efficiency when finalising the designing of the EBSS. Applying the same approach as the Essential Services Commission (ESC), the AER allowed the distribution

[19] Pollitt, 'Input Methodologies: Expert Review of the New Zealand Commerce Commission's Draft Decisions and Reasons for Electricity Distribution Services and Gas Pipeline Services," (July 2010)

business to retain 30 percent of the benefits of efficiency gains and consumers to obtain the remaining 70 percent—this is based on the calculation that at a real discount rate of 6 percent, the NPV of years one to five is approximately 30 percent of the NPV to infinity. While there is room for debate about whether an incentive rate of 30 percent is in fact sufficient, the AER's explicit statement on the level of incentives built into the regime helps to focus this debate.

The real operating expenditures incurred by Victorian distribution businesses have fallen by around 16 percent per unit of electricity distributed—from A$0.013/kWh in 1996 to A$0.011/kWh in 2009. With 70 percent of total savings passed to customers under the ECM and EBSS, the present value of the savings to customers over this period is estimated at around A$375 million (using a real discount rate of 6 percent). Given the operational challenges faced by some of the distributors in dealing with more frequent extreme weather events and the impacts of bushfires, these results are even more impressive than they first appear.

Similar trends have been observed in the United Kingdom electricity distribution and water sectors. As mentioned above, incentive rates are made explicit in the United Kingdom electricity sector through the application of a sliding scale. The incentive rates are now much higher than found in Australia—having increased from between 20-40 percent in DPCR4 to 30-53 percent in DPCR5. In the water sector, rolling incentives are applied for operating efficiency improvements relative to the benchmark of the most efficient firm in the sector. The rolling incentive scheme was introduced in the 1999 price review, and recently enhanced to allow the most efficient suppliers to retain efficiency gains for an extra year (a total of six years). Several studies of the United Kingdom regulatory approaches find a relationship between operating efficiency gains and regulatory incentives. The clear consensus that emerges from these studies is that stronger incentives have caused suppliers to seek out efficiencies, enabling costs to be contained and providing benefits for consumers.[20]

The evidence clearly points to the need for time-consistent incentives

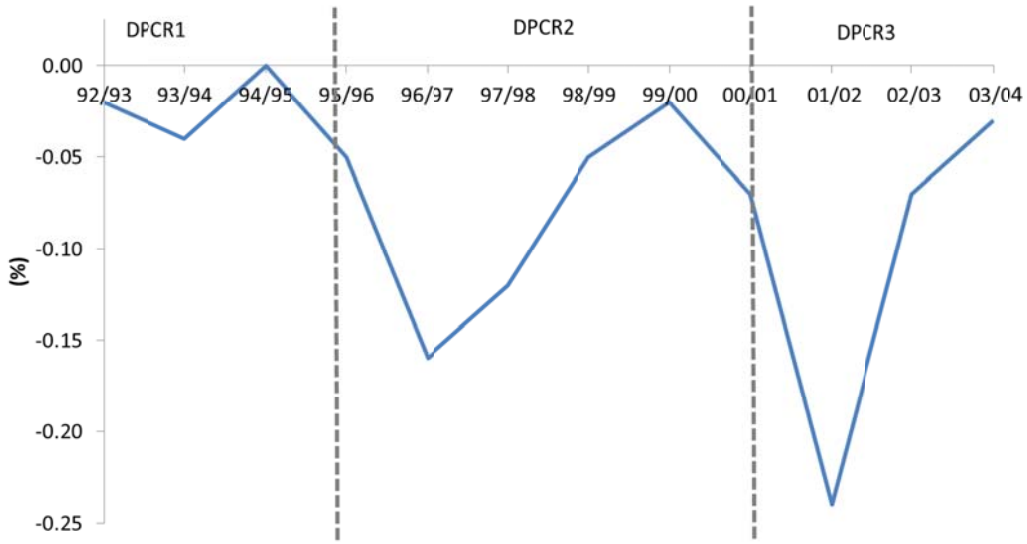
Until 2005, operating expenditure allowances for United Kingdom electricity distribution companies were set without regard to how the strength of incentives changed over the regulatory period. Unlike in Victoria and the United Kingdom water sector—where efficiency carryovers and rolling incentives maintain constant incentives in each year—the benefits distribution businesses received from achieving efficiency gains weakened over the course of the regulatory period.

The evidence clearly shows that suppliers responded to the changing strength of regulatory incentives by seeking out efficiency gains in the early years of the regulatory period, and deferring efficiency gains that could have been achieved in the later years. Figure 4.1 plots the change in real operating expenditure for distribution businesses in the United Kingdom from 1992 until 2003 (this issue was resolved in 2005). This shows that the level of cost reductions achieved in the year following the price review was significantly higher than other years, and that cost reductions gradually trail off until the next price review.

[20] Jamasb and Pollitt, "Incentive Regulation of Electricity Distribution Networks: Lessons of Experience from Britain," *Energy Policy* 35, (2007); and Cave, "Independent Review of Competition and Innovation in Water Markets: Final Report" (April 2009).

This behaviour is predicted as a matter of financial theory, and is starkly borne out in practice. Turvey (2004)[21] shows that this behaviour is commercially rational when suppliers face a decision on when to spend money to save on operating expenditures—a capital investment of $100,000 to save $7,000 per annum would only be viable in the first year of the price control period (assuming a discount rate of 6.5 percent and an asset life of 33 years).[22]

Figure 4.1: Growth in Real Unit Operating Expenditure (UK Distribution)



Source: Handbook of Economic Regulation (2006), Figure 8.3

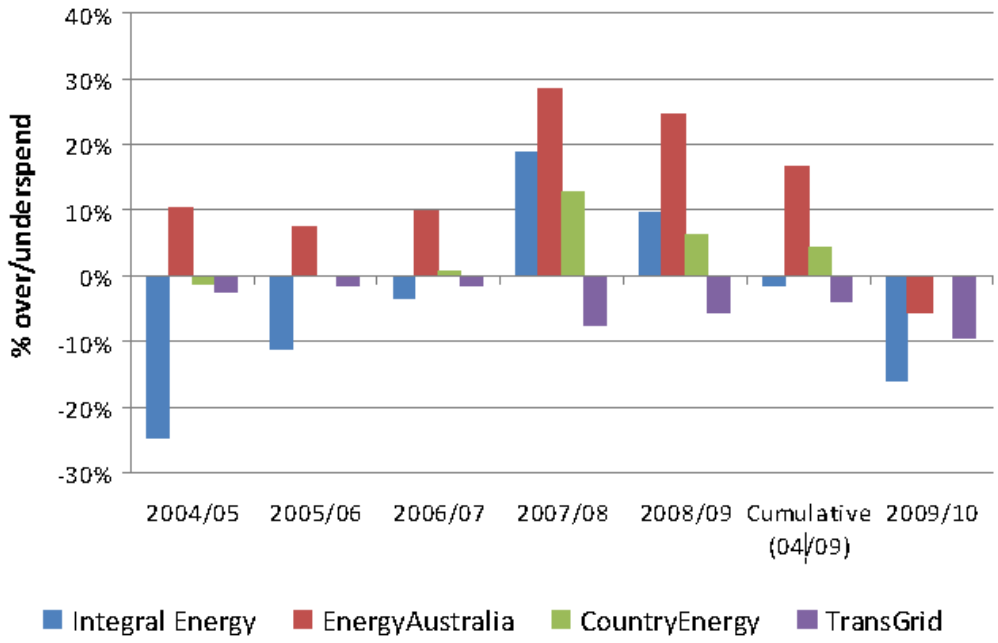
Price regulation in other countries has generated results similar to those shown in Figure 4.1 for the United Kingdom. Di Tella and Dyke (2002) investigated the changing costs incurred by distribution businesses in Chile, and found that strong initial cost reductions achieved soon after regulatory reviews were reversed later in the regulatory period. The authors explain these changes as responding to both the declining reward for efficiency over the regulatory period under RPI-X, and because the later years were used as the base-year to reset prices for the next regulatory period. This meant that cost changes in Chile had the same U-shape observed in the United Kingdom.

The same trend is seen in the behaviour of electricity distribution utilities in New South Wales (NSW), Australia from 2004-2009. Figure 4.2 shows that overspending of operating expenditure compared to the maximum allowed revenue trended up over the previous regulatory period (except for TransGrid, the transmission company). For example, Integral Energy spent around 12 percent less than its allowance in the first three years of the regulatory period and 15 percent more than its allowance in the last two years of the regulatory period.

[21] Turvey, "Price Control of Electricity Distribution Networks," *LBS Regulation Initiative Working Paper Series*, No 51, (2003)

[22] Vector's stylised example yields similar results: Vector, "Submission to the Commerce Commission on the Setting of Starting Pricings for Gas Pipeline Businesses under the Initial Default Price-Quality Path," (28 September 2011), at pages 23-27.

Figure 4.2: Comparison of Actual and Forecast Operating Expenditure in NSW



Source: Industry and Investment NSW, "NSW Electricity Network and Prices Inquiry" (2010)

Note: TransGrid is the NSW transmission business. Integral Energy, Energy Australia, and Country Energy are all distribution businesses

NSW distribution companies no longer face varying incentives because the AER EBSS has applied from 1 July 2009.[23] In 2009/10 (the first year of the current regulatory period), all suppliers have spent less than their operating expenditure allowance.

How does the evidence on time-consistent incentives apply in New Zealand?

The Commerce Commission has not explicitly considered the power of incentives that regulated suppliers will face through the application of the input methodologies. The Commission has previously proposed not to incorporate rolling incentives into the DPP (although rolling incentives are built into the Customised Price-quality Path). The Commission's reasoning for this approach was that the DPP was not based on supplier specific forecasts of operating expenditure, providing no confidence that cost reductions could properly be classified as efficiency gains.

If all efficiency gains are shared with customers at the end of each regulatory period, then the actual incentive power facing regulated suppliers in New Zealand under the DPP will vary over time. Assuming a WACC of 8 percent, the incentive rate will fall from 36.1 percent on the first day of the regulatory period to zero on the last day of the regulatory period.[24] Based on the evidence presented above, such an approach is likely to distort operating and investment decisions. Even costless efficiency gains would be deferred by a rational profit maximising business until the next regulatory period, unless they were identified towards the beginning of the regulatory period.

[23] AER, "New South Wales Draft Distribution Determination 2009-10 to 2013-14" (November 2008). See http://www.aer.gov.au/content/item.phtml?itemId=723824&nodeId=1da17c2b79d0464144fd898e3920196c&fn=NSW+DNSPs+draft+decisions.pdf

[24] Vector, "Submission to the Commerce Commission on the Setting of Starting Pricings for Gas Pipeline Businesses under the Initial Default Price-Quality Path," (28 September 2011)

The evidence provides strong support for the Commission to incorporate a rolling incentive scheme into the DPP to ensure stable incentives for efficiency. Without time-consistent incentives, regulated suppliers will use the variation in incentives to invest in ways that might not be consistent with the long term interests of consumers.

The evidence also suggests that stronger incentives are warranted, with regulators like Ofgem consistently increasing the power of incentives over time. The Commission should explicitly consider what proportion of efficiency should be retained by suppliers to provide strong incentives to improve efficiency. The regulatory settings could then be developed to provide those incentives. For example, applying a "stagger" approach to sharing the benefits of efficiency gains with consumers (instead of removing the benefit of efficiency gains from regulated suppliers in a single price adjustment at the end of each regulatory period), the Commission would clearly increase suppliers' expected returns from efficiency improvements.[25]

[25] Vector, "Submission to the Commerce Commission on the Setting of Starting Pricings for Gas Pipeline Businesses under the Initial Default Price-Quality Path," (28 September 2011), at pages 23-7; and Castalia, "Additional Input Methodologies for Default Price-Quality Paths," *Report to the Commerce Commission on behalf of PowerCo*, January 2012.

5 Incentives to Invest and Innovate: Achieving Targeted Incentives

The Commission is required to provide incentives for investment and innovation under sections 52A(1)(a) and 54Q of the Commerce Act. Providing investment incentives is particularly challenging for regulators because the information available to regulators will never enable proper scrutiny of investment decisions. In this section, we follow three steps to provide a framework for making decisions on investment incentives in the input methodologies:

- We examine how investment decisions are made in workably competitive markets, and in particular how the risk profile of different types of investment affects expected returns (Section 5.1).
- We evaluate how incentive-based regulation changes the way investment decisions are made, and how regulatory efforts to provide discipline on capital spending can lead to very weak incentives for innovative or non-conventional investment (Section 5.2)
- We describe how regulators overseas have overcome these challenges, using two specific investments as examples of how regulatory design can be targeted towards providing the incentives needed to invest (Section 5.3).

In workably competitive markets, different types of investment face different risks, and therefore have different expected rates of return (also known as hurdle rates). The greater the risks that a type of investment faces, the higher the returns needed to attract capital to that type of investment.

In regulated industries, regulatory settings dictate the rate of return suppliers will be able to earn on their investments. When assets are not rolled into the regulatory asset base (RAB)—for example, if the investments only result in "non-identifiable" assets—then returns are equal to the benefits retained by regulated suppliers. When assets are rolled into the RAB, then suppliers earn a return based on WACC. Regulators need to explicitly consider whether these levels of returns are sufficient to encourage efficient investments to occur. The "classic" RPI-X framework generally addresses the difficulties in balancing the risk-return profile for core business assets (such as poles and wires), and incentivises efficient capital spending. However, getting the incentives right for spending on non-conventional assets (such as those listed in section 54Q of the Commerce Act) is more challenging.

Overseas regulators have recognised RPI-X does not always provide the necessary strength of incentive required for investment in innovative or non-conventional assets. For example, Ofgem noted that the ratio of research and development (R&D) expenditure to revenues was less than 0.1 percent for electricity distribution companies from 2001-03, compared with an average across all sectors in the United Kingdom of 2.5 percent).[26] This is because the assets resulting from innovation have a fundamentally different risk-return profile to more "business-as-usual" capital assets that are reflected in existing supplier RABs. Regulators have then developed specific incentive mechanisms to share risks between business and customers. In doing so, the risk profile for non-conventional assets facing regulated suppliers becomes more in-line with the returns governed by the regulated WACC.

[26] Ofgem, "Regulatory Impact Assessment for Registered Power Zones and the Innovation Funding Incentive," (March 2004).

Evidence on the performance of these incentive mechanisms shows why the approaches adopted overseas work. We explore the need for targeted investment incentives in relation to two non-conventional investments that could be made to reduce the costs of providing network services. We show that distribution companies overseas have responded to incentive schemes by investing in these assets, with customers ultimately benefiting from the efficiency gains.

5.1 Impacts of the Risk Profile of Different Capital Investments

The financial risks of an investment determine the return required from the investment. Financial pricing models, such as the Capital Asset Pricing Model (CAPM), underpin financial theory by making theoretical predictions for the risk-return of different assets. CAPM predicts that the risk premium applicable to any investment is a linear function of the risk premium on the market portfolio. In other words, CAPM predicts that an investment that is more risky than the market portfolio ($\beta>1$) would need a higher return to compensate for the increased risk.

The approximate return required on an investment is also equal to the cost of raising capital from creditors and equity investors—the weighted average cost of capital (WACC). WACC reflects the opportunity cost of making an investment—that is, the return that could have been made on an alternative investment with similar risks. Therefore, riskier investments have a higher WACC, with the valuation of the investment based on the WACC. If the WACC does not reflect the risk of the investment, then distortions in investment can occur. For example, if the WACC used in determining the net present value of an investment does not adequately price all the risks of the investment, then over-investment can occur because the net present value is overstated.

Higher risk investments need to be compensated through higher returns

Distribution investments (electricity and gas) have a relatively low-risk profile, reflecting that investments generally result in well-understood assets with known benefits. In general, the financial characteristics of conventional electricity distribution assets include:

- Stable and predictable cash flows
- Long-term income streams
- Returns that are relatively insensitive to fluctuations in the business cycle
- Low default rates
- Low correlation with other asset classes (offering investors greater potential for diversification).

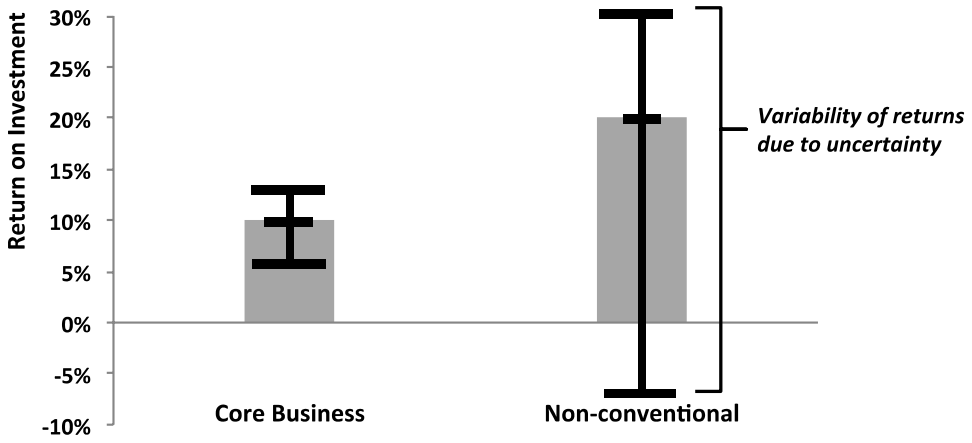
Distribution companies also have the ability to invest in non-conventional assets. In a workably competitive market, these riskier investments would have higher expected returns, but would also carry downside risks that might result in loss of value for shareholders. Non-conventional investments do not share the financial characteristics of "business-as-usual" investments. For example, investments in R&D could deliver significant operational cost savings that could then be passed through to customers. However, R&D investments face a higher level of uncertainty about factors such as.

- **The realisation of project benefits**—Innovative investments face greater uncertainty that the private benefits predicted in a business case will materialise. The promised benefits have generally not been revealed through a track-record of successful projects, and there is an added risk that the project will be abandoned.

- **Cost over-runs**—Innovative investments are at greater risk of exceeding initial budget estimates than well-understood investments. This is due to a number of factors, including unforeseen costs in technology development and innovation "dead ends".

The expected returns and the probability distribution of those returns are important to investors when assessing whether to proceed with an investment. The additional risks facing non-conventional investment mean that the investment upside would need to provide high enough returns or high enough cost savings to compensate for these downside risks. This point is illustrated in Figure 5.1. Core business investment has far less uncertainty in returns than non-conventional investment. However, the greater expected returns and high upside potential from non-conventional investments can provide benefits that far exceed those in the core business. Non-conventional investment also faces the risk of losses if fewer benefits are realized and/or costs are higher than expected.[27]

Figure 5.1: Illustration of Uncertainty of Returns for Different Investment Types



5.2 Regulatory Barriers to Innovation and Investment

As discussed above, certain non-conventional investments will have the potential to provide greater expected returns than core business investment. Regulators overseas have increasingly focused on ensuring regulatory settings do not impose barriers to innovation and investment by asking why non-conventional investment does not occur as expected under a classic RPI-X framework. Regulators have identified barriers within the classic RPI-X framework that lead to weak incentives for distribution companies to undertake innovative investment.

[27] Recent research has explored the implications of using a single WACC to evaluate all investment options facing a company, see Kruger, P et. Al., "The WACC Fallacy: The Real Effects of Using a Unique Discount Rate," (February 2011). This investment appraisal approach gives rise to what is known as the WACC Fallacy, which leads companies that use a single hurdle rate to over-investment in higher-risk assets. The WACC fallacy occurs if a company decides to invest in assets that are not valued at the project risk-adjusted WACC, and instead uses an average company WACC (which includes the risk profile of less risky investments). The valuation analysis completed under this approach will result in a higher NPV for more risky projects because of the lower company WACC (when compared to the actual WACC of the investment). For the reasons discussed in Section 5.2, regulatory settings under RPI-X overcome the problem of the WACC fallacy as returns for more risky investments are constrained in other ways, but this introduces new barriers for innovation and investment.

The main focus of RPI-X regulation is to allow regulated suppliers to make a risk-adjusted financial return on their capital (known as financial capital maintenance). Any investments that are rolled into the RAB will earn a return equivalent to the WACC, and this return will decrease over time as the asset is depreciated.[28] The calculation of the regulated WACC in New Zealand (and elsewhere) reflects the investment risks in core business assets (such as poles and wires) that have a relatively low-risk profile.

The standard application of RPI-X can provide a disincentive to invest in non-conventional investments where suppliers retain the exposure to the downside risks of investment, but do not share in the upside benefits. The treatment of new investments in the RAB clearly matters. There are two scenarios that could occur:

- **The investment does not get rolled into regulatory asset base**—If the investment is not rolled into the RAB then it cannot make a regulated return. For example, if an investment in R&D does not result in an identifiable non-monetary asset, then it would not be part of the regulated asset base.[29] Instead, the investment in R&D would need to cover costs through efficiency gains. The incentives described in Sections 3 and 4 of this report would drive the decision to invest, or not.
- **The costs of the investment are rolled into the regulatory asset base**—If the costs of constructing the asset are rolled into the RAB, the asset will earn a return equal to the regulated WACC. Even in this scenario, the length of time that non-conventional assets remain in the RAB may create a disincentive depending on how the asset is depreciated. For example, innovative investments may be depreciated over a shorter period than core business assets due to the likelihood of technological obsolescence.

Investment in innovation is inherently risky and the standard RPI-X framework alone does not incentivise high levels of innovation. There is a higher probability that the private benefits from innovation could be less than expected and/or costs are greater than estimated, resulting in significant downside risks for investors. Unless the upside benefits can also be captured—as opposed to, at best, a regulated WACC—then investment will not be financially viable.

5.3 Evidence on Overcoming Regulatory Barriers to Innovation and Investment

Overseas regulators have recognised that the standard RPI-X framework is unlikely to encourage investment in innovation. To address this issue, regulators have developed specific incentive mechanisms that share the risks between regulated suppliers and customers. In doing so, the risk profile for non-conventional assets becomes more in-line with the returns governed by the regulated WACC. These incentive mechanisms have proven successful in motivating regulated suppliers to innovate and invest.

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[28] Distribution companies can actually earn a return either greater, or less than, the regulated WACC. This depends on how closely aligned the capital and operational expenditure are with respect to the estimates at the beginning of the regulatory period.

[29] Commerce Commission, "Decision No. 710: Electricity Distribution Services Input Methodologies Determination," (2010). "Identifiable non-monetary asset" is defined in the New Zealand Generally Accepted Accounting Principles as when it is separable, i.e. capable of being separated or divided from the entity and sold, transferred, licensed, rented or exchanged, either individually or together with a related contract, asset or liability, or it arises from contractual or other legal rights, regardless of whether those rights are transferable or separable from the entity or from other rights and obligations.

The following real examples test whether investments would take place under a general RPI-X scheme, and therefore whether the incentives introduced overseas are truly needed to motivate investment. In both cases, the investments offer efficiency gains in excess of core business investment and are therefore desirable from the perspective of customers.

Investing in technology to improve network diagnostics (cable fault sniffers)

Ofgem wanted to provide incentives for regulated entities to invest in R&D. Acknowledging the role R&D plays in competitive industries, Ofgem recognised the need for R&D for continual network improvement, and to enable a low carbon network. As noted at the beginning of Section 5, R&D intensity for distribution companies was less than 0.1 percent in 2001-02 and 2002-03.

An example of the type of R&D Ofgem wanted to stimulate is rapid fault location through the development of a cable fault sniffer.[30] Cable fault sniffers decrease the time to locate faults on underground low voltage cables, offering operating cost savings for the company, and better service quality levels for the customer through a reduction in customer minutes lost. They work by sensing gases emitted when the cable insulation starts to break down under fault conditions. A significant advantage over traditional fault locators is customers can remain connected to the supply while the fault is located.

If all efficiency benefits were retained by the distribution company, the cable fault sniffer would have an expected internal rate of return (IRR) of 15 percent. However, given the current regulatory conditions, the distribution company could only retain the benefits for the length of the five-year price control period (i.e. this will not be rolled into the RAB). With this regulatory barrier, the IRR would be 4 percent, less than the WACC applied in the United Kingdom of 4.7 percent. Therefore, this investment would not go ahead. Figure 5.2 illustrates the cash flows for the cable fault sniffer project.

Figure 5.2: Cash Flows for Cable Fault Sniffer Project

WACC	%	4.7%											
Average Inflation	%	2.5%		IRR (All benefits)	15%								
Unit Production Cost	£	5000		IRR (5 year)	4%								
Estimated Application	Faults/yr	2500		NPV (All benefits)	456,555								
Use Rate	%	80%		NPV (5 year)	(13,742)								
Opex saving	£/fault	750											
R&D Probability	%	10%											
	Year		1-7	8	9	10	11	12	13	14	15	16	17
Fault cost savings	£		-	150,015	153,829	157,741	161,752	165,865	170,082	174,407	178,841	183,389	188,052
Revenue	**£**		**-**	**150,015**	**153,829**	**157,741**	**161,752**	**165,865**	**170,082**	**174,407**	**178,841**	**183,389**	**188,052**
Expenses													
R&D	£		(154,980)										
Production Cost	£			(525,000)									
Total Expenses	**£**		**(154,980)**	**(525,000)**									
Cashflow before financing	**£**		**(154,980)**	**(374,985)**	**153,829**	**157,741**	**161,752**	**165,865**	**170,082**	**174,407**	**178,841**	**183,389**	**188,052**

Source: Castalia analysis based on Ofgem (2004) "Regulatory Impact Assessment for Registered Power Zones and the Innovation Funding Incentive"

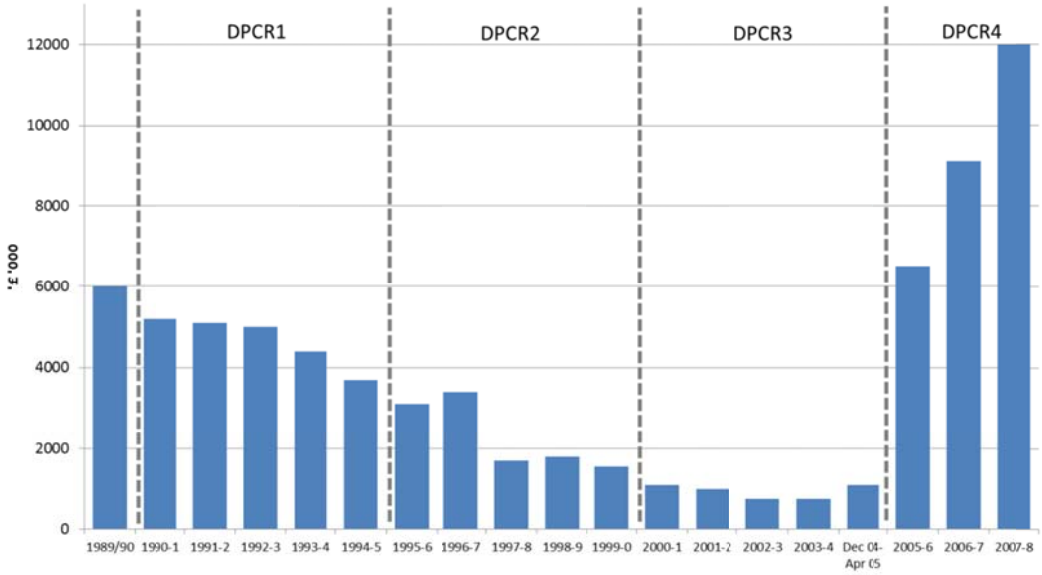
To provide an incentive to R&D investments like the cable fault sniffer, Ofgem introduced the Innovation Funding Incentive (IFI) in DPCR4. The IFI is intended to provide funding for projects focused on the technical development of distribution networks to deliver value (i.e. financial, supply quality, environmental, safety) to end consumers. The IFI works by funding eligible R&D projects by 80 percent, with the remaining 20 percent funded by the distribution company. This ensures the company is

[30] This example was described by Ofgem in the "Regulatory Impact Assessment for Registered Power Zones and the Innovation Funding Incentive" paper, for Ofgem's proposed DPCR4 R&D policy.

incentivized to undertake the R&D investment, while still adhering to the five-year regulatory time-frame under which they can capture the benefits.

The effect of IFI is clearly visible in Figure 5.3, which shows the trend of declining research and development expenditures throughout DPCR1-3 was dramatically reversed after the incentive took effect. This trend is related to the problem identified in Section 3 of this report—unless the regulator explicitly provides incentives to change behaviour, then suppliers will look for opportunities to reduce costs under a classic RPI-X approach. R&D is one area where cost-cutting is relatively simple, even though it may not be in the long term interests of the supplier and consumers.

Figure 5.3: R&D in the UK Electricity Distribution Sector



Source: "Regulatory Impact Assessment for Registered Power Zones and the Innovation Funding Incentive," (March 2004)

If IFI funding was applied to the cable fault sniffer project, the IRR would be increased to 15 percent if the distribution company retained the benefits for five years. Given the WACC is 4.7 percent, the distribution company would be highly incentivised to invest in this project. In fact, the United Kingdom has seen significant investment in cable fault sniffers since the IFI was put in place.

Investing in technology trials to facilitate efficient connection of distributed generation (BRISTOL)

The British Government has introduced policy to decarbonise energy use. This policy objective has provided the support for Ofgem to consider the role that distribution networks play in fulfilling 2020 Climate Change targets.[31] Ofgem recognised that distribution companies can take action to reduce their own carbon footprint, but are also an enabler for low carbon and energy saving developments to connect to their network. However, Ofgem also noted that trialling innovative solutions involves an element of risk in that the costs, benefits, and impacts of projects are not fully understood—and distribution companies may not act under the normal regulatory framework.

[31] Ofgem, "Electricity Distribution Price Control Review: Final Proposals," (7 December 2009).

The type of project trials Ofgem wanted distribution companies to undertake is exemplified in Western Power Distribution's (WPD) BRISTOL project. BRISTOL aims to trial ways to efficiently facilitate connection of low carbon distributed generation. The trials included the integration of photovoltaics, battery storage, demand response, direct current circuits, and variable tariffs; with trials taking place in residential, school, and commercial settings. This allows WPD to gain experience with new technologies to provide power system stability, as opposed to traditional network reinforcement techniques. The expected benefit is decreases in network reinforcement costs for integrating a high penetration of distributed generation.

If all efficiency benefits are retained by the distribution company, BRISTOL would have an expected IRR of 11 percent. However, if the benefits of the investment are only retained for the five-year regulatory period, the investment would have a negative IRR of -16 percent and would no longer be viable. Figure 5.4 illustrates the cash flows for the BRISTOL project.

Figure 5.4: Cash Flows for BRISTOL Project

WACC	%	4.7%	IRR (All benefits)	10.7%	
Inflation	%	2.5%	IRR (5 year)	-16%	
Network Savings	£/Substation	14,820	NPV (all benefits)	1,878,647	
Microgen Size	kWe	60	NPV (5 year)	(1,541,847)	

	Year	1	2	3	4	5	6	7	8	9	---	19	20
Estimated Locations GB	#	-	-	-	-	40	60	80	100	120	---	200	200
Estimated Locations WPD	#	-	-	-	-	7	10	13	17	20	---	33	33
Savings per Year	£	-	-	-	-	103,740	148,200	192,660	251,940	296,400	---	489,060	489,060
Revenue	£	-	-	-	-	**103,740**	**151,905**	**202,413**	**271,312**	**327,170**	---	**691,029**	**708,305**
Expenses													
Equipment	£	-	(529,600)	(104,570)	(6,000)								
Contractors & Labour	£	(63,000)	(559,570)	(563,870)	(419,470)								
User Payments	£	-	(131,130)	(33,350)	(6,000)								
Other	£	(2,450)	(44,790)	(24,120)	(16,040)								
Total Expenses	**£**	**(65,450)**	**(1,265,090)**	**(725,910)**	**(447,510)**						---		
Cashflow before financing	**£**	**(65,450)**	**(1,265,090)**	**(725,910)**	**(447,510)**	**103,740**	**151,905**	**202,413**	**271,312**	**327,170**	---	**691,029**	**708,305**

Source: Castalia analysis based on WPD (2011). "Low Carbon Networks Fund Submission"

For the purposes of this illustration, we have also assumed the BRISTOL project could be rolled into the RAB for five-years. That is, due to the nature of the asset the BRISTOL project is depreciated over a relatively short five-year period. In this scenario, the project would be added to the RAB at cost—which in this case is £2.5 million. The project would then earn a return equal to the regulated WACC of 4.7 percent per year. Assuming that the project would also retain efficiency benefits for five years, the expected IRR would be -9 percent. Therefore, a company would still not invest in this project.

To incentivise investment to decarbonise the energy sector, Ofgem introduced the Low Carbon Networks fund (LCN fund) in DPCR5. The £500 million LCN fund is intended to allow distribution companies to run trials to gain experience with new technology, commercial, and network operating arrangements that they should put in place. The LCN fund works to incentivise trials by funding eligible projects by 90 percent, with the remaining 10 percent funded by the distribution company. Funding is allocated in three ways: £16 million of annual funding is allocated across all companies for small projects that meet LCN objectives; £64 million of annual funding is competitively tendered for larger flagship projects; and £100 million of discretionary award funding is available to projects that have best met criteria, imitating the commercial benefits of innovation.

In the 2011 competitive tender, the BRISTOL project was awarded 90 percent funding through the LCN fund. This boosted the expected IRR of the project to 36 percent,

assuming WPD kept project benefits for the five-year regulatory period. WPD have now undertaken this project.

The LCN fund has proved successful to date. The BRISTOL project is one out of ten projects that have been awarded funding from the competitive bidding rounds. These projects represent £61.7 and £56.8 million (out of £64 million annually) for 2010 and 2011 respectively.

5.4 How Does the Evidence on Investment and Innovation Incentives Apply in New Zealand?

The evidence presented above suggests the Commission should acknowledge that certain investments have a different risk-return profile to the "business-as-usual" capital assets reflected in existing supplier RABs. Failing to appreciate the distinction between the risk profile of different investments will reduce the already weak incentive to invest in risky projects with long-term pay-offs, such as those associated with energy efficiency.

Some of the regulatory approaches discussed in Section 4 (such as staggering the sharing of benefits between suppliers and customers) would increase investment incentives. The Commission could also provide alternative sources of funding for non-conventional investments by allowing regulated suppliers to recover cost overruns or lower benefits realised from their customers. For higher risk assets that will not enter the RAB (potentially including R&D), this will help suppliers justify investment based on having to earn lower rates of return than would otherwise be required.

6 The Impact of Incentives on Rates of Return

The Commission has previously proposed to adjust prices so that the forecast returns earned by all companies equals the Commission's 75th percentile estimate of industry WACC.[32] This approach of strictly setting returns to estimated WACC would make the New Zealand regulatory regime quite different from the orthodox regulatory approaches used in the United Kingdom and Australia—where rates of return are expected to vary across companies.

The evidence from overseas points to two key elements in the regulatory treatment of suppliers' returns:

- **Regulators expect companies to earn different rates of return than the estimate of industry-wide WACC.** The practical effect of incentive schemes (such as rolling incentives) is that suppliers will earn more than their cost of capital when their performance has exceeded forecasts.
- **Suppliers' actual returns will differ from the regulator's expectations, due to their actual performance.** Suppliers that outperform regulatory expectations of efficiency and service quality are able to increase their returns. This dynamic drives better industry performance over time, as superior management teams, governance arrangements, and ownership structures prevail for the overall benefit of consumers.

The Commission's previous draft determination on starting prices was clearly at odds with the first of these two elements—forecast company returns were all set at the same level. Although the Commission acknowledged that regulated suppliers would be able to increase their returns by beating forecasts of costs, the Commission's clear focus on eliminating "excessive" profits, and its definition of excessive profits as anything above WACC, risks operation of Part 4 as de facto rate of return regulation.[33]

Balanced, stable, targeted incentives should directly affect the returns earned by regulated suppliers. Good performance should be rewarded with higher rates of return, and poor performance should result in lower rates of return, on average. Although regulation cannot be expected to provide a perfect set of incentives that links all aspects of performance with profitability, the incentive approaches discussed in Sections 3-5 of this report all provide opportunities for regulated firm to increase their returns.

A clear link exists between performance and returns in Victoria

The clearest evidence on how performance impacts on returns under modern incentive-based regulation comes from Victoria, Australia.

As shown in Table 6.1, regulated suppliers in Victoria frequently earn profits that are above the regulator's estimate of WACC. In the 2001 price review, all distribution suppliers were expected to earn more than the WACC benchmark set by the regulator, and all suppliers generated even higher actual returns. The 2006 price review presents a more mixed picture of performance—with the regulator only expecting one company (United Energy) to earn more that the WACC benchmark. This stands in direct contrast

[32] Commerce Commission, "Input Methodologies (Electricity Distribution Services) Draft Reasons Paper," (June 2010)

[33] Commerce Commission, "Input Methodologies (Electricity Distribution Services) Draft Reasons Paper," (June 2010).

to the approach previously signalled by Commission, where the Commission's forecast of returns would equal the Commission's WACC determination.

Table 6.1: Returns Earned by Victorian Distributors (2001-2010)

	2001 Price Review (2001-2005)		2006 Price Review (2006-2010)	
	Forecast	**Actual**	**Forecast**	**Actual**
WACC Benchmark	6.8%		5.9%	
CitiPower	9.2%	11.9%	5.9%	8.9%
Powercor	8.5%	10.6%	5.3%	9.2%
SP Ausnet	8.4%	10.2%	5.5%	5.0%
Jemena	7.3%	8.9%	5.2%	8.6%
United Energy	7.7%	11.0%	6.2%	7.5%

Source: ESC Comparative Performance Reports 2005 and 2009

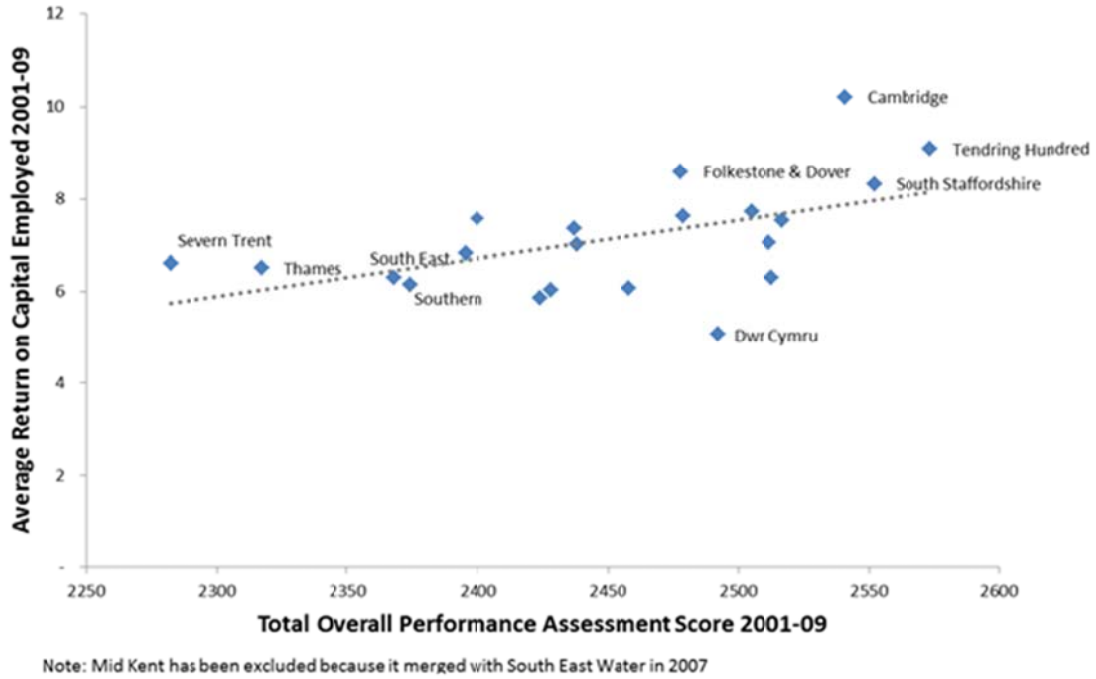
In fact, the only company that actually earned less than the regulator's WACC benchmark was SP Ausnet, with a rate of return of 5.0 percent. Almost half of the difference between the regulator's forecast returns and SP Ausnet's actual financial performance is explained by penalties of A$8.5 million paid by SP Ausnet in 2009 for breaching service quality targets.[34]

The regulation of water companies in the United Kingdom also links overall and financial performance

The regulation of water and sewerage companies in the United Kingdom also rewards strong overall service performance with higher returns on average. Figure 6.1 illustrates the relationship between performance (as measured by the Overall Performance Assessment (OPA)) and returns on capital employed. The three companies that have consistently achieved the highest OPA scores are Tendring Hundred, South Staffordshire, and Cambridge (these companies are labelled in Figure 6.1). These top performing companies have all earned average annual returns from 2001 to 2009 that are above 8 percent, and well above the industry average. In contrast, the poorest performing companies all earned average annual returns of less than 6.7 percent over the same period.

[34] By way of contrast, the supplier with the next highest level of penalties in 2009 (Powercor) only paid A$1.8 million in penalties.

Figure 6.1: Overall Performance and Returns for Water and Sewerage Companies in the United Kingdom, 2001 - 2009



Note: Mid Kent has been excluded because it merged with South East Water in 2007

Source: Ofwat, "Financial Performance and expenditure of the water companies in England and Wales" reports from 2005-06 and 2009-10; and Ofwat, 'Service and delivery – performance of the water companies in England and Wales" reports from 2001 to 2009

As well as earning higher returns for good performance within the current regulatory period, water companies in the United Kingdom are also rewarded with increased price limits in the next regulatory period. Ofwat provides positive financial incentives to the top performers by increasing the price limits for the following regulatory period by up to 0.5 percent. Poor performance is penalised by a reduction in price limits of up to 1 percent.

How does the evidence on rates of return apply in New Zealand?

The evidence on rates of return in regulatory systems overseas stands in direct contrast to the approach to adjusting starting prices previously signalled by the Commission. In its (now superseded) draft determination on staring price adjustments, the Commission proposed to set the forecast profitability for all companies equal to the Commission's 75th percentile estimate of industry WACC. The Commission stated that "if we did not reset the 2010-15 DPP, there would be significant disparities between the current and projected profitability of EDBs (paragraphs 2.24-2.25)."

As shown above, regulators overseas acknowledge that efficient suppliers will earn returns above their cost of capital for sustained periods due to superior strategy and execution. Other suppliers earn returns below their cost of capital for sustained periods, enduring debt write-downs, bankruptcies and takeovers. This dynamism of returns is precisely what drives the investment, innovation and efficiency in real competitive markets.

We have previously shown that in other markets that the Commission has judged to be workably competitive, rates of return differ substantially between companies and these

differences persist over many years.[35] Taking one industry, it is uncontroversial to assert that New Zealand's horticultural industry (growing and packing produce) is workably competitive.[36] The presence of several publicly listed companies in that industry (Satara, Seeka, and Turners & Growers) allows us to observe whether their rates of return in recent years have been the same, or even broadly similar. In fact, as shown in Table 6.2 we find that rates of return differ not only across the companies, but also vary from year to year within each company.

Table 6.2: Comparison of Rates of Return in a Competitive Market

	Satara	Seeka	Turners & Growers
2008	12.7%	8.7%	7.1%
2009	11.1%	11.7%	4.2%
2010	9.2%	10.1%	5.2%

Note: For this calculation, we use returns as earnings before interest, tax, amortisation and depreciation (EBITDA) as a proportion of total assets

Source: Company annual reports

Two important choices of regulatory design stem from an acknowledgement that returns should vary between suppliers in New Zealand's regulated industries:

- The objective of limiting the ability of suppliers to "extract excessive profits" in section 52A would not require the Commission to remove any expectation of above-WACC returns. As shown above, such an interpretation would be at odds with the experience in Australia, the United Kingdom, and in competitive markets in New Zealand.
- Practical measures to balance the objectives in section 52A can be developed. Allowing suppliers to earn a margin above the Commission's estimate of industry WACC would allow some headroom to enable the regulatory regime to reward good performance. Poor performance should also lead to lower returns, suggesting that applying a band around expected returns may be appropriate.

[35] Castalia, "Review of Draft Decision Paper for the 2010-15 Default Price-Quality Path for Electricity Distribution," *Report to Powerco,* (August 2011).

[36] The Commission has previously permitted industry consolidation in horticultural packaging and marketing industries—see for example Decision 251 (http://www.comcom.govt.nz/clearances-register/detail/251), 171 (http://www.comcom.govt.nz/clearances-register/detail/171).

7 Conclusion

Price-quality regulation aims to replicate workably competitive outcomes by balancing consumer interests in quality service with the need to apply pressure on supplier costs and investment decisions. Achieving this balance is complicated by the fact that regulated suppliers will always have better information than the regulator. The evidence from overseas highlights that "RPI-X" by itself does not address this information asymmetry. As a result, experienced regulators have built explicit incentives onto the foundation of RPI-X regulation to better align the financial incentives of suppliers with the interests of consumers.

The incentives that are commonly provided by regulators overseas fit well with the objectives of Part 4 of the Commerce Act to ensure regulated suppliers have incentives to invest, innovate, improve efficiency, and provide services at a quality that reflects consumer demands (section 52A(1)(a)-(b)). These incentive schemes also work in ways that meet the other objectives of Part 4, to share efficiency gains with consumers and limit the ability of suppliers to earn excessive profits (section 52A(1)(c)-(d)).

The research presented in this report aims to inform the Commission's thinking on how incentives are provided to regulated suppliers as part of price-quality regulation in New Zealand. The input methodologies completed by the Commission to date do not provide the balanced, stable, targeted incentives found overseas. This is clearly seen by contrasting the Commission's expectations of the returns regulated suppliers will earn, and the expectations of regulators overseas. The Commission has previously proposed to adjust starting prices to set the forecast returns of all suppliers equal to WACC. The incentives provided to suppliers in the United Kingdom and Australia mean forecast supplier returns vary depending on performance and often exceed the regulator's WACC determinations and rate of return expectations.

The incentives discussed in this report are given a level of prominence in the objectives of Part 4 that is yet to be reflected in the input methodologies. Most of the incentives discussed in this report could be applied through the SPA IMs currently being drafted by the Commission. The findings of this report clearly indicate the Commission needs to analyse what incentives suppliers will have under the input methodologies as a whole to improve efficiency, invest and innovate, and to incorporate additional measures where those incentives need to be strengthened.

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Appendix A. Victorian Electricity Distribution Networks

This case study evaluates the impact of regulatory incentives built into the economic regulation of Victorian electricity distributors from 1996 until 2010. We find that the regulatory framework has evolved from an initial reliance on the incentives inherent in the CPI-X approach to provide stronger incentives on distribution businesses to improve performance. This reflects the view of the Victorian regulator that regulatory incentives are an important determinant of the success of price-quality regulation, stating in 2004 that:

> *"The actual performance of the distributors to date tends to bear out the proposition that the incentives created by the regulatory framework are effective in encouraging distributors to achieve and reveal efficiencies"*[37]

One example of how Victoria has moved towards stronger incentives is in the treatment of operating expenditures. When price-quality regulation was first introduced in 1995, distribution businesses were only allowed to retain the benefits of any efficiency gains until the next regulatory review. This incentive was changed in 2001, and the businesses now retain the benefits of operating cost reductions they achieve into the next regulatory period under an explicit efficiency carryover scheme. More specific measures have also been developed to encourage quality of service improvements, through financial rewards for reducing network outages and financial penalties for failing to meet customer service standards.

Data on the performance of the distribution businesses from 1996-2009 show that the businesses have found ways to lower their costs, while improving reliability and service standards. While it is not possible to observe the outcomes that would have prevailed without the incentives in place, it is reasonable to conclude that the performance improvements are a response to the system of incentives in place in Victoria.

In this section, we describe the regulatory framework that has been applied to distribution businesses in Victoria, and the particular way that incentives have evolved over time. We separately consider the incentives for suppliers to improve operating efficiency, capital efficiency, and service quality, drawing on the analysis completed to make regulatory decisions and the available data on sector outcomes to evaluate the effect of incentives on costs and service levels.

A.1 Main Features of the Regulatory Approach

The five electricity distribution companies in Victoria (CitiPower, Powercor, SP AusNet, Jemena and United Energy) have been regulated since their privatisation in 1995. The experience with regulation can be divided into two distinct phases:

- **The classic CPI-X phase.** For the period from 1996 to 2000, immediately after the businesses were privatised, network tariffs were regulated by a legislated Tariff Order that set all network tariffs. The Tariff Order was based on a 'building blocks' model that contained the Government's estimates of the reasonable costs of service provision on each network. The Tariff Order was not released publically, but was available to the bidders that participated in the privatisation process. The Tariff Order had no incentive mechanisms beyond

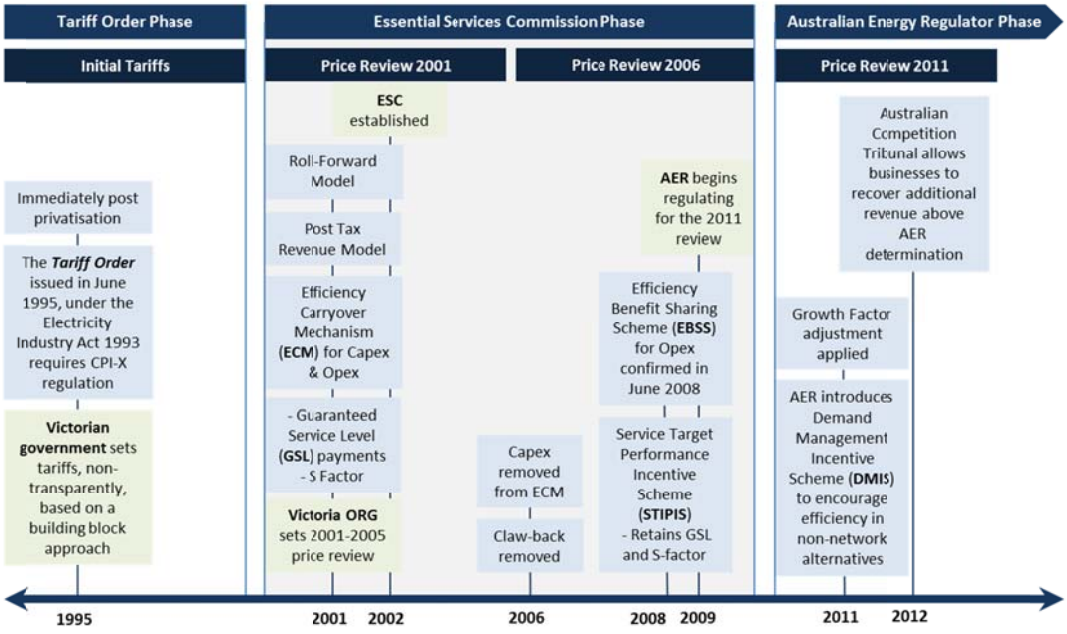
[37] Essential Services Commission, "Electricity Distribution Price Review 2006 Final Framework and Approach: Volume 1, Guidance Paper," (June 2004), at page 59.

the ability of suppliers to retain any difference between forecast costs and actual costs until the next regulatory price review in 2000—a classic CPI-X approach.

The targeted incentives phase. For the period from 2001 to 2010, the distribution businesses were regulated by the Victorian state regulator—the Essential Services Commission (ESC)—under a state-based regulatory framework. Specific incentives were introduced during this phase of regulation, including an efficiency carryover that allowed suppliers to retain any reductions in controllable costs in the following regulatory period. Service quality targets were also introduced that allowed the suppliers to increase their rates of return by improving quality in cost-effective ways. From 2011 onwards the distribution businesses have been regulated by the national energy regulator—the Australian Energy Regulator (AER) under a national electricity regulatory framework. The AER has incorporated elements of the previous Victorian approach into the national regulatory regime through the Efficiency Benefit Sharing Scheme (EBSS) and a Service Target Performance Incentive Scheme (STPIS).[38]

These two phases are shown in Figure A.1, which also identifies when specific incentive mechanisms were put in place and how they have been adjusted over time.

Figure A.1: Evolution of Price-Quality Regulation for in Victoria's Electricity Sector



A.2 Incentives for Operating Efficiency

Operating expenditures are equal to around one third of the costs of service for distribution businesses in Victoria. A substantial proportion of operating expenditures are strongly influenced by management decisions on how to provide the network services, how to use third-party contractors, and what investment to make. As a result,

[38] The AER regulatory framework is set by national legislation—the National Electricity Law (NEL) and the National Electricity Rules (NER). State regulatory frameworks were originally derived from a common set of principles for the regulation of monopoly infrastructure established by the Competition Policy Agreement between all states and the Commonwealth in 1994.

regulators in Victoria seek to provide strong incentives for efficient operating expenditure by consistently allowing companies to increase their profitability when efficiency improves.

Incentives inherent in the classic CPI-X approach to regulation

As described in Section 2, the classic CPI-X framework provides an incentive for suppliers to reduce costs because the business retains any operating cost savings made until the next price review. Regulators in Victoria have been vigilant in ensuring the incentives of the classic CPI-X approach are not weakened by focusing on supplier profitability, instead of the prices paid by consumers.

When the Victorian Office of the Regulator General (ORG) consulted on improvements to the initial Tariff Order, it clearly highlighted why measures to reduce the incentives in CPI-X should be resisted:

> *The first principle the Office will apply in striking this balance is that investors should be able to retain all the profits earned within each review period by outperforming the relevant benchmarks. If this principle were not maintained, and instead, price limits were set on the basis of clawing back excess profits from the previous period, then the principal purpose of the 'CPI - X' regulation would be undermined. Controls on prices would become controls on profits. Regulatory risks and the cost of capital would increase. There would be a shift towards a cost plus mentality and the incentive for the businesses to pursue efficiencies would be eliminated. Thus, although clawback of past excess profits may appear to have short-term attractions, the Office considers that it would have serious long-term disadvantages for customers.*[39]

This commitment to a forward-looking approach to regulation has meant that the regulated suppliers in Victoria frequently earn profits that are above the regulator's estimate of WACC.

Table A.1: Returns Earned by Victorian Distributors (2001-2010)

	2001 Price Review (2001-2005)		2006 Price Review (2006-2010)	
	Forecast	**Actual**	**Forecast**	**Actual**
WACC Benchmark	6.8%		5.9%	
CitiPower	9.2%	11.9%	5.9%	8.9%
Powercor	8.5%	10.6%	5.3%	9.2%
SP Ausnet	8.4%	10.2%	5.5%	5.0%
Jemena	7.3%	8.9%	5.2%	8.6%
United Energy	7.7%	11%	6.2%	7.5%

Source: ESC Comparative Performance Reports 2005 and 2009

Strengthening incentives for operating efficiency through a carryover mechanism

Although the lower operating expenditures incurred by the distribution businesses under the Initial Tariff Order had improved efficiency (and increased profitability), the

[39] Office of the Regulator-General, "Consultation Paper No 1: 2001 Electricity Distribution Price Review Framework and Approach," (June 1998), at page 5

regulator considered that additional incentives were needed to make further operating improvements. When the ORG conducted the first full price review for Victorian distribution businesses (effective from 2001), it decided to implement stronger incentives to motivate the businesses to seek out new ways to improve performance. This reflects the regulator's view that the near-term profitability of the distribution businesses in Victoria is entirely consistent with the long-term interests of consumers:

> *The ultimate objective will be to pass the benefits of efficiency improvements on to customers. The Office believes, however, that by allowing the licensees to retain for a period the benefits of efficiency gains before they are passed on to customers, they will be motivated to deliver greater efficiencies over the long-term than would otherwise be the case.*[40]

The major change introduced in the 2001 review was to apply an Efficiency Carryover Mechanism (ECM). The ECM allowed regulated suppliers to retain the benefits of efficiency gains in the next regulatory period, extending the period of time available to suppliers to repay the investments made to improve efficiency. The key features of the ECM were to:

- **Allow business to retain benefits for a longer time period.** The ECM ensures that suppliers retain efficiency gains for five years, regardless of when they are achieved within the regulatory period
- **Focus on incremental differences between allowed costs and actual costs.** The efficiency carryover amount is calculated as the difference between the actual and forecast operating expenditure in one regulatory year, less the difference from the preceding regulatory year
- **Only apply to costs that are controlled by the distribution business.** The ECM required the regulator to distinguish efficiency gains from other factors that lead to lower costs, so that cost reductions outside the management's control would be passed onto consumers at the beginning of the next review period (i.e. no carryover would apply).[41]

In practice, the ESC found the task of isolating controllable costs difficult. The carry forward amounts for operating efficiencies in the 2001 price determination were judged to have been calculated in a way that did not properly isolate factors within management control (by ignoring the impact of demand growth).[42] In the 2006 price review, the ESC addressed this issue by adjusting controllable costs for the impact of any difference (positive or negative) between forecast demand growth and actual growth on operating and maintenance expenditure. To make this adjustment, the ESC defined a relationship between demand growth and expenditure that only factored in those components of operating and maintenance expenditure that have a direct relationship to growth (such as billing and revenue collection, and customer service).

The 2006 determination also changed the treatment of cost overruns to be consistent with cost savings. This means that when a business has a negative carryover amount (actual costs were greater than forecast), this amount is applied to the building block revenue requirement for the next period's price determinations (rather than setting

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[40] Office of the Regulator-General, "Consultation Paper No 1: 2001 Electricity Distribution Price Review Framework and Approach", (June 1998), at page 5

[41] Office of the Regulator-General, Victoria "2001 Electricity Distribution Price Review: framework and approach" *Consultation Paper No. 1* Melbourne (June 1998).

[42] The Essential Services Commission was subject to limited merits review.

negative carryovers to zero). This further strengthens the incentive to beat the cost forecasts because over-spending reduces future profits.

The efficiency carryover mechanism is now used nationwide

In June 2008, the AER made a final decision on the form of the Efficiency Benefit Sharing Scheme (EBSS)—the nationwide scheme that applies to all electricity distribution businesses in Australia. This provided a timely opportunity to review the incentives under the ECM used in Victoria. The AER ultimately adopted all of the key features of the ECM in the new scheme.

In reaching this decision, the AER evaluated the essential features of the incentive scheme. The AER decided that the EBSS would:

- **Only apply to operating expenditure.** Earlier discussion papers and consultation proposals indicated the EBSS would apply to capital expenditure. This was ultimately rejected by the AER on the basis that it was not possible to differentiate between capital expenditure efficiencies and deferral of capital expenditure. In an effort to prevent companies substituting capital expenditure for operating expenditure, the EBSS accounts for any changes in capitalisation policies. However, concerns remain as to whether the EBSS properly balances trade-offs between operating and capital expenditures to ensure that total costs are efficient.
- **Allow companies to retain 30 percent of efficiency gains.** The distribution EBSS carries over operating expenditure efficiency gains and losses for five years after the year in which the gain or loss is made. At a real discount rate of 6 percent, this timeframe means that the distribution business retains 30 percent of the benefits of efficiency gains and consumers obtain the remaining 70 percent—i.e. at a real discount rate of 6 percent, the NPV of years one to five is approximately 30 percent of the NPV to infinity.
- **Provide symmetrical incentives.** All differences between forecast and actual costs, positive and negative, are carried over for a period of five years.

The performance of distribution businesses has improved with stronger incentives

Figure A.2 shows that real operating expenditures across the industry have been consistently lower than regulatory allowances. We draw three conclusions from the data (while accepting that factors other than regulation have had a significant impact on operating costs):

- **Suppliers have responded to incentives and increased their profits.** As a result of the operating efficiencies achieved, regulated suppliers have earned around A$160 million (in present value terms) between 1996 and 2009 over and above the regulator's estimate of weighted average cost of capital. Compared to a regulated WACC of 5.9 percent (real), in 2009 Powercor earned a rate of return of 9.2 percent, Citipower 8.9 percent, Jemena 8.6 percent, and United Energy earned a 7.3 percent return.
- **Costs per unit of output have fallen.** Although operating allowances in the 2006 price review have increased in real terms, costs increases are driven by operating expenditures that are not controlled by management—such as demand growth and the need for additional vegetation management in the wake of the 2009 bushfires. These cost increases are largely confined to one distribution business (SP Ausnet). When SP Ausnet's increases in operating

expenditures from 2006-2009 are removed, real operating costs remain largely constant from 2006-2009. Even when SP Ausnet's higher costs are included, real operating expenditure has fallen by around 16 percent per unit of electricity distributed—from A$0.013/kWh in 1996 to A$0.011/kWh in 2009.

- **Consumers have benefitted from efficiency gains.** With 70 percent of total savings passed to customers under the EBSS, the present value of the savings to customers over the period is around A$375 million (using a real discount rate of 6 percent).

Figure A.2: Real Operating Costs and Regulatory Allowances

Source: Victorian Comparative Performance Reports

We also note that unlike the experience of the operating expenditures in the United Kingdom electricity distribution sector (discussed in Section B.2), the timing of efficiencies is not related to the time remaining in the regulatory period. This suggests the efficiency carryover mechanism introduced in the 2001 price review has maintained consistent incentives throughout the regulatory period.

A.3 Incentives for Capital Efficiency

Capital cost allowances are equal to around two thirds of the costs of service for distribution businesses in Victoria. Most of these allowances relate to the suppliers' historical investments, which are reflected in the value of the RAB. However, as the value of existing assets depreciates and as new investments are made, capital expenditure becomes an increasingly important component of regulated prices. Despite the importance of promoting efficient capital spending, regulators in Victoria have not developed strong incentives in this area—primarily due to the challenge of distinguishing between capital efficiency and the deferral of needed investments.

Little attention has been paid to incentives for efficient capital spending

In contrast with the focus on ensuring incentives for operating efficiency, relatively little attention has been given to developing high-powered incentives for efficient capital expenditure. The classic CPI-X approach again provides basic incentives for distribution businesses to keep capital expenditure low—the business is permitted to charge prices that incorporate a return on capital expenditure that has not been made (as well as depreciation). This incentive is weakened by the fact that at the next price review the RAB is adjusted to include only those investments actually made.

Unlike the experience with operating expenditure described above, few additional incentives have been developed in Victoria to promote efficient capital spending. This is because the regulator cannot readily distinguish between the efficient implementation of capital projects from investment deferral.

As a result, the efficiency carryover schemes implemented by the ESC and the AER both exclude capital costs. The original ECM used by the ESC was intended to apply to capital expenditure, but the ESC acknowledged that it could not identify whether the significant under spending against capital expenditure allowances observed from 2001-2005 could properly be classified as efficiency gains.[43] The distribution businesses also received material increases in capital expenditure allowances in the 2006 price review, creating a risk that any additional incentives would simply lead the suppliers to increase their returns by deferring required capital expenditure (see Figure A.3 below). The AER also decided that the EBSS would only apply to operating expenditure because it could not differentiate between capital expenditure efficiencies and deferral of capital expenditure.[44]

Regulation that might inhibit efficient capital has been removed

One change made to the incentives for capital expenditure was to remove the regulatory *ex post* prudency test that applied from 2001-2006. This test gave the ESC the ability to declare that particular capital costs had not been prudently incurred, and would therefore not be rolled into the RAB. The ESC removed the prudency test in the 2006 price determination on the basis that it created uncertainty for the distribution businesses about their ability to recover the costs of their investments, and therefore inhibited efficient investment.

Although the ESC never actually used the prudency test to prevent the recovery of capital expenditure, the regulator decided the effects on investment incentives were sufficiently important to remove even the prospect of clawback of capital expenditure. The treatment of capital costs therefore appears consistent with the trend identified for operating expenditure of moving towards more high-powered incentives over time.

Evidence on capital expenditure efficiency is inconclusive

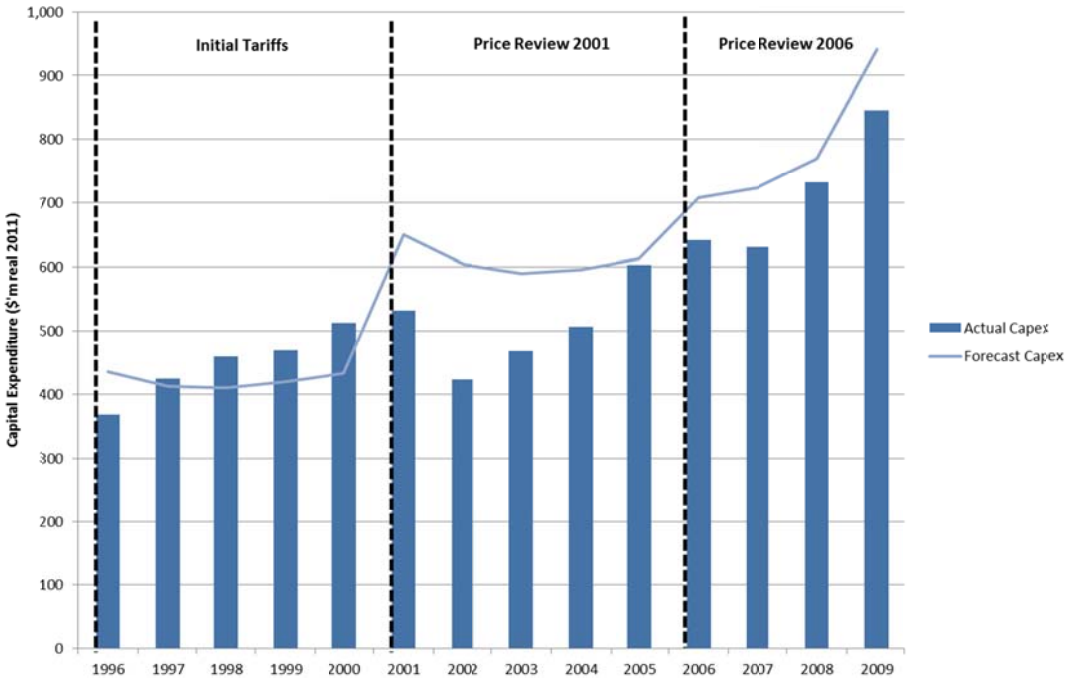
Figure A.3 compares actual capital expenditure against allowances for 1996-2009. As found by the ESC and the AER, the reasons for the different outcomes compared to allowances are not easily identified. As with operating expenditure, factors other than regulation (such as network condition) will explain a significant amount of the changes in capital expenditure. The significant under-spend from 2001-2005 might reflect the inherent incentive in CPI-X to maintain an efficient capital programme. Alternatively, the under-spending might reflect a tendency to defer capital investment—either to increase returns or due to the prospect of having the expenditure disallowed in a later prudency

[43] Essential Services Commission, "Electricity Distribution Price Review 2006 Final Framework and Approach: Volume 1, Guidance Paper," (June 2004)

[44] AER, "Final Decision: Efficiency Benefit Sharing Scheme," (June 2008), at page 10

review. Unlike operating expenditure, capital expenditure has increased significantly in recent years.

Figure A.3: Real Capital Expenditure and Regulatory Allowances



Source: Victorian Comparative Performance Reports

A.4 Service Quality Incentives

Changes in service quality can provide a signal to regulators about whether operating and capital cost savings are in fact efficiency gains, as opposed to unsustainable deferrals. A tendency to defer required maintenance or capital upgrades will eventually lead to a decline in network reliability and service standards. In Australia, the AER recognises the importance achieving a set of incentives that balances cost savings and service quality:

> *Where the regulator would like a firm to pursue multiple objectives, the power of the incentives to pursue these different objectives should be balanced wherever possible. For example, if the incentive to maintain service standards is weak, introducing high powered expenditure incentives increases the risk that the firm will cut service standards in order to reduce expenditure.*[45]

Distribution businesses in Victoria have strong incentives to improve service

The Tariff Order that applied from 1996-2000 contained no explicit incentives to improve quality of service. In the 2001 price review, the ESC put two service incentive arrangements in place to balance the incentives the distributors had to achieve cost efficiencies with the need to maintain or improve service levels.

- **The S-factor scheme.** Through the price control mechanism, the S-factor scheme financially rewards or penalises distributors for their performance against a subset of the average service reliability targets. This is done through the price control formula [(1+CPI)(1-X)S] which contains a service term (S)

[45] AER, "Final Decision: Efficiency Benefit Sharing Scheme", (June 2008), at page 3.

that allows the distribution tariffs to increase in years following above target reliability performance and decrease following below target performance; and

- **The Guaranteed Service Levels (GSL) scheme.** The GSL scheme required the distributors to make an automatic payment (A$80) to customers that consume less than 160 MWh per year that experienced a level of reliability below an established threshold.

The ESC price determinations included an explicit allowance to recover the costs of GSL payments in the building blocks. While it may seem unusual to allow suppliers to recover some of the costs of penalty payments, the ESC wanted to reduce any incentive to pursue uneconomic reliability improvements that would reduce GSL payments to zero.

In the 2006 price review, the ESC examined the performance of these schemes over the 2001-2005 current period and made adjustments to both schemes based on that experience and other information provided by stakeholders. The adjustments were all directed at increasing the incentives on distribution businesses to maintain or improve service and quality of supply:

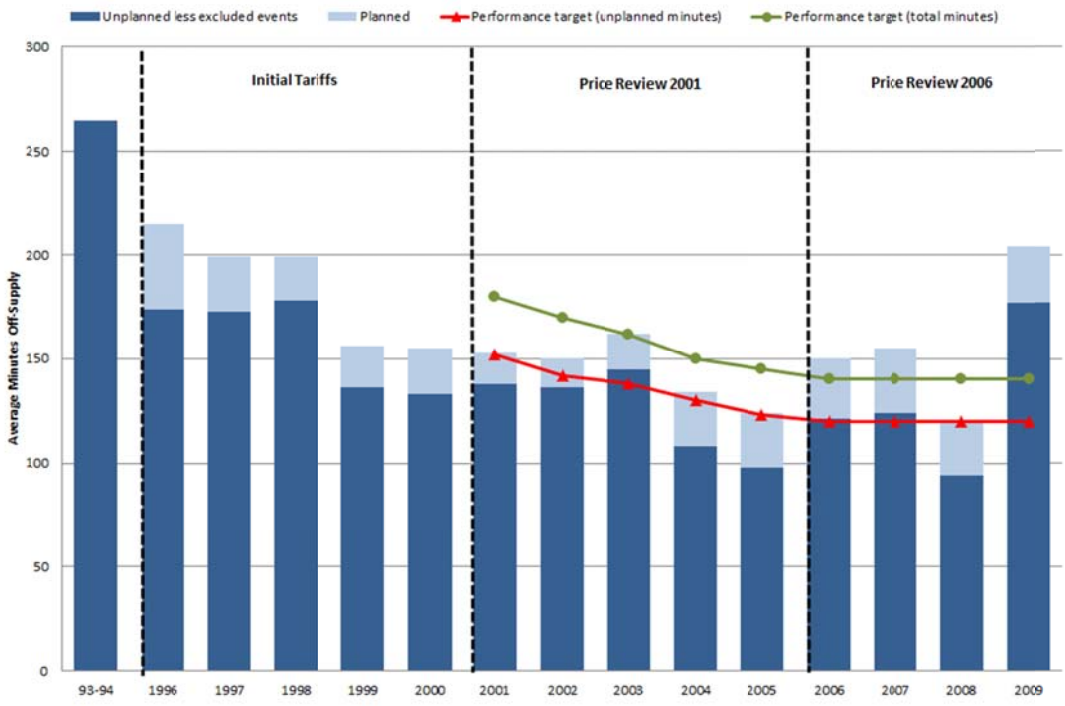
- For the S-factor scheme, the ESC increased the incentive (and penalty rates) and expanded the performance indicators included in the scheme. The ESC also excluded impacts on service levels from events that were deemed to be beyond the control of the distribution business.
- For the GSL scheme, the ESC substantially increased the level of payments and the circumstances under which payments were required to be made. The GSL payment rates were increased around four-fold.

The AER has adopted the approach of the S-factor and GSL schemes in its national Service Target Performance Incentive Scheme (STPIS). The AER has increased the amount of revenue at risk under the scheme from ±3 percent to ±5 percent—providing the distribution businesses with opportunities to further increase revenues for outperforming service expectations.

Suppliers have responded to incentives by improving quality of supply

As shown in Figure A.4, reliability (as measured by average minutes off supply per customer) has steadily improved from 1996-2008. Unplanned outage levels have fallen by almost 50 percent, and total minutes of outage have been maintained around the target level of less than 150 minutes per year. This result deteriorated in 2009 due in part to extreme weather conditions—drought and high temperatures and record peak demands—leading to higher failure rates from overloaded transformers and load shedding.

Figure A.4: Average Minutes Off Supply Per Customer



Source: Adapted from AER, "Victorian Electricity Distribution Businesses Comparative Performance Report for Calendar Year 2009," (December 2010)

A.5 Conclusions on the Impacts of Incentives in Victoria

The initial regulatory framework for Victoria was established by policy makers and regulators who believed that allowing distribution businesses to retain some of the benefits of efficiency gains will motivate suppliers to deliver greater efficiencies for customers over the long-term. The legislation mandated a "CPI-X incentive based regulation" approach, and the approach to implementation has built on the general CPI-X framework with efficiency carryover schemes and service standard incentives.

The regulatory framework evolved over the period of ESC regulation, and the national regulatory framework now administered by the AER further enhances many of the ESC approaches. The fact regulators and policy makers have sought to strengthen the power of incentives provides a clear signal that regulators and policy makers in Australia are convinced of the ability to regulate explicitly for efficiency incentives.

The evidence on sector performance supports this conclusion. The distribution businesses in Victoria have consistently incurred lower operating costs than their allowances—placing downward pressure on regulated prices over time as efficiency gains are shared with consumers. This has led to substantial cost savings for consumers. The evidence also shows these savings have not come at the expense of service quality. The ESC and AER have attempted to balance the incentives to reduce costs with incentives to maintain or improve quality—substantially increasing reward and penalty schemes over time.

Appendix B. United Kingdom Electricity Distribution Networks

This case study evaluates the impact of regulatory incentives built into the economic regulation of United Kingdom distributors since the majority of the industry was privatised in 1992. We find that the regulatory framework has evolved from an initial reliance on the incentives inherent in the RPI-X approach to provide stronger incentives on distribution businesses to improve performance. The incentives introduced through subsequent price controls have tried to better reflect the service quality that customers expect by changing supplier behaviour.

The United Kingdom energy regulator (Ofgem) is a world leader in introducing incentives to incentivise good performance, while appropriately penalising under-performance. For example, a sliding scale incentive (later renamed the Information Quality Incentive (IQI)) was introduced in 2005 to reward suppliers for providing good quality information as part of their regulatory submissions. The IQI helps to overcome the distinct advantage that suppliers have over regulators in being better able to forecast their likely capital and operating costs. Under the IQI, suppliers that accurately forecast their costs are offered stronger incentives to beat those forecasts. Since the approach was introduced, nearly all suppliers have opted for lower cost forecasts with stronger incentives, with customers benefiting from lower tariffs than would otherwise be set.

Data on the performance of the United Kingdom distribution sector from 1992-2004 show that suppliers have found ways to lower their costs, while improving reliability and service standards.

In this section, we describe the regulatory framework that has been applied to distribution businesses in United Kingdom, and the particular way incentives have evolved over time. We separately consider the incentives for suppliers to improve operating efficiency, capital efficiency, and service quality, drawing on the analysis completed to make regulatory decisions and the available data on sector outcomes to evaluate the effect of incentives on costs and service levels.

B.1 Main Features of the Regulatory Approach

The United Kingdom has a total of 14 electricity distribution companies that have been subject to price regulation for more than 20 years. The broad approach to regulating prices has not changed (and remains the same following the recent RPI-X@20 review)[46]—the regulator (Ofgem) sets allowed revenues by forecasting distributor's costs, adding inflation from the Retail Price Index (RPI), and subtracting expected industry productivity gains (X).[47]

Although the broad approach to price regulation has remained the same, new measures to influence supplier behaviour have been introduced at each five yearly price review. Figure B.1 provides an overview of the regulation of United Kingdom distribution utilities over time, with a particular focus on new approaches to incentives. As with the experience in Victoria, the UK approach can be divided into two phases:

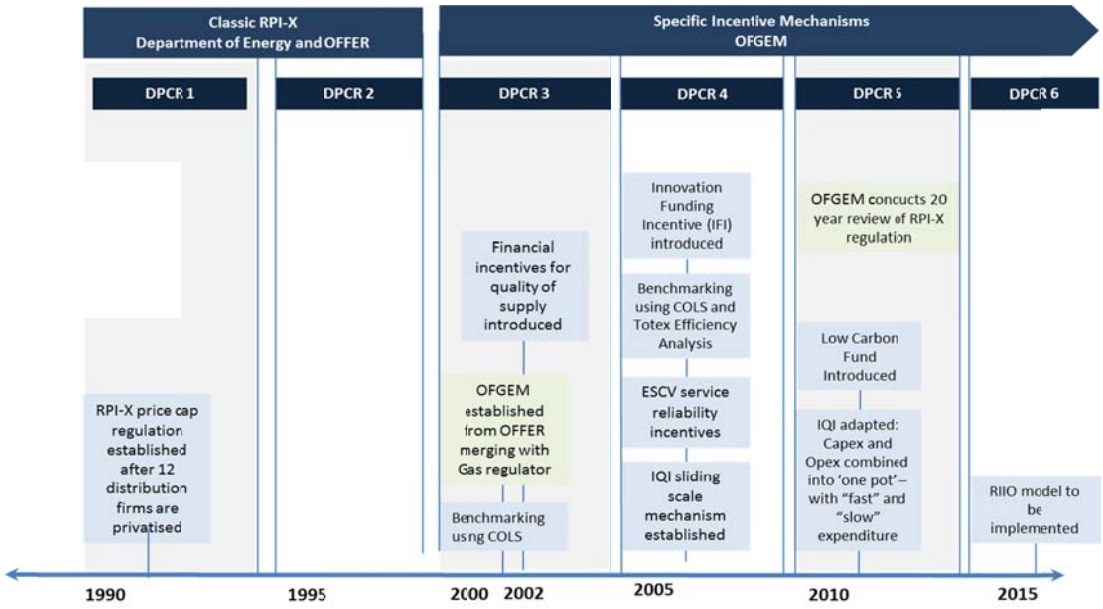
[46] Ofgem, "Handbook for Implementing the RIIO model", (October 2010)

[47] Ofgem uses RPI to measure inflation (rather than the Consumer Price Index (CPI)) because corporate and government index-linked bonds in the United Kingdom use RPI as the relevant index. See Ofgem, "RIIO: A New Way to Regulate Energy Networks Final Decision," (October 2010). In Australia, inflation-proof bonds are linked to CPI.

- **Classic RPI-X phase.** During the first ten years of incentive-based regulation of distribution businesses in the UK, the Department of Energy and Ofgem (formally Offer) relied on the incentives built into the CPI-X framework.
- **Specific incentive mechanisms phase.** Since 2000, targeted incentives have been used to move suppliers towards specific goals. This started with operating expenditure benchmarking and quality of service targets, and now includes a total of 15 specific mechanisms covering operating expenditure, capital expenditure, and service quality.

The move towards more targeted incentives reflects Ofgem's belief that regulation can and should influence supplier behaviour to improve supplier performance.

Figure B.1: Evolution of Price-Quality Regulation for in the UK Distribution Sector



To understand why Ofgem has developed the targeted incentive schemes listed in Figure B.1, we have reviewed the regulatory decisions that introduced each incentive scheme. This provides an important source of evidence as the Commission considers the likely impact of different regulatory approaches to incentives. The recent 20-year review of the RPI-X regime also considers how to further increase the incentives that suppliers face to improve performance (such as through time-limited innovation stimulus that will be open to projects at any point in the innovation cycle, and available for investments made by both network companies and third parties).[48]

B.2 Incentives for Operating Efficiency

The ability for suppliers to achieve operating efficiencies is regarded as one of the success stories of incentive-based regulation of electricity distributors in the United Kingdom. This section reviews the evidence on how the regulatory approaches adopted have influenced supplier efforts to achieve operational efficiencies.

Approaches to operating expenditure allowances have evolved considerably

The UK Department of Energy set the prices in the first electricity distribution price control review (DPCR1), and allowed price rises of between the inflation rate and

[48] Ofgem, "RIIO: A New Way to Regulate Energy Networks Final Decision," (October 2010).

2.5 percent above the inflation rate in some cases (Jamasb and Pollitt, 2007 at p6169). The incentive on suppliers to improve efficiency was that they could retain any cost savings relative to the Department of Energy's forecasts for the five-year period from 1990-1995. In fact, significant efficiency gains were achieved during the price control period (primarily through redundancies). As a result, the companies earned substantial profits and saw their share prices increase markedly from 1990-1995 (Jamasb and Pollitt, 2007 at p6170).

The second price control review (DPCR2) was carried out by an independent regulator, known at that time as Offer (since renamed Ofgem). All of the distribution businesses received downward price adjustments at the start of DPCR2 (averaging 14 percent), and were expected to reduce total costs by 2 percent each year. This approach again relied on the general incentive in the RPI-X framework to drive efficiency improvements. As experienced in DPCR1, the potential for productivity improvements exceeded the regulator's expectations—as evidenced by a high takeover bid for one of the companies (Northern Electric) shortly after the price controls were announced.[49]

A major shift in the regulator's approach to setting operating expenditure allowances came in DPCR3 (2000-2005). In this decision, Ofgem benchmarked the operating expenditure of each firm against its expectations of efficient costs. The operating expenditure allowances for the next five-year period required suppliers to close a proportion of the gap between their historical performance and the most efficient company (known as the efficiency frontier). Ofgem used corrected ordinary least squares (COLS) regressions to benchmark operating costs that are controlled by management. This approach was then extended in DPCR4 to cover an analysis of total operating and capital costs and to benchmark the suppliers by the nine ownership groups that exist as well as the 14 individual companies.

Several studies link operating efficiency gains to high-powered incentives

The long time period since incentive-based regulation was first introduced in the UK electricity distribution sector has enabled researchers to carefully estimate its effects. The changes in approach to regulating operating expenditure over this time period have also prompted commentators to consider whether the increased emphasis on efficiency has led to any noticeable changes in the behaviour of regulated suppliers. The clear consensus that emerges from these studies is that stronger incentives have caused suppliers to seek out efficiencies.

The earliest studies were published between 2001 and 2005, and evaluate the impact of introducing classic RPI-X regulation in DPCR1 and then reducing real distribution charges in DPCR2. A study conducted by Hattori, Jamasb and Pollitt (2005)[50] compares the efficiency of United Kingdom distribution companies with similar suppliers in Japan from 1985/86 to 1997/98. This cross-country comparison helps to address the absence of a counterfactual by benchmarking outcomes against another distribution sector that has similar features and technology choices. The authors find that the last sub-period studied (1995/96-1997/98) saw the largest productivity gains in United Kingdom relative to Japanese suppliers. During that period, the companies were operating under the tighter revenue caps in DPCR2 than had previously applied. By using Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) the authors could confidently

[49] Chris Godsmark, "Northern Electric sparks pounds 650m US bid," *The Independent,* (29 October 1996), at http://www.independent.co.uk/news/business/northern-electric-sparks-pounds-650m-us-bid-1360778.html

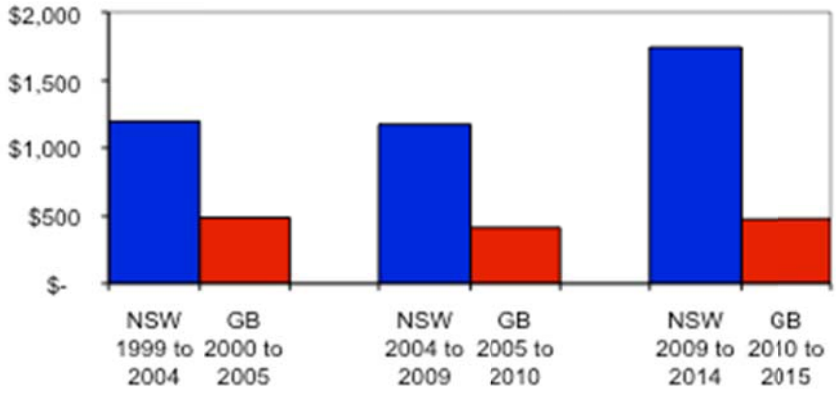
[50] Hattori, Jamasb and Pollitt, "Electricity Distribution in the UK and Japan: A Comparative Efficiency Analysis 1985-1998". *The Energy Journal* (2005). Vol. 26, No 2.

attribute most of the changes in firm performance to efficiency improvements, rather than factors such as technological progress.

Another study completed by CEPA in 2003 draws similar conclusions about changes in efficiency during DPCR1 and DPCR2. CEPA found that Total Factor Productivity (TFP) growth for UK distribution businesses was much stronger in the period from 1996/7-2001/2 (5.2 percent) than in the years since RPI-X regulation was first introduced (2.7 percent growth from 1991/2-1996/7). The authors considered that the substantial cost reductions were unlikely to continue at that rate in the future.

More recent studies have considered the impacts of moving from the classic RPI-X approach to benchmarking operating efficiency against the frontier firm. In a study that also uses cross-country comparisons, Littlechild and Mountain (2009) compare the operating efficiencies achieved in the UK with similar suppliers in New South Wales (NSW), Australia. The authors find that opex allowances per customer (aggregated over each five-year regulatory period) have remained relatively constant over time in the UK. In contrast, operating expenditures per customer are higher and are projected to increase in the future in NSW. As shown in Figure B.2, operating expenditure in NSW was about double the UK level in the period from 2000-2005 (DPCR3), and is projected to be about 3.5 times the UK level from 2010-2015 (DPCR5). The authors conclude that benchmarking the efficiency of operating expenditure has played a role in incentivising cost savings (together with the private ownership of the distribution businesses in the UK).

Figure B.2: Allowed Operating Expenditure per Customer (2008 Australian Dollars)



Source: Littlechild and Mountain (2009)

The NSW Government held an inquiry into electricity networks and prices in 2010. It concluded that the growth in operating expenditure shown in Figure B.2 is mainly explained by wages growth and higher staff numbers.[51]

Suppliers respond to the changing strength of incentives over the regulatory period

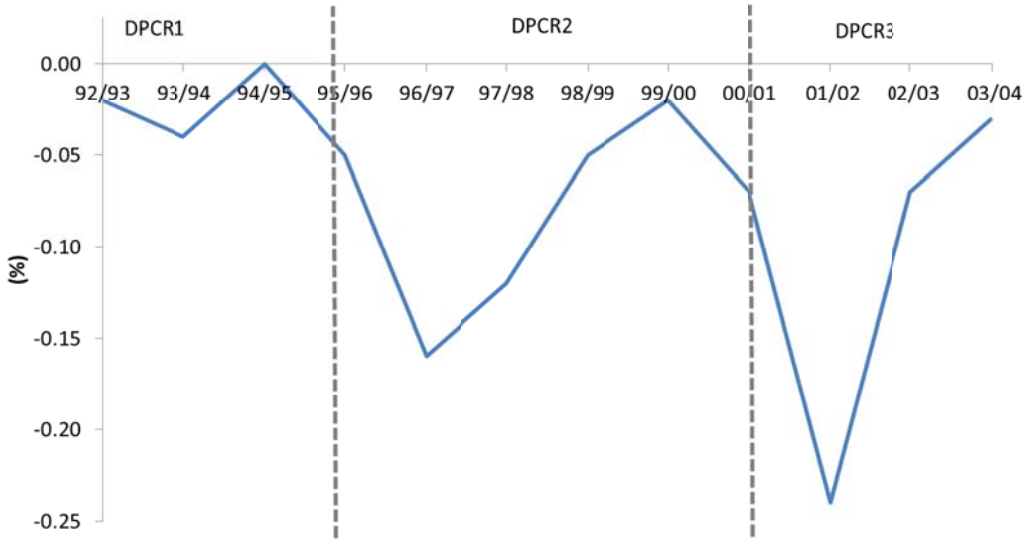
Operating expenditure allowances in the UK in DPCR1-DPCR4 were set without regard to how the strength of incentives changes over the regulatory period. Unlike Victoria—where the efficiency carryover mechanism maintains incentives at a constant level in each

[51] Industry and Investment NSW, "NSW Electricity Network and Prices Inquiry," (December 2010). See http://www.dpc.nsw.gov.au/__data/assets/pdf_file/0005/118904/NSW_Electricity_Network_and_Prices_Inquiry_Report.pdf

year—the benefits that UK distribution businesses receive from achieving efficiency gains has traditionally weakened over the course of the regulatory period.

The evidence clearly shows that suppliers have responded to the changing strength of regulatory incentives by seeking out efficiency gains in the early years of the regulatory period, and deferring efficiency gains that could have been achieved in the later years. Figure B.3 plots the change in real operating expenditure for distribution businesses in the United Kingdom from 1992 until 2003. This highlights the effect of a decreasing incentive to achieve efficiency gains—the level of cost reductions achieved in the year following the price review is significantly higher than other years, and cost reductions gradually trail off until the next price review. Turvey (2004) demonstrates how this behaviour is commercially rational when suppliers face a decision on when to spend money to save on operating expenditures—a capital investment of $100,000 to save $7,000 per annum would only be viable in the first year of the price control period (assuming a discount rate of 6.5 percent and an asset life of 33 years).

Figure B.3: Growth in Real Unit Operating Expenditure



Source: International Handbook of Economic Regulation (2006), Figure 8.3

B.3 Incentives for Capital Efficiency

This section discusses the approaches used by Ofgem to ensure that suppliers have incentives to accurately forecast capital expenditure needs, and then to efficiently deliver the allowed capital programme.

Incentives are in place to reveal an efficient level of capital expenditure

Despite the positive research published on the impact of incentives for operating efficiency, during DPCR3 (2000-2005) Ofgem became concerned that its focus on operating efficiency might lead regulated suppliers to inflate their capital expenditure forecasts to increase returns. Ofgem considered that opportunities to trade-off capex and opex might lead companies to gradually increase capital expenditure (and consequently their RAB), while at the same time reducing their operating expenditures. These concerns were amplified when all 14 suppliers requested substantial increases in capital expenditure

in DPCR4 (2005-2010)—company forecasts for required capital expenditure in DPCR4 were 49 percent higher than what had been spent throughout DPCR3.[52]

Regulators have a clear informational disadvantage when assessing capital expenditure requests because regulated suppliers have better knowledge of the capital needs on their networks. Prior to DPCR4, Ofgem sought to overcome this problem by engaging engineering consultants to review capital expenditure proposals for reasonableness. In most cases, this led to Ofgem allowing less funding for capital works than the suppliers proposed. For example, the final decision for DCPR3 lowered capital expenditure allowances from company forecasts by 13 percent, on average. This approach was criticised for failing to give the suppliers any incentive to accurately forecast capital needs—and instead to inflate their initial estimates on the expectation that the final capital allowance would be reduced by some proportion.

The engineering review was also considered inadequate given the size of increases in capital spending proposed in DPCR4. Ofgem acknowledged that some of the increased capital expenditure was part of the investment cycle (known in the distribution sector as the "wall of wires" issue). However, Ofgem could not be confident that this explained the entire increase in forecast capital expenditures.

To provide an incentive for the suppliers to accurately disclose their true expectations of capital spend, Ofgem introduced a "sliding scale", or menu regulation approach in DPCR4. In simple terms, the sliding scale allows companies to choose between:

- Lower expenditure forecasts with higher-powered incentives, allowing companies to retain a larger proportion of any under-spending, and
- Higher expenditure forecasts with lower-powered incentives, meaning that companies would be allowed to spend more but would retain a smaller proportion of the benefits of under-spending against forecasts.

This approach allows companies to select an incentive scheme that best fits their ability to control capital expenditure. A business that has a high-level of confidence in its ability to beat the forecast should opt for higher-powered incentives, while a business that does not expect cost reductions to be possible should choose lower-powered incentives. The incentive rates are designed to reward suppliers for choosing lower capex forecasts, while still providing incentives for suppliers that choose higher forecasts to beat those targets by spending less.

The sliding scale was adapted in DPCR5 (2010-2015) and renamed as the information quality incentive (IQI). The IQI eliminates any distinction between capital and operating expenditure by combining both sets of costs into one 'pot', of which 15 percent is treated as 'fast money' (like opex) and 85 percent is treated as 'slow money' (like capex).[53]

Companies have generally chosen quite high-powered incentives

Table B.1 lists the incentive rates chosen by each of the distribution business groups in DPCR4, and how the suppliers performed against their capex targets. The incentives are applied at the group level (rather than for each of the 14 individual suppliers) to prevent common ownership costs from being allocated to the companies within the group with the weakest incentive rates.[54] This shows that only one business (CN) spent more than its

[52] Ofgem, "Electricity Distribution Price Control Review Final Proposals," (2004) at page 84.

[53] Ofgem, "Electricity Distribution Price Control Review Final Proposals – Incentives and Obligations" (7 December 2009) at page 110.

[54] Ofgem, "Electricity Distribution Price Control Review Final Proposal," (2009) at paragraph 8.4

forecast, and this business had selected an incentive rate (36 percent) that was around the middle of the range (29-40 percent). The incentive rates chosen in DPCR5 are all higher than for DPCR4 because Ofgem has increased the proportion of capital expenditure savings that the suppliers are permitted to keep across the scale. The practical effect of this change is that in DPCR5 the suppliers will keep between 45-51 percent of any under-spending against total expenditure forecasts.

Table B.1: Capital Expenditure Incentives (£m '07-'08)

	Incentive Rate (DPCR4)	Capex Efficiency (Allowance – Actual)	Efficiency Benefit (Loss)	Incentive Rate (DPCR5)
CE	39%	6	2.4	48%
CN	36%	-18	(6.6)	47%
ENWL	38%	112	42.6	45%
SP	31%	65	20.2	45%
SSE	39%	61	23.9	49%
UKPN	29%	54	15.6	45%
WPD	40%	6	2.3	51%

Source: Ofgem, "Electricity Distribution Annual Report" 2009-10; Ofgem, "Electricity Distribution Price control Review Final Proposals" November 2004; and Ofgem "Electricity Distribution Price Control Review Final Proposals – Incentives and Obligations" 7 December 2009

The regulatory commitment to allowing suppliers to benefit from spending less than forecast will continue under the RIIO model that will be applied from 2015. No retrospective adjustments to revenue will occur if actual costs exceed (or fall short of) the costs forecast when determining the price control, except through the application of the efficiency rate. Clawback adjustments would only be considered if the service was not sufficiently delivered or if Ofgem is concerned a company "has manifestly wasted money".[55]

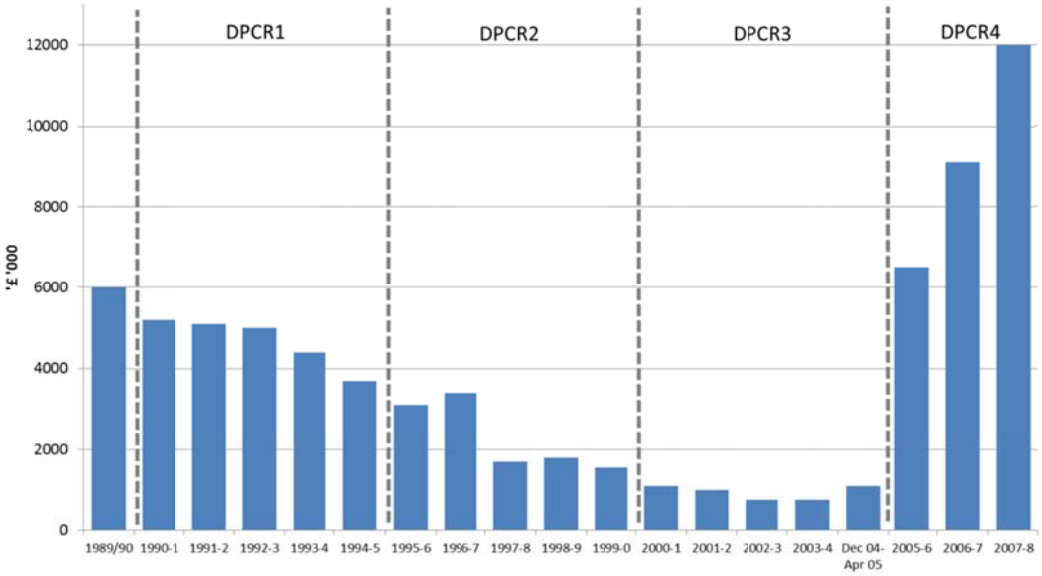
Innovation incentives have increased research and development spending

In addition to offering the sliding scale for capital expenditure forecasts, Ofgem has introduced specific investment incentives in recent years. One example is the Innovation Funding Incentive (IFI) introduced in DPCR4 which allows the suppliers to spend up to 0.5 percent of their allowed revenues on research and development activities.[56] The effect of this incentive is clearly visible in Figure B.4 which shows that the trend of declining research and development expenditures throughout DPCR1-3 was dramatically reversed when the incentive took effect.

[55] Ofgem, "Handbook for Implementing the RIIO Model" (October 2010) at page 83

[56] Ofgem, "Electricity Distribution Price Control Review Final Proposals," (7 December 2009).

Figure B.4: R&D in the UK Electricity Distribution Sector



Source: Ofgem, RPI-X@20, Working Paper 2

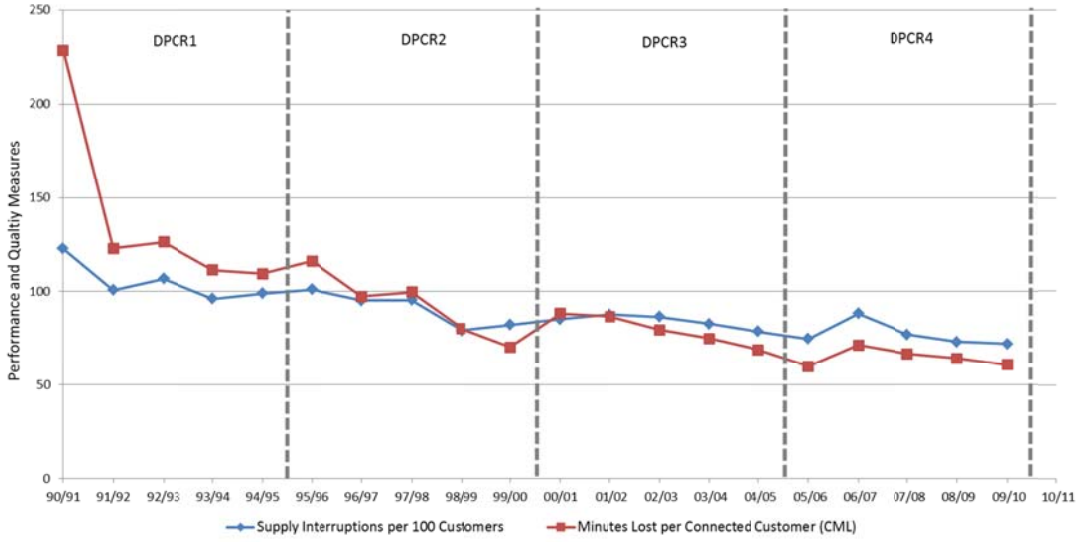
B.4 Service Quality Incentives

The importance of maintaining and improving service quality has been a feature of RPI-X regulation of distribution businesses in the United Kingdom since this form of regulated was first implemented. Although there are a number of factors other than regulation that impact on service quality outcomes, Ofgem has placed growing importance on incentives for service quality. During the first two regulatory periods of classic RPI-X regulation, service quality indicators were simply monitored by the regulator. To give the service expectations force, financial incentives were introduced in April 2002 (part way through the DPCR3) to improve quality of service.

Figure B.5 shows changes in service quality throughout the first four regulatory periods (DPCR1-4), as measured by the frequency and duration of interruptions to supply. Substantial improvements in early years were followed by a levelling out of improvements from around 2000. In the first three years after financial incentives for service quality were introduced in 2002, the suppliers achieved a 16 percent drop in both the number of customer interruptions (CI) and the customer minutes lost (CML).[57] Service interruptions increased in 2006-2007, and have since returned to previous levels with a gradual decline in interruptions.

[57] Ofgem, "Electricity Distribution Price Control Review: Final Proposal," (2004).

Figure B.5: Measures of Interruptions to Supply



Source: Ofgem, "Electricity Distribution Annual Report" 2009-10; Offer, "Report on Distribution and Transmission System Performance", 1997/98; Jamasb and Pollitt (2007) at page 6176

DPCR5 has retained financial incentives for decreasing interruptions, and expanded incentives to consider effects on the environment, increasing customer satisfaction and increasing the speed of providing quotes and completing work. The RIIO model proposes to include "reputational incentives" in addition to financial penalties and rewards, which will involve the publishing performance measurements to interested stakeholders. Reputational incentives are most likely to be used where they could facilitate competitive pressures between suppliers, or where performance improvements/deterioration could be monitored over time.[58]

B.5 Conclusions on the Impacts of Incentives in the UK Distribution Sector

The RPI-X incentive-based regulatory framework was introduced in the United Kingdom as an alternative to rate of return regulation. Policy makers believed that incentive-based regulation would drive cost efficiencies by avoiding some of the problems with rate of return regulation, such as lack of incentives to improve efficiency.

The regulatory framework has evolved considerably since the United Kingdom Department of Energy set the first price control in 1992. The first performance incentives were introduced by Ofgem in DPCR3, and included service quality incentives and operating efficiency performance benchmarking. Since then, Ofgem has continued to enhance the regulatory framework by providing various opportunities for suppliers to earn financial rewards for better meeting customer expectations.

The evidence on sector performance supports this approach. Incentives are in place to ensure United Kingdom distributors undertake efficient capital expenditure, and distributors have consistently incurred lower operating costs than their allowances. The evidence also shows that these savings have not come at the expense of service quality. The outcome of the recent RPI-X@20 review suggests that the broad approach to regulating prices will remain the same in the future, with some modifications to further increase supplier incentives (such as extending the regulatory period to 8 years).

[58] Ofgem, "Handbook for Implementing the RIIO model," (October 2010)

Appendix C: United Kingdom Water Networks

This case study evaluates how the water sector regulator in the United Kingdom (Ofwat) provides incentives to water and sewerage network companies under the regulatory framework applied since 1994, when the RPI-X approach was first adopted in the water sector. Ofwat has a long history of providing incentives to suppliers through financial rewards and penalties, and has continued to refine these incentives at each price review. The incentives have become progressively more targeted over time—Ofwat now differentiates between "catch up" and "continuing" efficiency, and between expenditures for "base service" and "enhancements".

In this case study, we describe the regulatory framework that has been applied to the water and sewerage network companies in the United Kingdom. In particular, we describe the way the regulatory framework has evolved over time to incorporate more targeted and strengthened incentives. We first consider the overall approach to regulation, and then detail the specific incentives applied to operating expenditure, capital expenditure and the level of service quality.

C.1 Main Features of the Regulatory Approach

The water and sewerage industry in the United Kingdom was privatised in November 1989 when Water Authorities were replaced by ten Water and Sewerage Companies (WaSCs). Each WaSC was floated on the London Stock Exchange, and another 29 private water-only companies (WoCs) remained across the United Kingdom.

The economic regulator for the water and sewerage sector, the Office of Water Services (Ofwat) was also established in 1989. Ofwat was supported by two other agencies that focused on regulating water quality and environmental pollution—the Drinking Water Inspectorate (DWI) and the National Rivers Authority (now the Environment Agency).

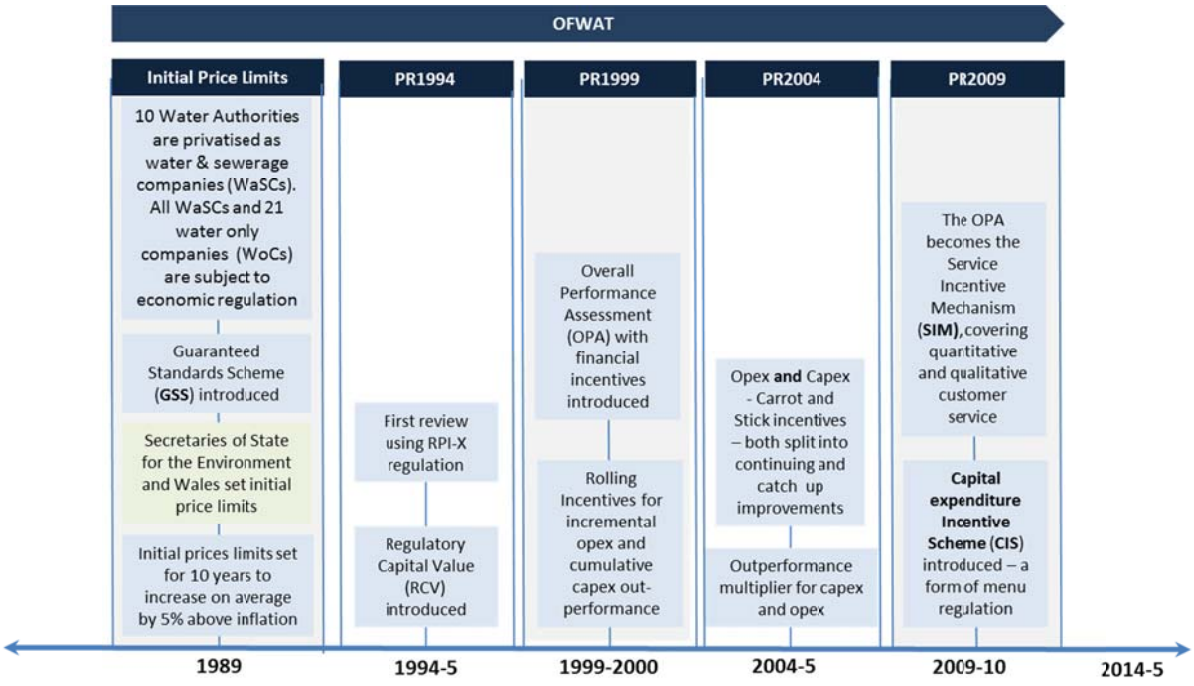
The initial price limits that applied from 1989-1994 were set by the Secretaries of State for the Environment and Wales. The average annual increase in prices was limited to about five percent above inflation. In 1994, Ofwat undertook the first review of prices, and set new price limits using RPI-X to all 21 WoCs and 10 WaSCs.

In subsequent price reviews additional incentive measures have been incorporated under the broad RPI-X approach.

- In 1999, Ofwat introduced rolling incentives for both capital and operating expenditure. Service quality incentives were also introduced through the establishment of Overall Performance Scores (OPA)
- The 2004 price review introduced "Carrots" and "Sticks" to provide rewards and penalties for performance against the regulator's expectations, and
- In the most recent price review (2009), the OPA financial incentives were adjusted to improve performance in areas that were not previously covered. The OPA was renamed the Service Incentive Mechanism (SIM). Menu regulation was also introduced for capital expenditure through the Capital expenditure Incentive Scheme (CIS).

Figure C.1 provides an overview of the evolution of the regulatory approach used in the United Kingdom water sector.

Figure C.1: Evolution of Price-Quality Regulation in the UK Water Sector



C.2 Incentives for Operating Efficiency

This section discusses the approaches used by Ofwat to regulate the operating expenditure of the water and sewerage companies. We describe how incentives are applied to improve the overall efficiency of the sector, as well as to ensure all companies are incentivised to catch up to the top performers in the sector.

Incentives are provided for catch-up and continuing efficiency

In each price review since 1994, Ofwat has determined the allowed level of operating expenditure by first calculating a base level of expenditure, and then adjusting for atypical costs and incremental costs not covered by RPI. Ofwat then applies the following efficiency challenges:

- **Relative or catch-up efficiency**—the efficiency improvements required to catch-up to the top performing companies in the industry. This mechanism explicitly covers operating expenditure only (capital expenditure catch up efficiency is included in the CIS ratio described further below), and
- **Technical or continuing efficiency**—the continuing innovation and improvement in both operating and capital expenditure that moves the industry efficiency frontier outwards.

In the 1994 price review, Ofwat decided that catch-up and continuing efficiencies should have an approximately equal effect on price limits.

In the 1999 price review, rolling incentives were applied to improved efficiency and incremental out-performance in operating expenditure. This meant that companies were able to retain any efficiency gains for a period of five years, regardless of when those efficiencies were achieved (i.e. companies' incentives were equalised over the regulatory period).

Since 2004, Ofwat has relied on what it calls a "carrots" and "sticks" approach to provide operating cost incentives. This approach provides financial rewards and penalties depending on how companies perform compared to their targets. The carrots are efficiency gains the regulator believes can be made, but suppliers are allowed to keep the benefits from, resulting in outperformance and above WACC profits. Sticks are efficiency gains that it is assumed the supplier will make. These efficient gains are included in the prices set by the regulator. Therefore, if the companies do not achieve these efficiency gains, they will earn lower returns than projected by the regulator. Figure C.2 illustrates the incentives for the annual rates of improvement in operating efficiency.

Figure C.2: Operating Efficiency Targets "Carrots" and "Sticks"

Operating expenditure – annual average rate of improvement	Efficiency improvement factors assumed in our draft determinations			Potential outperformance incentive			Likely overall scope
	'Sticks'			'Carrots'			
	Catch-up improvement factor	Continuing improvement factor	Total 'stick' improvement factor	Catch-up out-performance	Continuing out-performance	Total out-performance 'carrot'	
Water service – base	1.1%	0.3%	**1.4%**	0.7%	0.3%	**1.0%**	**2.4%**
Water service – enhancements	1.4%	0.45%	**1.85%**	0.4%	0.45%	**0.85%**	**2.7%**
Sewerage service – base	0.8%	0.5%	**1.3%**	0.5%	0.5%	**1.0%**	**2.3%**
Sewerage service – enhancements	1.0%	0.75%	**1.75%**	0.3%	0.75%	**1.05%**	**2.8%**

Source: Ofwat "Future Water and Sewerage Charges 2005-2010: Final Determinations" (2004) at page 148

The carrots and sticks are different for water and sewerage, and different for base assets and enhancements. The two incentive rates are added to each other within each category of carrots and sticks, are the "catch-up" rate and the continuing improvement factor. Ofwat believes that almost half of the potential efficiency improvements are not accounted for in these rates, as they provide scope for outperformance of these targets.

Additional incentives are provided to leading companies

In the 2004 price review, Ofwat introduced an additional incentive for leading companies through an "outperformance multiplier". The multiplier adds an additional year to the period that companies keep any efficiency gains, allowing companies to retain outperformance efficiencies for the remaining portion of that year, plus an additional five years. Companies at the relative efficiency frontier at the start of the regulatory period benefit from an additional 50 percent of the outperformance benefit (a multiplier of 1.5). Companies that are within 5 percent of the frontier receive an additional 25 percent benefit (a multiplier of 1.25). The outperformance multiplier reflects the fact that efficiency gains are harder to make for companies that are already efficient (efficiency gains exhibit diminishing returns to effort), and that efficiency gains that expand the efficient frontier set a higher bar for other regulated suppliers.

C.3 Incentives for Capital Efficiency

In an effort to balance the incentives for operating and capital cost reductions, Ofwat has used a similar approach to regulating both types of expenditure. This section describes how the carrot and sticks approach is applied to capital expenditure, and discusses the recent introduction of menu regulation for capital expenditure.

Carrots and sticks are also applied to capital expenditure

Ofwat introduced rolling incentives to capital expenditure in the 1999 price review (the same time that rolling incentives were applied to operating expenditure). The main difference between the rolling incentives for operating expenditure and capital expenditure was that incentives for capital expenditure were applied to cumulative outperformance, rather than incremental outperformance. This reflects the fact that capital projects can take longer than one year to deliver, potentially distorting annual measures of capital efficiency.

The carrot and stick approach is applied to capital expenditure forecasts using the same categories of incentives used for operating expenditure (described above). However, the incentive rates applied to capital efficiency are higher. Figure C.3 provides the incentives for improvements in capital expenditure efficiency used in the 2004 price review.

Figure C.3: Capital Efficiency Targets "Carrots" and "Sticks"

Capital expenditure – cumulative improvement over the period 2005-10	Efficiency improvement factors assumed in our draft determinations			Potential outperformance incentive			Likely overall scope
	'Sticks'			'Carrots'			
	Catch-up improvement factor	Continuing improvement factor	**Total 'stick' improvement factor**	Catch-up out-performance	Continuing out-performance	**Total out-performance 'carrot'**	
Water service – capital maintenance	5.4%	2.5%	**7.9%**	6.6%	2.5%	**9.1%**	**17.0%**
Water service – capital enhancements	8.2%	3.7%	**11.9%**	2.6%	3.7%	**6.3%**	**18.2%**
Sewerage service – capital maintenance	6.2%	3.0%	**9.2%**	6.6%	3.0%	**9.6%**	**18.8%**
Sewerage service – capital enhancements	8.5%	4.4%	**12.9%**	2.7%	4.4%	**7.1%**	**20.0%**

Source: Ofwat, "Future Water and Sewerage Charges 2005-10: Final Determinations" (2004) at page 149

The higher incentive rates for capital expenditure reflect Ofwat's belief that there is more scope to improve efficiency in capital programmes. Expenditure is larger for sewerage services than water services, and incentive rates are higher. Ofwat assumes that the overall scope of the carrots and sticks accounts for approximately 60 percent of the possible efficiencies. The remaining 40 percent of possible efficiencies provide room for outperformance.

Companies are able to choose the strength of capital expenditure incentives

In the 2009 price review, Ofwat introduced the Capital expenditure Incentive Scheme (CIS). This scheme is a menu regulation approach, and provides stronger incentives for companies to create efficient business plans and to out-perform the regulated prices. Companies are allowed to recover their capital expenditure plus (or minus) an incentive allowance that is dependent on forecast and actual capital expenditure. Rewards or penalties are reconciled at the end of the price review, and the regulatory capital value is adjusted to reflect the actual expenditure. A symmetrical approach to over and under spending on forecasts is used in the Ofwat CIS. Ofwat developed the CIS with explicit reference to the Ofgem experience with menu regulation.

Menu regulation reduces the problem of information asymmetry by providing less incentive for companies to inflate their business plans, allowing each company to choose its own risk and reward trade-off. As a result, the CIS process has allowed Ofwat to provide greater certainty about the likely shape of the capital programme at an earlier stage of the price review.

To determine future capital expenditure allowances, Ofwat makes the following assumptions:

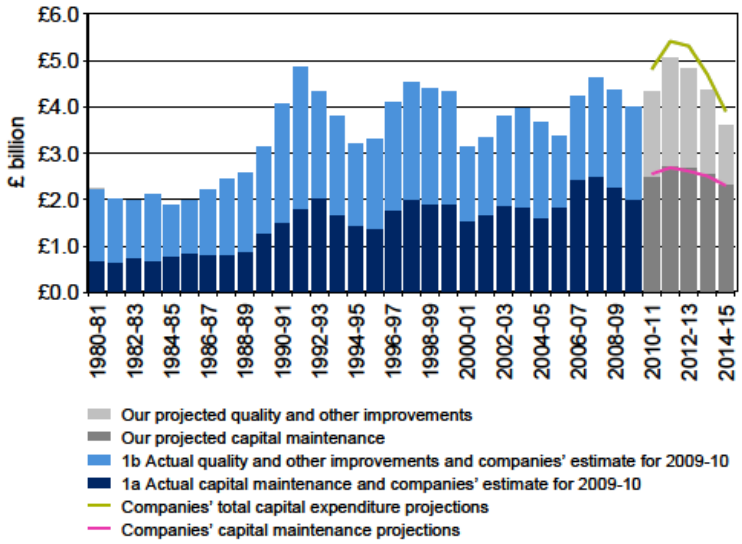
- A **single continuing efficiency** assumption (the same for each company), and
- A **company-specific efficiency** assumptions that is relative to a middle ranking company.

Ofwat builds the second of these efficiency assumptions into the ratios in the CIS menu. The company-specific assumption has changed from the previous approach that used a 'frontier' benchmark. This new element of CIS approach creates lower expectations of efficiency gains, thereby providing companies with more scope to outperform the CIS baseline.

Under the CIS approach any overspending of capital expenditure is directly penalised, with actual investment costs then added to the regulated asset base. As a result, over the life of an investment companies will retain approximately 30 percent of any outperformance at the breakeven point of the CIS matrix.[59] Prior to the 2009 price review, any overspending on capital expenditure was not added to the regulatory asset base, except with exceptional justification.

Figure C.4 illustrates the capital expenditure patterns for the water and sewerage companies since 1981, and provides the companies' and Ofwat's projections for to 2015.

Figure C.4: Actual and Forecast Capital Expenditure (1981-2015)



Source: Ofwat, "Future water and sewerage charges 2010-15: Final Determinations" (2009)

Ofwat requires the water and sewerage companies to differentiate between capital expenditure for capital maintenance and for quality and other improvements. Differentiating capital expenditure helps Ofwat to determine where the efficiency improvements are being made.

[59] Ofwat, "The Role and Design of Incentives for Regulating Monopoly Water and Sewerage Services in England and Wales – a Discussion Paper", (2011)

C.4 Service Quality Incentives

Service quality incentives are crucial to ensure that companies to do not cut costs to meet operating and capital expenditure targets, at the direct expense of service quality. This section describes the evolution of service quality incentives provided for water and sewerage companies in the United Kingdom.

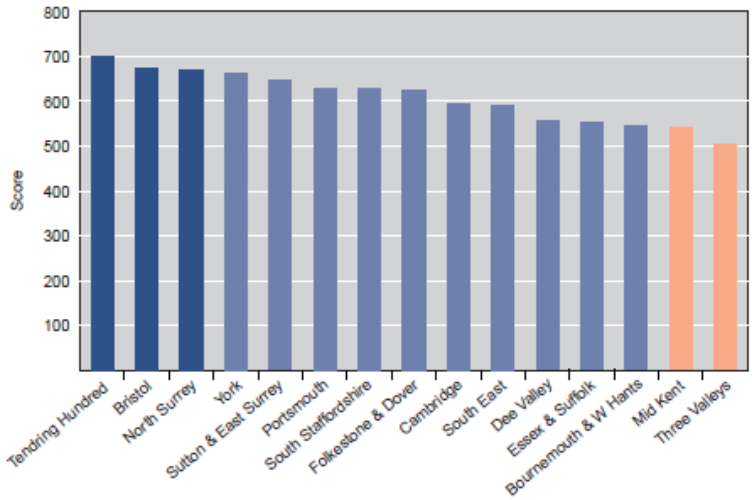
Ofwat has a long history of providing financial incentives for service quality

Service quality incentives have always been an integral part of the regulatory framework for water and sewerage companies in the United Kingdom. Since privatisation in 1989, the Guaranteed Services Scheme (GSS) has set minimum standards of service quality for all regulated companies. The GSS provides customers with compensation for receiving poor service performance. Companies are required to comply with specified standards of performance that relate to supply interruptions, low pressure, written complaints and queries, and failure to keep appointments.

Since 1999, Ofwat has strengthened service quality incentives. The Overall Performance Assessment (OPA) introduced in 1999 scores each company based on a number of quantitative (number of complaints, telephone contacts) and qualitative (extent of customer satisfaction) aspects of the customer service. Suppliers are provided with financial incentives of between +0.5% to -1% of allowed revenue based on their OPA scores. The OPA also provides "reputational" and "procedural" incentives to improve data collection and reporting.

In the 1999 price review, the OPA scores for 1996-1999 were ranked. The results are shown in Figure C.5. Any company that performed significantly better than the industry generally (dark blue) received price limits that were increased by 0.5 percent. No company's performance was considered to be so poor as to justify a reduction in their price limit by 1 percent, so the poorest performers (orange) received a reduction of 0.5 percent. All others (light blue) received no change in the set price limits based on their performance score.

Figure C.5: OPA Scores for Water and Sewerage Companies



Source: Ofwat, "Future Water and Sewerage Charges 2000-5 Final Determinations," (1999)

In the 2004 and 2009 Price Reviews, Ofwat adjusted this incentive scheme by introducing additional performance bands. This made the incentives more granular and targeted towards the actual service provided by different companies.

Strengthened incentives for service quality

The Service Incentive Mechanism (SIM) was initiated in 2010 as an adaptation of the OPA. The SIM is based on two customer experience measures:

- A quantitative measure – the number of complaints and unwanted contacts a company receives (already part of the OPA)
- A qualitative measure – the quality of the experience derived from a customer experience survey (a new initiative to get direct feedback from customers on service performance).

Ofwat introduced this change because most companies had reached an acceptable level in performance for OPA measures. However, while customers were satisfied with the basic aspects of the service, many complaints were received about quality of the service provided.[60] Most of the OPA measures did not focus on quality of a company's response and instead measured reliability and response times. Ofwat also viewed the OPA to be potentially limiting innovative service improvements.

Positive and negative financial incentives remain in the SIM, and continue to be asymmetric (stronger for poor performance than good performance).

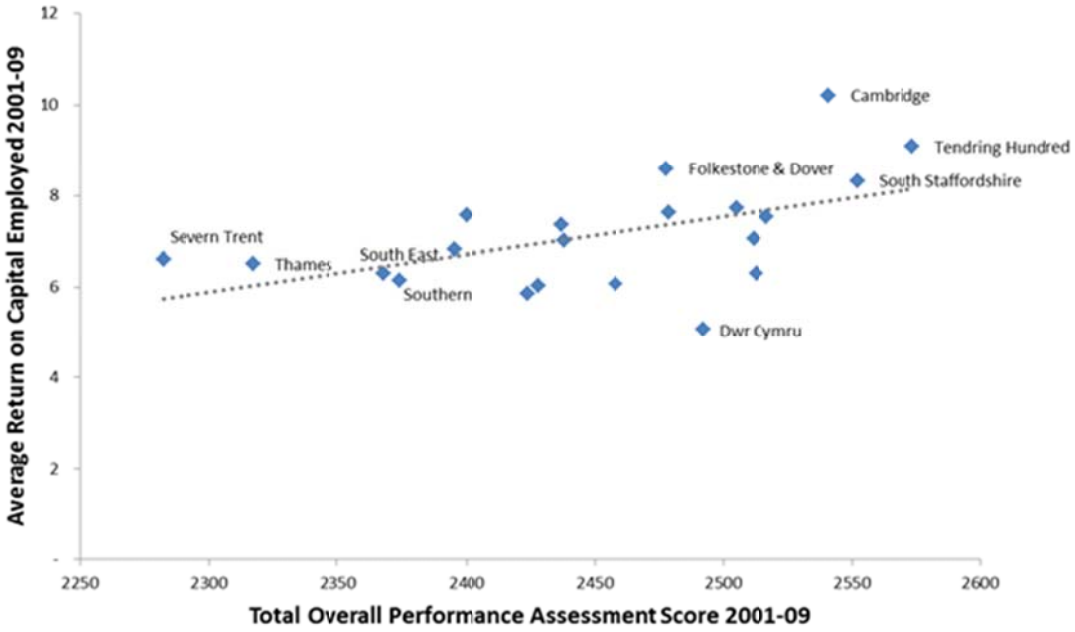
C.5 Conclusions on the Impacts of Incentives in the UK Water Sector

Ofwat has strengthened the incentives provided to water and sewerage companies over the past twenty years. Ofwat has adopted successful approaches implemented by other regulators (such as Ofgem's menu regulation), and has been innovative in other areas (such as designing the 'carrots' and 'sticks' approach to incentives).

Water and sewerage suppliers have responded well to Ofwat's incentives. The three companies that have consistently achieved the highest OPA scores are Tendring Hundred, South Staffordshire, and Cambridge (these companies are labelled in the graph below). These top performing companies have all earned average annual returns from 2001 to 2009 that are above 8 percent, and well above the industry average of 7.1 percent. In contrast, the poorest performing companies all earned average annual returns of less than 6.7 percent over the same period.

[60] Ofwat, "Putting Water Consumers First – The Service Incentive Mechanism," (2010)

Figure C.6: UK Water Industry Average Rate of Returns and Service Quality Scores



Note: Mid Kent has been excluded because it merged with South East Water in 2007

Ofwat, "Financial Performance and Expenditure Water Companies" reports from 2001 to 2009; and Ofwat, "Service and Delivery – performance of the water companies in England and Wales" reports from 2001 to 2009

At the other end of the spectrum, companies that perform poorly on measures of service quality also earn lower returns, on average. This is not surprising, given that poor performance is penalised by a reduction in price limits of up to 1 percent.

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