Dynamic Efficiency and the Energy Transition

A report for Vector

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Project Team

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1. Introduction

This report has been prepared by Axiom Economics (Axiom) on behalf of Vector. Its subject is the Commerce Commission's (Commission's) input methodologies (IM) review.[1] Vector has asked us to provide our views on the extent to which the Commission should be focussing on *static* versus *dynamic* efficiency considerations when making decisions about its IMs. It has also asked us to highlight any specific potential implications for certain aspects of the IMs, including the choice of 'WACC percentile' and the design of expenditure allowances.

The starting point is the statutory objective. The Commission must specify IMs that support the long-term benefit of consumers by promoting outcomes consistent with those produced in workably competitive markets.[2] The purpose here is not to mimic competition as a means to itself but, rather, to *enhance efficiency*. Put simply; efficiency is the goal; imitating competition is the process. As foreshadowed above, efficiency can be disaggregated into a *static* and a *dynamic* component. As the names suggest, the concepts straddle different time periods:

- **Static efficiency** measures the effect of a policy or option on overall welfare at a *particular point in time*. It explores the extent to which producers are supplying the goods and services that customers want to buy, producing them at the lowest possible cost and selling them at cost-reflective prices.
- **Dynamic efficiency** refers to how well a policy or option promotes welfare *over time*, i.e., in the *longer term.* It examines matters such as whether businesses have appropriate incentives to invest in the right things at the right times, and to engage in innovations targeted at best serving customer needs.

Well-designed regulation can deliver long-term benefits to consumers by enhancing *both* these aspects of efficiency. However, it is widely accepted as a matter of economics that the *greatest* potential benefits are usually of a *dynamic* nature. For example, the benefits obtainable from reducing tariffs on existing services to more 'cost-reflective' levels accrue to only *some* consumers.[3] In contrast, *new* investments in lower-cost technologies and innovative services can benefit a much wider group – and consumers and producers alike.[4]

1 The Commission released two papers in May, outlining its approach to the review and identifying what it saw as the key issues. *See:* Commerce Commission, *Part 4 Input Methodologies Review 2023, Process and Issues paper,* 20 May 2022 (hereafter: 'Process and Issues Paper'); and Commerce Commission, *Part 4 Input Methodologies Review 2023, Draft Framework paper,* 20 May 2022 (hereafter: 'Draft Framework Paper').

2 *See: Commerce Act 1986*, s.52A.

3 In more technical economic parlance, regulation typically forces prices down and allows some consumers to capture a fraction of the so-called 'Harberger triangle', i.e., the previous 'deadweight loss' arising from inefficiently unserved demand.

4 To use a simple example (from a competitive setting), any benefit customers would have received from a small reduction in the average price of 'flip phones' would have been dwarfed by the benefits arising from the release of the first iPhone, and subsequent smartphone innovations.

For that reason, although the Commission cannot – and should not – *automatically* elevate dynamic efficiency considerations in its decision making, those concerns will nevertheless be frequently decisive. Furthermore, the circumstances that currently exist in the energy sector provide *even more* reason for the Commission to pay heed to long-term dynamic factors as it performs its review. Most notably, the full force of transformational change is in motion across the energy sector, driven by rapidly evolving technology, government policy and changing customer demands.

There is a strong public interest in line companies making the investments needed to meet expected increases in electricity demand, keep pace with increasingly complex consumer preferences and aid the transition to a low carbon economy. If the IMs provide network owners with appropriate incentives throughout this transitional period, then the potential dynamic efficiency benefits are likely to be substantial. If they do not, the downside costs would be vast – likely much higher than in years past. For those reasons, we have concluded that:

- the profound changes sweeping through the energy sector should cause the Commission to give particular emphasis to long-term dynamic efficiency considerations as it reviews the IMs – even more than it has previously; and
- some of the more specific manifestations of such a focus might include a reluctance to reduce the WACC percentile from its current level and potential changes to the way in which expenditure allowances are specified.

We elaborate on these findings in the remainder of this report, which is structured as follows:

- in **section two**, we describe what economists mean by the term 'economic efficiency', identify its static and dynamic components and explain how regulation can promote both of these efficiency variants;
- in **section three,** we explain how these efficiency concepts fit within the statutory scheme of Part 4, which requires the Commission to promote outcomes consistent with those produced in workably competitive markets; and
- in **section four,** we detail the profound changes taking place in the energy sector and explain why the Commission should arguably be focussing even more keenly than usual on dynamic efficiency considerations as it reviews the IMs.

For the avoidance of doubt, the opinions expressed throughout this report are our own and do not necessarily reflect the views of Vector.

2. Economic efficiency

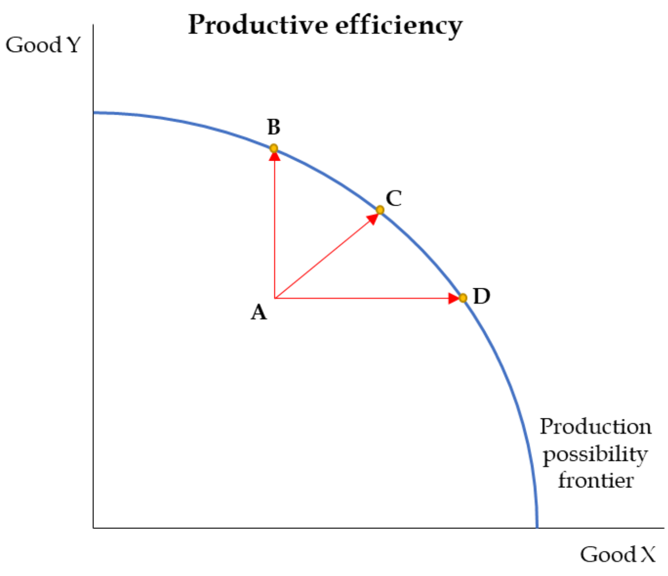
In this section, we provide a brief primer on efficiency. When taken as a whole, the overall 'economic efficiency' of a policy represents the *total increase in net benefit* (i.e., social welfare) arising from it.[5] A policy is said to be 'economically efficient' if no alternative exists that could produce an even *higher* net benefit. This broad concept can be disaggregated further into a *static* and a *dynamic* component:

- static efficiency measures the effect of a policy or option on overall welfare at a *particular point in time*; and
- dynamic efficiency refers to how well a policy or option promotes welfare *over time*, i.e., in the *longer term.*

Within these categories, economists recognise three distinct types of efficiency that can be enhanced or improved as a result of competitive rivalry between producers, or through the application of economic regulation where competition is not feasible. Two are static in nature – 'productive' (or 'technical') efficiency and 'allocative' efficiency – and the third is dynamic.

2.1 Productive efficiency

Productive (or technical) efficiency measures how well a given value of inputs (such as salaries and the costs of equipment) is converted into output value (such as the quantity of the service delivered, e.g., kWh of electricity). An outcome is said to be 'productively efficient' if the service in question is provided at the lowest possible cost using facilities of optimal scale with existing technology.[6] This scenario occurs when no more output can be produced given the available resources.



In the adjacent figure, points B, C and D are 'productively efficient' because they all lie on the 'production possibility frontier ('PPF')'.[7] It is not possible to increase production of Good X or Y without sacrificing some

5 Productivity Commission, *On efficiency and effectiveness: some definitions, Productivity Commission Staff Research Note*, May 2013, p.13 (hereafter: 'Productivity Commission Research Note (2013)').

6 Pass, C and Lowes, B, 1993, *Collins Dictionary of Economics: Second Edition*, Harper Collins, Great Britain, p. 434.

7 The PPF illustrates the possible quantities that can be produced of two products or services if both depend upon the same finite resource for their manufacture. It is curved because, as more of one product is produced, incremental units become more costly, i.e., the producer will be forced to start deploying resources that are better suited to producing the *other* product.

production of the other. In contrast, point A exhibits productive *inefficiency*, since it is possible to increase production of both Goods X *and* Y utilising the same inputs, i.e., with the existing resources at the producer's disposal.

Firms in competitive markets must strive constantly to minimise their costs, lest they be driven out of business. However, a natural monopoly has no such concerns, because if faces no prospect of entry and its customers have no close alternatives at their disposal. Consequently, monopolists often do not operate anywhere near the PPF – or the 'minimum average total cost curve'. Preventing this productive inefficiency is one of the motivations for introducing regulation.

When regulation is first introduced in a sector, there is often a sharp initial focus on driving out entrenched productive inefficiencies.[8] By 'de-linking' costs and prices for periods of time, incentive forms of regulation allow efficient costs to be 'revealed' by firms striving to earn additional profits by outperforming benchmarks.[9] However, once the 'low-hanging fruit' has been picked, the potential for significant further productive efficiency gains tends to diminish.

2.2 Allocative efficiency

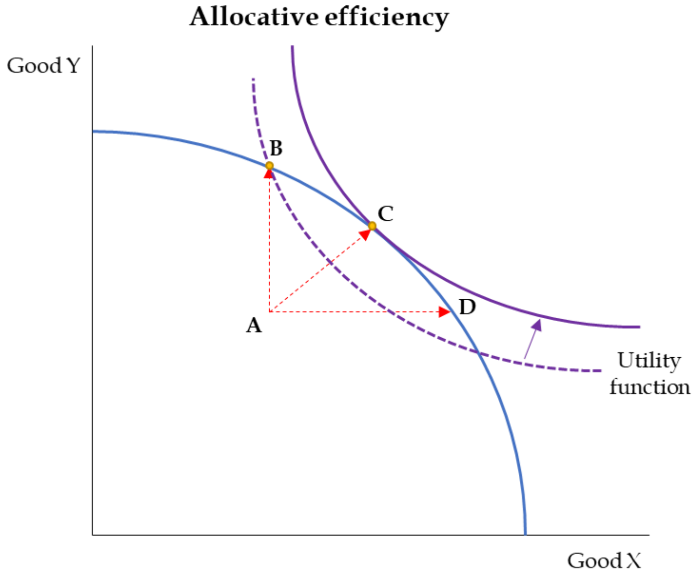
Just because a bundle of goods and services is produced at the lowest possible cost – and is therefore *productively* efficiency – does not mean it is the collection that consumers value most highly. Allocative efficiency is about ensuring that the community gets the greatest return (or utility) from its scarce resources. The best or most *allocatively efficient* use of resources is the one that contributes most to community wellbeing, i.e., maximises utility.

In the figure below, points B, C and D are all 'productively efficient' since they lie on the PPF. However, point C is more 'allocatively efficient' than either B or D because it sits on a higher 'utility function'. In other words, the benefits that society as a whole would obtain from the combination of Goods X and Y produced at point C exceeds the levels achievable at B and D. The long-term benefits of consumers can therefore be enhanced by moving from positions B or D towards C.

[8] For example, when the 'thresholds and control regime' was introduced under Part 4A (the predecessor to the current arrangements), the 'B' (industry-wide) and 'C1' (firm-specific) productivity factors were designed to provide regulated electricity lines businesses with strong incentives to reduce costs *See:* Commerce Commission, *Regulation of Electricity Lines Businesses Targeted Control Regime Threshold Decisions (Regulatory Period Beginning 2004)*, 1 April 2004, pp.4-5.

[9] Specifically, incentive forms of regulation typically estimate an *ex-ante* benchmark of the efficient future level of costs and set price or revenue caps accordingly. Firms are then able to retain the additional profits arising from any outperformance against those benchmarks. The firm's *actual* level of performance (including any outperformance) – i.e., its *revealed* costs – can then inform the establishment of the *ex-ante* benchmarks for the *next* pricing period.

A natural monopolist has the power to increase prices above its marginal cost of supply by restricting output. This compromises allocative efficiency because consumption that *could* occur at a price that would have covered the firm's cost of production (and therefore generated a positive economic profit) is inefficiently choked off, resulting in a deadweight loss from unserved demand.[10] This is the familiar textbook problem of 'monopoly pricing'.



Regulation can assuage the allocative inefficiencies arising from above-cost pricing. By controlling prices (and/or revenues) regulation can limit monopoly service providers' abilities to earn excessive profits and, in the process, increase overall consumption (by reducing unserved demand). However, the incremental gains to total welfare from eliminating monopoly pricing – whilst by no means immaterial – are often modest, due to the typical geometry of demand and supply curves.[11]

2.3 Static efficiency

Static efficiency is achieved when both productive *and* allocative efficiency have been maximised. This is accomplished when suppliers supply the combination of goods and services that consumers value most highly, produce them at the lowest possible cost and sell them at cost-reflective prices. Or, put more simply, it occurs when consumers get what they want, at the lowest cost and the right price. As noted earlier, this occurs at point C in the figure above.

However, static efficiency measures the effect of a policy or option on overall welfare only at a *particular point in time*. Its sole concern is *current* production possibilities, i.e., with what is feasible given the existing resources and technologies. Over time, new investment and/or innovations can enable the PPF to *shift outwards* and enable even greater possibilities. The success with which this occurs brings us to the third – and most important – source of efficiency: dynamic efficiency.

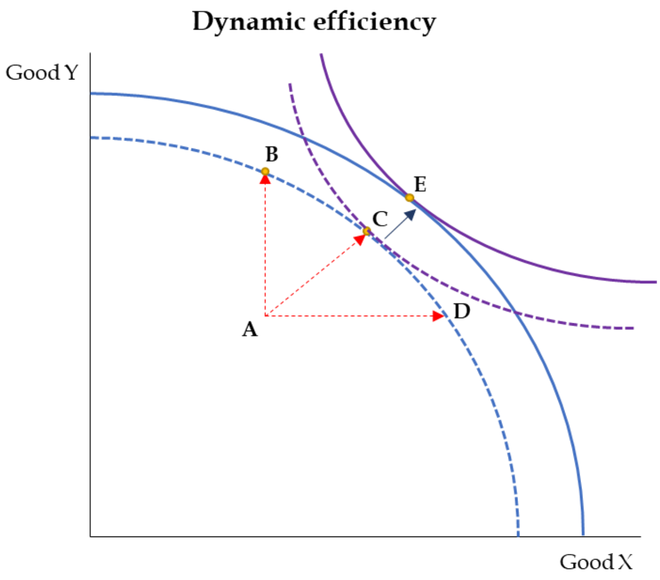
10 A deadweight loss occurs when it is possible to make someone better off without making anyone else worse off. Or, more specifically, it is possible to increase the sum of 'consumer surplus' and 'producer surplus' and, therefore, overall economic welfare.

11 Because demand for regulated services tends to be highly inelastic, unless the application of regulation leads to *substantial* price reductions the potential allocative efficiency gains achievable through regulation (i.e., the reductions in deadweight loss or 'Harbinger triangles') can be limited. *See for example:* Small., J., 'Regulatory Evolution: lessons from New Zealand', *presentation at ACCC regulatory conference*, July 2007, slides 4 and 5 (available: here).

2.4 Dynamic efficiency

Dynamic efficiency is concerned with the allocation of resources *over time.* It refers to the ability of markets to adapt in response to changes in consumer preferences and/or technology through the development of *new* products and services and/or production processes. It is tied closely to the concepts of investment and innovation. Firms that are able to do these things successfully and find better products and modes of production can deliver substantial benefits.

In the adjacent figure, point C represents the most *statically* efficient initial combination of resources. However, as time passes, investments and innovation (producing more with less) and, potentially, growth in resources enables the PPF to shift out, enabling more of both goods to be produced. This represents an improvement in *dynamic* efficiency. Such developments can give rise to large increases in net benefits.



Dynamic inefficiency is the single largest potential source of social cost from monopoly. A monopolist that does not need to fear competition can continue to produce the same products in the same ways, while still earning healthy profits. Nobel Prize winner John Hicks arguably put it best when he observed that: "The best of all monopoly profits is a quiet life."[12] Put simply, monopolists are oftentimes content to rest on their laurels, banking their profits without focusing on investing in new and innovative services their customers may value.

Regulation can therefore perform a crucial role in incentivising essential service providers to invest and innovate more efficiently. Industries for which regulation is usually contemplated are typically characterised by large, lumpy investments that have no alternative purposes. The long-run costs of supplying services and the overall benefits that consumers derive are therefore determined to a substantial extent by the effectiveness of those investments. For example:

- if regulation provides companies with appropriate incentives to invest and innovate (including a reasonable rate of return), then they will have the confidence to continue doing so in the future; but

12 Hicks, J. R., (1935), 'Annual Survey of Economic Theory: The Theory of Monopoly', *Econometrica,* Volume 3, Issue 1, January 1935, p.8.

- if regulation does not provide adequate incentives (e.g., if a firm foresees that it will not gain an adequate return on new capital expenditure), they may inefficiently delay projects, underbuild or abstain from investing altogether.

If regulation successfully facilitates the right investments in the right things at the right times, then the potential uplift in net benefits is considerable. The welfare gains achievable from investment and innovation can dwarf those achievable via static efficiency improvements. That is because investments, say, in *new* lower-cost technologies and innovative services can benefit a much wider group than, say, incremental reductions in prices for existing services. For example:

- the benefits obtainable from reducing tariffs on existing services to more 'cost-reflective' levels accrue to only *some* consumers;[13] whereas
- *new* investments in lower-cost technologies and innovative services can benefit *everyone*, i.e., consumers and producers alike.[14]

Dynamic efficiency benefits can also arise in the form of *avoided* costs. For example, if an electricity lines business is appropriately incentivised to invest in reliability, then this can pay large dividends for consumers during any subsequent occasions that prolonged outages would have occurred had it not been for those upgrades.[15] Recognising and minimising inefficiencies in relation to long-term investments is consequently a core element of the design of sound regulatory frameworks, as we explain in more detail in the following sections.

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13 In more technical economic parlance, regulation typically forces prices down and allows some consumers to capture a fraction of the so-called 'Harberger triangle', i.e., the previous 'deadweight loss' arising from inefficiently unserved demand. This typically accounts for only a small fraction of the area under the demand curve.

14 To use a simple example (from a competitive setting), any benefit customers would have received from a small reduction in the average price of 'flip phones' were dwarfed by the benefits arising from the release of the first iPhone, and subsequent smartphone innovations. The introduction of new products enables the *entire region* under the demand curve to be translated into net benefits – invariably a much larger area than a typical Harberger triangle.

15 For example, Orion's significant historical investments in various 'earthquake proofing' measures may not have manifested in any obvious way in its 'SAIDI' and 'SAIFI' statistics, prior to the Christchurch earthquakes. However, when disaster struck, those investments paid dividends by limiting the extent of the damage, i.e., but for those historical outlays, the repair bill would have been substantially higher.

3. Efficiency and the statutory objective

In this section, we explain how the efficiency concepts described earlier fit within the statutory scheme of Part 4, which requires the Commission to promote outcomes consistent with those produced in workably competitive markets. We then explain why it will often be in the long-term interest of consumers for the Commission to give significant weight to dynamic efficiency considerations when making decisions on matters such as IMs and price-quality paths.

3.1 The statutory objective

The Commission is tasked with determining IMs – and subsequent price-quality paths – in a manner consistent with the statutory objective. That overarching purpose is, in brief, to support the long-term benefit of consumers by promoting outcomes consistent with those produced in workably competitive markets.[16] The idea is to try and *mimic* some of the disciplines of a competitive market where *actual* rivalry is not possible, such that suppliers of regulated services:

a. have incentives to innovate and to invest, including in replacement, upgraded, and new assets;

b. have incentives to improve efficiency and provide services at a quality that reflects consumer demands;

c. share with consumers the benefits of efficiency gains in the supply of the regulated goods or services, including through lower prices; and

d. are limited in their ability to extract excessive profits.

In other words, the chief virtue of workable competition is that it drives *efficiency*.[17] Competition is the *process*, and efficiency is the *result*.[18] To that end, all the outcomes listed above touch upon aspects of the orthodox efficiency concepts described in the previous section that, collectively, motivate regulation; namely:

- criterion b is the most generic, and appears to encapsulate all three forms of efficiency, i.e., **productive**, **allocative** and **dynamic**;
- criteria c and d are targeted most obviously at promoting **allocative** efficiency, i.e., removing monopoly profits and reducing prices; and

16 *See: Commerce Act 1986*, s.52A.

17 Competition is a process by which the goals of all three forms of economic efficiency can be achieved or at least improved. First, competition can enhance productive efficiency, since firms that face competitive pressure from rivals have a strong incentive to reduce their costs of production in order to protect or improve their market share. Second, it can enhance allocative efficiency, because firms facing competition may reduce their prices (possibly as a result of reduced production costs), such that previously unmet demand is served at prices that generate positive economic profits. Firms that are unable to compete effectively will divert their resources to more productive endeavours. Finally, it can enhance dynamic efficiency by providing suppliers with a strong incentive to develop new and innovative products or more cost-efficient production processes in an effort to protect market share in a changing environment.

18 *See for example:* W Kolasky (2002), *Global Competition: Prospects for convergence and cooperation*, Speech before the American Bar Association, November 7 2002.

- criterion a is transparently intended to promote primarily **dynamic** efficiency, as evidenced by the reference to innovation and investment.

The Commission has stated – and the High Court has confirmed[19] – that none of the workably competitive market outcomes listed above can be automatically elevated above the others, *per se*:[20]

> *"None of the outcomes is paramount and, further, the outcomes are not separate and distinct from each other, or from section 52A(1) as a whole."*

For example, it is not appropriate for the Commission to assume that, say, it is *always* more important to promote incentives to innovate and invest (criterion (a)) than it is to limit excess profits (criterion (d)) regardless of the circumstances, thereby explicitly elevating one criterion over the latter in the statutory scheme.[21] Rather, the Commission has explained that, when necessary, it must *balance* the outcomes, and exercise its judgement in doing so.[22]

3.2 Balancing static and dynamic considerations

When the Commission is weighing the outcomes specified in the purpose statement – e.g., balancing shorter-term static concerns against longer-term dynamic considerations – it is guided by *what best promotes the long-term benefit of consumers*.[23] To assist it in making such judgements during its IM reviews (and other regulatory determination processes), the Commission has defined and applied three core economic principles. In brief, these are:[24]

- **ex-ante real financial capital maintenance (FCM)**: the Commission seeks to provide regulated suppliers the *ex-ante* expectation of earning their risk-adjusted cost of capital (a 'normal return') and of maintaining their financial capital in real terms over timeframes longer than a single regulatory period;[25]

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19 *Wellington International Airport Ltd & others v Commerce Commission [2013],* NZHC 3289, paragraphs 1391-1492.

20 Draft Framework Paper, p.12.

21 The purpose of IMs *themselves* is to provide certainty to both regulated suppliers and consumers about the rules, requirements and processes applying to Part 4 regulation (*see: Commerce Act 1986*, s.52R.). As the Commission explained during its previous review: 'a stable and predictable regime provides suppliers and investors in regulated firms with *the* confidence to invest in long-lived infrastructure that provides essential services to all New Zealanders' (*see:* Commerce Commission, *Input methodologies review decisions Summary paper*, 20 December 2016, p.2.). This objective is therefore linked inextricably to dynamic efficiency. If the IMs contain clear regulatory principles that are administered openly, transparently and consistently, efficient investment can be fostered. However, if the IMs are uncertain, or the Commission is seen to be constantly altering its approach, investment incentives may be distorted, harming the long-term interests of consumers.

22 Draft Framework Paper, p.12.

23 *Ibid*.

24 Draft Framework Paper, p.8.

25 This is intended to maintain incentives to invest in line with s.52A(1)(a) of the Act.

- **allocation of risk:** the Commission attempts to allocate risk to suppliers or consumers, based on who is best placed to manage the risk;[26] and
- **asymmetric consequences of over-/under-investment:** the Commission seeks to apply its *ex-ante* FMC principle recognising any adverse consequences to consumers of regulated services of under-investment versus over-investment, over the long term.[27]

If, when applying these principles, the Commission determines that the long-term interests of consumers would be best served by providing stronger incentives to innovate and invest, even if this would lead to higher prices, then it will act accordingly. Perhaps the clearest example of the Commission assessing the relative importance of dynamic and static efficiency considerations by applying this framework came during its review of the WACC percentile – see Box 3.1.

Box 3.1: Weighing dynamic and static efficiency: the WACC percentile

In 2014, the Commission reviewed the continuing appropriateness of setting the WACC for regulated price-quality paths at the 75th percentile of its estimated range. The cost of capital incurred by regulated firms cannot be directly observed, even *ex post*. This gives rise to an inherent a risk that any WACC will over- or under- compensate businesses by an indeterminate amount. The question at issue was how best to deal with that uncertainty; namely:

- if the social losses of setting the regulatory WACC either too high or too low were *symmetric*, it would then be appropriate to set the WACC at the 50th percentile of the estimated range (provided it was unbiased); *but*
- if, as had long been assumed, the social costs of setting the WACC *too low* exceeded those of setting it *too high* (i.e., if there was an asymmetry), then it would be appropriate to set the WACC at a level *above* the midpoint.

The fundamental question was whether it was in the long-term interests of consumers to pay higher prices (via a 'WACC uplift') in order to avoid potentially even greater costs stemming from subsequent under-investment. The Commission determined that it was, but that adoption of the 67th percentile (rather than the 75th) was more appropriate.[28] Central to this decision was analysis (performed by Oxera), which suggested that:

26 This is intended to provide appropriate compensation for the risks carried, maintain incentives to invest and promote efficient behaviour.

27 This is intended to maintain incentives to invest in the service quality that consumers demand, in line with ss.52(A)(1)(a) and (b).

28 Commerce Commission, *Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services, Reasons paper*, 30 October 2014.

- if the WACC was inadvertently set 'too low', this may cause businesses to underinvest,[29] potentially culminating in severe outage events – the annual costs of which could be as much as $1b to $3b;[30] and
- it was consequently in the interests of consumers to reduce the probability of that underinvestment occurring by paying higher prices via the WACC being set somewhere between the 60th and 70th percentile.

Linking this back to the three core economic principles described above, the Commission concluded that:

- a WACC uplift to the 67th percentile was not necessarily inconsistent with *ex-ante* real FCM, given the uncertainties surrounding the true level of the WACC (i.e., it may not result in over-recovery, in the long-term);
- in terms of risk allocation, it was in the best interests of consumers to pay an 'insurance premium' in the form of higher prices in order to mitigate against the even greater costs that could arise from underinvestment; and
- there was demonstrably an asymmetry in the consequences arising from under- versus over-investment, with the former giving rise to much larger costs, thereby justifying a WACC uplift and higher prices.

In other words, when the Commission balanced the criteria contained in the purpose statement, long-term dynamic efficiency considerations proved to be more important than short-term static efficiency concerns. It surmised that the long-term benefit of consumers would best be served by incentivising investment (criterion a), even if doing so would increase prices and heighten the probability of suppliers earning excessive profits (criterion d).

The 'welfare calculus' described in Box 3.1 is neither unique nor surprising. Improvements in welfare can be achieved by enhancing static *and* dynamic efficiency. However, the *greatest* benefits from regulating sectors characterised by substantial market power will often be of a *dynamic* nature. Consider the classic problems that motivate regulation: monopoly service providers reducing output and/or service quality to boost prices and profits, and not focusing sufficiently on best meeting the changing needs of customers:

- well-designed and targeted regulation can certainly improve static efficiency by reducing prices and consequently increasing output, i.e., by reductions in 'deadweight loss';[31] *but*

29 The Commission did not suggest that there would be an 'investment strike' if it inadvertently set the WACC below its 'true level'. Rather, it recognised that other subtler avenues are available to EDBs to cut back on spending that may not be easily observable. These strategies included neglecting to replace ageing assets in a timely fashion, increasing the probability of failure, allowing utilisation of existing assets to increase to levels that heighten the probability of failure before investing in new capacity, choosing to invest in inefficiently small-scale projects to alleviate capacity constraints, etc.

30 *See:* Oxera, *Input methodologies, Review of the '75th percentile' approach, Prepared for the New Zealand Commerce Commission,* 23 June 2014, p.72.

31 Benefits are generated because the quantity produced of a product or service is otherwise inefficiently low since consumers who are willing to purchase it at cost reflective levels are unable

- in the long run, net economic welfare is influenced principally by the dynamic efficiency of *new* investments and innovations and their cumulative effect on the capital stock of an industry.

The intuition here is straightforward. Once regulation has removed any entrenched historical cost inefficiencies the scope for significant further productive efficiency gains tends to narrow. The benefits allocative efficiency gains obtainable from reducing tariffs to more 'cost-reflective' levels also accrue to only *some* consumers.[32] However, the dynamic efficiency gains arising from new investments – including in lower-cost technologies and/or innovative services – can be substantial, long-lasting and often benefit consumers and producers alike.

3.3 Implications

Although the Commission cannot – and should not – *automatically* elevate dynamic efficiency considerations in its decision making[33], those concerns should nevertheless be frequently decisive. That is not to say that static efficiency considerations are not important: they most assuredly are. However, when the Commission is performing the balancing exercise described earlier, it is reasonable to anticipate that dynamic efficiency considerations will often have the *greater overall bearing* on long-term consumer welfare.

This is uncontroversial as a matter of economics, given the strong link that exists between investment and long-term consumer interests in industries characterised by long-lived infrastructure. Put simply, consumers almost always derive greater benefits from firms investing in the right things at the right times than they do from lower prices for existing services. Furthermore, as we explain below, the circumstances that *currently* exist in the energy sector provide *even more* reason for the Commission to pay heed to long-term dynamic factors.

to do so. It is consequently possible to make some consumers better off by facilitating greater consumption at prices that still allow producers to recoup their production costs, including a reasonable rate of return.

32 In more technical economic parlance, regulation typically forces prices down and allows some consumers to capture a fraction of the so-called 'Harberger triangle', i.e., the previous 'deadweight loss' arising from inefficiently unserved demand.

33 For example, it cannot automatically give greater priority to, say, s.52A(1)(a) of the purpose statement, regardless of the circumstances.

4. Focus on dynamic efficiency

The current review is the second the Commission has undertaken since it first determined IMs in December 2010.[34] It consequently has more than a decade's experience setting, implementing, reviewing and amending IMs. However, this current review presents new challenges. When the IMs were first put in place – and throughout much of the ensuing period – economic regulation was in its infancy and the energy sector was in a reasonably 'steady state' in terms of consumer preferences and technology. That is no longer the case today.

Lines businesses have now been subject to economic regulation for nearly twenty years and have faced significant pressure to reduce cost inefficiencies – particularly since the introduction of Part 4. The sector is also facing the full force of transformational change, driven by rapidly evolving technology, government policy and changing customer demands. As we explain below, these profound changes should cause the Commission to focus *even more* keenly than previously on long-term dynamic efficiency considerations as it reviews the IMs.

4.1 Scope for static efficiency improvements

From 1984 to the early 2000s, New Zealand operated a so-called 'light-handed' approach to the regulation of natural monopoly infrastructure. Electricity lines companies – and other network businesses – were subject only to the behavioural prohibitions in general competition law and an ongoing 'threat' of more formal price controls being introduced if they failed to comport themselves appropriately. However, as one commentator observed:[35]

> *"In practice, the threat of re-regulation could not have seemed especially credible. Having staked substantial political capital on the virtues of the [light-handed] regime, governments were hardly likely to walk away from it. … Governments may have had a gun pointed at the incumbent's head; unfortunately, they stood between it and the target. Under these circumstances, incumbents could heavily discount the likelihood of the trigger being pulled … The hand which was meant to be light had all but vanished."*

Consequently, when the initial price and quality 'thresholds' were set under Part 4A in 2003,[36] lines businesses were coming off a century of state ownership, followed by

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34 The original IMs for specified airport services, electricity distribution and transmission, and gas pipelines were developed and determined in 2010. The first review of those IMs was completed in December 2016 and the Commission commenced the second review in February this year.

35 Ergas, H *"Brief Comments on the Discussion Paper on Regulation of Access of Vertically –Integrated Natural Monopolies"*, speech on investiture as BellSouth New Zealand Visiting Professor of Network Economics and Communications, Auckland, New Zealand, 19 December 1995.

36 The Commission set 'initial' price and quality thresholds in May 2003. It required businesses to, in effect, maintain their existing prices and quality levels (*See:* Commerce Commission, *Regulation of Electricity Lines Businesses, Targeted Control Regime Thresholds* Decision, 2 May 2003). Just over a year later the Commission then set firm specific thresholds. A 'CPI-X' price path was determined with the X-factor comprised of an industry-wide productivity factor (a 'B' factor, that was set at 1% for all businesses), a firm-specific relative productivity factor (a 'C1' factor, which varied from -1% to 1% depending on perceived performance) and a firm-specific relative profitability factor (a 'C2' factor that varied from -1% to 1% based on estimated outcomes) (*See: Regulation of Electricity*

twenty years of virtually no meaningful regulatory oversight. It is reasonable to surmise that a substantial amount of static inefficiency had accumulated throughout most – if not all – of the twenty-nine distribution businesses during that period. Those firms would almost certainly *not* have been producing their services at the lowest possible cost and selling them at cost-reflective prices.

The regulatory arrangements therefore likely had significant work to do to eradicate historical productive and allocative inefficiencies. However, it is now almost twenty years since the Commission set the initial price and quality 'thresholds' for electricity lines businesses under the 'targeted control regime' under Part 4A. In addition, nearly thirteen years have passed since the first IMs were introduced – a period in which they have been reviewed comprehensively and price/quality paths have been reexamined on multiple occasions.

After two decades of regulatory oversight – and thirteen years of incentive-based regulation – one might expect there to now be markedly less static inefficiency present in the lines sector than there was in, say, the early 2000s. As we noted earlier, when regulation is first introduced in a sector, there is often a sharp initial focus on driving out entrenched static inefficiencies.[37] But once the 'low-hanging fruit' has been picked, the potential for significant further productive efficiency gains wanes thereafter.

Put another way, as an industry moves closer to the 'PPF' (remembering the diagrams in section 0), incremental static efficiency gains usually become more difficult to achieve. One might therefore expect the energy sector to have followed this trajectory. Yet, despite this seemingly logical inference, the Commission has suggested that productivity – and, by implication, static efficiency – *may not*, in fact, have improved over this period. Specifically, the Commission:[38]

- observes that expenditure by electricity distributors has nearly doubled in nominal terms since 2008, but notes consumers have not borne the full brunt of those increases due to low inflation and interest rates;
- states that revenues and prices have grown faster than inflation, and by more than the increase in factors such as network growth; and
- expresses concern that the innovation and efficiency properties of the current framework may consequently not have been sufficient to encourage businesses to improve static efficiency.

Do these empirical observations mean that there have *not*, in fact, been any material improvements in static efficiency, despite incentive regulation being in place now for over thirteen years? Or, put another way, might there *still* be 'low hanging fruit' to pick? That is certainly *possible*. However, it does not seem very *likely*. The metrics

Lines Businesses Targeted Control Regime Threshold Decisions (Regulatory Period Beginning 2004), 1 April 2004, pp.4-5.).

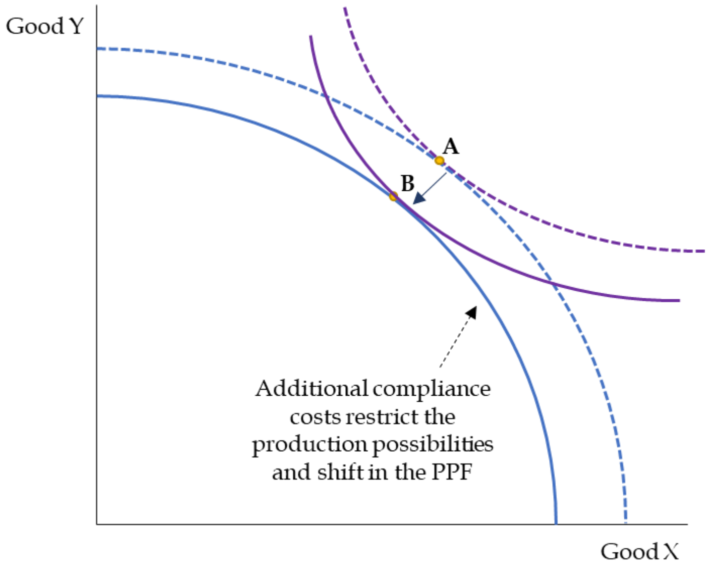
37 By 'de-linking' costs and prices for periods of time, incentive forms of regulation allow efficient costs to be 'revealed' by firms striving to earn additional profits by outperforming benchmarks.

38 Process and Issues Paper, p.51.

described above focus on 'inputs' (i.e., expenditure levels) and a narrow set of 'outputs', without accounting for myriad other factors germane to static efficiency. Unison explained this concisely recently:[39]

> *"The growth in narrowly measured outputs such as length of lines, customers served and kWh delivered has increased at a slower rate than inputs, such as operating expenditure. But what these simplistic models exclude (the point made in submissions in the DPP3 reset) is that the operating environment, laws, regulations and customer expectations have driven significant increases into the costs of conveying electricity …*
>
> *…simple measures such as absolute movements in expenditure levels (especially at time where network assets are generally reaching late stage of life) are very unlikely to be indicators of efficiency performance. Indeed, if expenditure levels are not rising, this may be more likely to be an indicator of potential problems, as was the case of Aurora. The "3-waters" sector is also good example that maintaining low levels of opex and capex over extended periods, when assets are known to be aging, is more likely to be demonstration of inefficiency."*

The simplistic measures relied upon by the Commission are unlikely to take adequate account of the broadening array of 'outputs' that lines companies are now providing *vis-à-vis* 2008. Moreover, if businesses have faced more compliance costs (e.g., traffic management, cyber security requirements and so on) this will have reduced the outputs that can be produced with the same level of inputs. That does not mean that static efficient has declined. Businesses could instead by converting inputs into outputs *even more* efficiently that previously – even if they are doing so at a greater overall cost.



If the operating climate, laws and regulations have increased the costs of supplying electricity lines services, then this will have *shifted in* the PPF. Additional production costs will reduce the production possibilities by limiting the output that can be produces with available resources. However, as the diagram opposite illustrates, it does not follow that static efficiency will have deteriorated. Although point B is clearly not as desirable from a macroeconomic perspective as point A it is, nevertheless, *equally statically efficient* given existing production limitations.

Simply put, empirically assessing static efficiency is not easy. As the Commission has acknowledged, it is a 'complex analytical exercise that requires the right

39 Unison Networks Limited, *Submission on Input Methodologies Process and Issues Paper and Draft Framework Paper*, 11 July 2022, pp.10-12.

methods, data, stakeholder engagement and consequently time.'[40] Consequently, we do not consider the narrow metrics cited by the Commission detract from the aforementioned proposition – namely, that thirteen years of incentive is likely to have *improved* static efficiency levels since the early 2000s. Of course, that is not to say that static efficiency considerations should henceforth be *irrelevant* to the determining of IMs or price-quality paths. Far from it.

Indeed, the Commission should certainly strive to eradicate any residual static inefficiencies and to ensure that firms *maintain* their positions relative to the efficiency frontier, i.e., do not slip backwards. Nonetheless, consumers may *already* have experienced many of the largest achievable static efficiency gains, i.e., as the most prominent sources of inefficiency were driven out in the initial years of the regime. Moreover, given the market circumstances, by far the biggest source of long-term benefits *looking forward* likely lies in promoting dynamic efficiency.

4.2 A sector undergoing fundamental change

Throughout most of the period following the introduction of the initial IMs New Zealand's energy sector has been in a relatively steady state. Until quite recently, almost all electricity flowed in one direction from large power stations over long distances via high voltage transmission lines to reach end users connected to local distribution networks. The vast majority of capital investments by lines companies were consequently in poles, wires and transformers. And all consumers really expected was for the lights to stay on – ideally at a reasonable price.

Even within that highly centralised supply chain with its strong emphasis on 'traditional' network solutions, dynamic efficiency considerations were crucial. As the example in Box 3.1 highlighted, the potential downside costs to consumers of companies under-investing in that infrastructure have been – and remain – considerable. Oxera (2014) estimated that the annual costs of outages culminating from underinvestment could be \$1b-\$3b.[41] Recent developments can be expected to have raised the stakes *further still.* As the Commission has observed:[42]

> *"This IM review is occurring during a period of change for the energy sector, particularly in relation to the impacts of climate change, the transition to a low carbon economy, and the ongoing impact of COVID-19. Changes to consumer preferences, technology, and government policy are all expected to also affect these sectors in the short to medium term."*

Put simply, the energy sector is no longer in a stable state. The full force of transformational change is in motion, driven by rapidly evolving technology, government policy and changing customer demands. In 2018, the Electricity Authority remarked that, after years of stability, the energy sector had become one of the most active in terms of innovation and technological change.[43] The power

40 Process and Issues Paper, p.54.

41 *See:* Oxera, *Input methodologies, Review of the '75th percentile' approach, Prepared for the New Zealand Commerce Commission,* 23 June 2014, p.72.

42 Draft Framework Paper, p.4.

43 Electricity Authority, *Adjusting to New Zealand's Electricity future,* 26 March 2018, p.4.

system is increasingly becoming one in which consumers are also producers and where electricity flows are bidirectional. For example:

- the emergence of distributed energy resources such as small-scale solar photovoltaic (PV) systems and the steadily declining cost of battery storage means that these technologies can be an efficient source of back-up capacity in some circumstances;
- the widespread availability of residential-sized battery packs and the continuing strong interest in electric vehicles (EVs) – spurred on by government subsidies – will inevitably result in more and more bi-directional flows over time, especially within local distribution networks; and
- newcomers are entering the retail and distribution spaces with offers based on pricing, transparency and convenience – and new types of technologies are emerging, including smart home energy management devices, many of which are resulting in yet more bi-directional flows.

Consumer preferences are also evolving apace. Many end-users are no longer content for distributors to simply keep the lights on at a reasonable price. They instead want to be able to integrate their PV/battery systems and EVs into the grid, and to export surplus power.[44] Increasingly, distributors are responding by taking measures to deal with the effects of new technology on their ability to deliver consumers what they want, whilst continuing to meet their quality-of-service obligations. Box 4.1 provides some recent case studies.

Box 4.1: Some initiatives being undertaken by lines companies

Vector has been very much at the forefront of new technology and solutions. For example, in October 2016, it was the first lines company in the Asia-Pacific to install a grid-scale Tesla battery storage system – at its Glen Innes substation. The solution enabled it to continue to provide a secure, reliable power supply – but at a significantly lower cost than a 'traditional' upgrade (see: here).

In 2019, Vector also had customers in Piha (in Auckland's west) trialling 'vehicle to home (V2H)' solutions, which can turn EVs into mobile batteries. The trial was designed to determine whether (and how) this technology might help ease expensive peak demand on its network, as well as provide a back-up supply for customers during short-term outages (see: here).

Vector and Amazon Web Services are also jointly developing a 'New Energy Platform (NEP)' under a multi-year strategic alliance. The initial focus of the NEP will be to collect and analyse data from more than 1.6m Vector smart meters that securely gather information on energy consumption and network performance across Australia and New Zealand.

The idea is for the insights gathered by the NEP to help Vector enable energy and utility companies to develop tailored products and pricing solutions for their customers based on their energy consumption habits. For example, it could

44 To put in colloquially, while consumers might previously have been content with a plain old 'butter knife', more and more and now demanding a 'Swiss army knife' instead.

enable energy and utility companies to develop innovative solutions and market models that accelerate uptake of renewables and EVs (see: here).

At the other end of the country, **Alpine Energy**, which has had well-documented problems delivering reliable electricity services in the past,[45] is preparing for the uptake of EVs by rolling out charging infrastructure. It recently installed two 'hyper' 150kW stations, and it also plans to install a rapid 50kW charger at Mt Cook Village – which will take its network of stations to nine (see: here).

New environmental policies will serve as additional catalysts for change as the country seeks to fulfil its carbon reduction objectives. Demand for electricity lines services will increase significantly as transport, process heat and home heating transition away from fossil-fuel sources to electricity in order to meet climate change targets. If the right investments occur at the right times, enabling the power grid to become smarter and more integrated, then lines businesses will play an important role in delivering the desired clean energy transition.

But without investments by lines businesses, the economy cannot decarbonise. The energy sector will need to move earlier than most, accelerating pathways for other sectors, such as transport. For example, if power grids are unable to accommodate uptake in EVs, or if charging infrastructure is inadequate, then take-up may be less than optimal. This would give rise to costs not only in the form of additional emissions but, potentially, also through foregone reductions in peak demand (which would otherwise have resulted in infrastructure cost savings).[46]

The transition away from gas presents similar investment challenges and opportunities. The government has a target of reaching 100% renewable electricity by 2030 which, if implemented and enforced, would effectively ban coal and gas generation. Separately, the Climate Change Commission has recommended phasing out natural gas use in residential, commercial and public buildings (the initial report recommended a 'hard sunset' of 2050).[47] These developments have profound ramifications for lines businesses and the broader macroeconomy.

Lines businesses face the prospect of having to accommodate significantly greater downstream demand from those customers transitioning away from gas (for heating, cooking, etc.) towards electricity. On top of this the renewable energy target means 100% of that electricity can be expected to be supplied from renewable

45 *See for example:* Commerce Commission, 'Alpine Energy limited – warning for contravention of the DPP quality standard in the 2016 assessment period', *letter to Andrew Tombs*, 14 February 2019 (available: here).

46 EV chargers will typically use the most electricity of any appliance in a household. Consequently, widespread investment in 'smart' and energy-efficient EV chargers could significantly reduce peak demand issues by shifting the demand from charging away from peak periods to times when demand on the network is lower. This could then reduce the need to upgrade the electricity supply and distribution system and result in lower electricity bills for charging. These are benefits which would ultimately accrue to consumers.

47 Climate Change Commission, *Ināia tonu nei: a low emissions future for Aotearoa Advice to the New Zealand Government on its first three emissions budgets and direction for its emissions reduction plan 2022 – 2025*, 31 May 2021 (available: here).

generation sources. This can potentially create its own challenges since such technologies tend to be more intermittent[48] and decentralised than the thermal forms of generation they will be replacing.

In short, significant volumes of additional renewable generation and demand will be added to the electricity system over the next few decades. Upgrades to networks are likely to be needed to transport that power to consumers. For New Zealand to avoid the use of fossil-fuelled backup generation while retaining high reliability standards it will not only need more investment in 'poles and wires', but also innovations in technology and demand management to deliver more *flexibility*. Box 4.2 provides a case study of the benefits flexibility might provide.

Box 4.2: UK study of transition to a more flexible energy system

A **flexible energy system** is one that minimises the amount of generation and network assets that are required to meet peak demand. It gives consumers greater control over their energy bills, through access to smart technologies and services. Flexibility enables the time or location of consumption or generation to be shifted, thereby managing network constraints.

Ofgem recently explored the potential costs of the future UK electricity system under a range of different flexibility assumptions (using a dynamic dispatch model).[49] Its objective was to understand the role and value of flexibility in a decarbonised power sector, and to identify the amount and type of flexibility needed in that system. Its modelling showed the following:

- Increased flexibility was estimated to provide significant cost savings in a decarbonised power sector. In the scenarios Ofgem tested, increased system flexibility provided system cost reduction of up to **£10bn per year** (2012 prices, undiscounted) in 2050.
- Ofgem also assessed the cumulative value (from 2020 to 2050) of increased flexibility based on illustrative pathways to net zero. It estimated that increased flexibility could reduce system costs **between £30-70bn** across that period (2012 prices, discounted).

Ofgem's analysis suggested that a smart and flexible energy system could deliver **significant benefits for consumers**, the system and the wider UK economy whilst lowering carbon emissions. Networks were thought to have an important role to play in delivering that flexibility by facilitating smart charging of EVs and flexible use of heat pumps (among other things).

For these reasons, it would appear to be clearly in consumers' long-term interests for line companies to make the investments needed to meet expected increases in electricity demand, keep pace with increasingly complex consumer preferences and

48 Renewable forms of generation such as wind and solar power are only capable of producing electricity when atmospheric conditions are conducive (when the wind is blowing and there is no cloud cover). There consequently needs to be careful consideration of how to ensure the supply of electricity to end consumers remains secure.

49 Ofgem, *Transitioning to a net zero energy system Smart Systems and Flexibility Plan 2021*, July 2021 (available: here).

aid the transition to a low carbon economy. If the IMs provide those businesses with appropriate incentives throughout this transitional period, then the potential dynamic efficiency benefits are substantial. If they do not, the downside dynamic inefficiency costs could be vast – much higher than in years past.

4.3 Implications

As a general proposition, the changes sweeping through the energy sector should cause the Commission to place particular emphasis on long-term dynamic efficiency considerations as it reviews the IMs – even more so than in its past deliberations. Some of the more specific manifestations of such a focus might include a reluctance to reduce the WACC percentile and potential changes to the way in which expenditure allowances are specified.

We elaborate below. For the avoidance of doubt, what follows is neither intended to be an exhaustive list of the matters for which dynamic efficiency considerations are likely to be relevant during the IM review, nor an in-depth account of the relevant issues.[50] It instead provides a high-level indication of some of the key factors the Commission might examine when reviewing certain aspects of the existing IMs through a dynamic efficiency lens.

4.3.1 WACC percentile

Significant upgrades to networks will be needed in coming years to transport power to consumers as additional renewable generation and demand come on-stream. Those investments may, in some cases, necessitate higher prices for regulated services – at least in the near-term.[51] However, as we observed earlier, the potential long-term dynamic efficiency benefits such investments could deliver are potentially substantial (as the case study in Box 4.2 attests). This is highly germane to the cost of capital IM – including the WACC percentile.

As the case study in Box 3.1 highlighted, when setting the regulatory WACC – including the applicable percentile – there is a trade-off between static and dynamic efficiency considerations. On the one hand, reducing the benchmark from the 67th to, say, the 50th percentile would decrease the probability of the regulatory WACC exceeding its *true* (unobservable) level. That would, in turn, reduce the chances of *over*-investment and hinder lines businesses' ability to extract excess profits and compromise allocative efficiency (relevant for s.52A(1)(d)).

On the other hand, such a reduction would also increase the probability of *under*-investment. Specifically, it would heighten the risk of the regulatory WACC being

50 For example, many of the submissions in response to the Commission's Process and Issues Paper have highlighted perceived shortcomings with features such as the incremental rolling incentive regime (IRIS) and the innovation allowance framework. Dynamic efficiency considerations analogous to those set out below may be equally applicable to those matters and many others.

51 Investments by networks tend to be 'lumpy' in nature and the front-loaded nature of the revenue profile implied by straight-line depreciation means that they often result in near-term price increases (depending, of course, on volumes).

underestimated, thereby compromising companies' incentives to innovate and to invest, including in replacement, upgraded, and new assets (relevant for s.52(1)(a)). There are compelling reasons to think that these potential dynamic inefficiencies of under-investment continue to significantly outweigh the costs of over-investment:[52]

- there are no obvious reasons to think that the potential costs of major supply disruptions – which motivated the selection of the 67th percentile – would have changed materially since 2014 (see Box 3.1); and
- what is more, lines businesses are also facing the prospect of making significant *new* investments and, as we have observed already, the potential costs of getting those wrong could be profound (see for example Box 4.2).

In terms of the latter bullet point, the Commission has pointed to the predicted decline in gas over the longer-term and corresponding increased dependence on electricity as being especially relevant to the selection of the WACC percentile.[53] We agree. If lines businesses under-invest in their networks, this may significantly hinder the transition away from gas, resulting in potentially substantial dynamic inefficiencies. This suggest strongly that the Commission should be wary of reducing the WACC percentile. There may even be grounds for lifting it.

4.3.2 Expenditure allowances

Historically, lines companies' expenditure allowances under Part 4 have been established largely on the basis of historical outcomes. That is partly a product of necessity – the unusually large number of regulated distributors in New Zealand makes it nigh on impossible to apply fully-fledged 'building block' approaches to all (such treatment is reserved for customised price-quality path applications). However, with expenditure requirements expected to ramp up as electrification intensifies, the past may no longer be a reliable harbinger of future requirements.

This has potential implications for the design of, among other things, the 'base-step-trend' approach[54] for determining operating expenditure (opex) allowances.

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52 We note that the Commission recently arrived at a different view when it set the regulatory cost of capital for Chorus' regulated fibre services, i.e., it did not apply a percentile uplift (it used the midpoint). However, its reasons for doing so were couched in the perceived *differences* between the two sectors. The Commission noted that most of Chorus' fibre assets are nearly brand new and so, even if it cut corners on maintenance, etc., there was less chance of major outages resulting. To use a simple analogy, a car with 500,000km on its odometer is more likely to break down if its owner neglects to get it serviced than a vehicle that has travelled only 5,000km. This is quite different to the situation lines businesses find themselves in, because they are *yet to make* many of the larger investments that will be required to achieve the country's decarbonisation objectives. The Commission also concluded that if a major 'fibre' supply failure did transpire, it would not be as costly as an electricity outage. That is because fibre services will not work in the event of a power outage (at least not without a backup) and so the costs of a fibre outage must therefore be smaller. Furthermore, consumers also have substitutes (albeit in some cases imperfect) in the event that fibre becomes unavailable (e.g., mobile networks).

53 Process and Issues Paper, p.112.

54 In brief, under the base-step-trend approach, a 'base year' is first established – typically the most recent year for which 'actual' cost information is available. A 'trend element' is then determined, which forecasts any cost changes expected to arise from, growth in network length and numbers

Currently, the only 'trends' provided for are growth in network length and customer numbers. There is not presently any scope to include forward-looking 'trend' estimates of the additional costs lines businesses may incur supporting decarbonisation initiatives. Any such incremental costs can only really be accommodated within the existing framework:

- if there is a reasonable degree of precision surrounding future requirements, in which case they can be factored into a 'step change' allowance; or
- *after* any additional expenditure has been incurred (and considered prudent), at which point it will form part of the new 'base'.

In other words, if incremental expenditure requirements cannot be specified with sufficient precision to warrant a 'step change' within existing approach, companies face the prospect of being undercompensated during the regulatory period. They will then be further disadvantaged by the application of the incremental rolling incentive scheme (IRIS).[55] It is not hard to imagine businesses being disinclined to invest in decarbonisation initiatives if expenditure allowances are inadequate and there is insufficient flexibility to make adjustments within periods.

There may consequently be sound dynamic efficiency-based reasons for the Commission to consider revising its base-step-trend approach. For example, it may be worthwhile examining the current methodology for determining 'step-changes' to see if it can be made more permissive, i.e., more readily applied in such scenarios. In a similar vein, there could well be merit in broadening the scope for default price-quality paths to be revisited *within* periods to account for new expenditure requirements that were either unknown or uncertain when paths were set.[56]

For example, in the UK, Ofgem has included several new re-opener mechanisms in gas distributors' price paths. These enable prices to be adjusted 'mid-period' if certain events occur through the regulatory period, including changes to the applicable carbon target.[57] To be sure, introducing a more flexible 'step change' process and broader re-openers could lead to higher prices. However, the trade-off is exactly the same as it was in the context of the WACC percentile: a reduced probability of under-investment and all that costs thereby potentially avoided.

of customers. Finally, any potential 'step changes' in expenditure not otherwise accounted for in the base year or trend component are identified and factored in.

55 Under the IRIS, lines companies retain the benefit of any opex underspend (relative to forecast allowances) – and incur the cost of any overspend – for five years. After this period, the benefit (cost) is returned to users through lower (higher) forecast opex and prices.

56 Such re-openers could be applied to both opex *and* capital expenditure allowances.

57 These re-openers will enable prices to be adjusted if certain events occur through the regulatory period, including changes to the net zero carbon target, changes to the UK Government's 'clean heat' policy, and changes to the regulations related to the quality and composition of gas. *See:* Ofgem, *RIIO-2 Final Determinations - Core Document*, 8 December 2020 (available: here).