Transmission pricing methodology: Sunk costs

Working paper

8 October 2013

Market Design

1 Executive summary

1.1 Consultation by the Electricity Authority (Authority) on the Transmission Pricing Methodology (TPM) identified a number of key issues. The Authority is developing working papers on these issues. This paper is one of them. It considers the definition of sunk costs and the relevance of sunk costs to efficient production and pricing decisions.

1.2 Several submitters argued that the proposed TPM would change the way sunk costs are charged for and doing so would give rise to economic inefficiencies. A strong claim is made that there can be no dynamic efficiency benefits from adjusting prices to incorporate the cost of sunk assets. The contention in several submissions is that a pricing methodology that alters the prices charged for services provided using existing (sunk) investments can produce no efficiency gains, and may result in inefficiency losses. Some submitters also expressed concern that the proposed methodology would convert a fixed or sunk cost to a variable charge and that this would result in allocatively inefficient pricing signals.

1.3 To assess the validity of these claims, this paper reviews the definitions of a sunk cost in economic theory and considers the relevance of sunk costs to efficient production and pricing decisions. The subject matter of this paper is inevitably technical and involves discussing economic concepts. The Authority has also released an accompanying non-technical paper for readers unfamiliar with economic terminology and concepts.

1.4 The economic concept of sunk cost is built on the foundation of opportunity cost. One of the basic themes of economics is that the resources available to decision-makers are almost always limited. With limited resources, a decision to have more of something is simultaneously a decision to have less of something else. Hence, the opportunity cost of any decision is the foregone value of the next best alternative that is not chosen.

1.5 A common theme in the economics literature is that sunk costs cannot be avoided in the relevant timeframe, even if the firm were to close and production were to cease entirely; they are costs that have been irrevocably committed. A sunk cost might arise because of technical characteristics or because of its legal or contractual characteristics. If there is no alternative use for the asset and no demand for the asset in its current use, the costs committed to that asset are sunk under all definitions of a sunk cost.

1.6 Sunk costs are therefore an important consideration in *production* decisions, because there is no opportunity cost in continuing to use the asset in current production. A supplier should ignore the cost of the sunk asset in deciding whether to continue to *produce* a service. As long as the revenue received for the service exceeds the non-sunk costs of producing the service, the firm is better off continuing to supply the product. If its revenue does not cover the non-sunk costs, the supplier would be better to stop producing the service and divert the non-sunk resources to alternative uses.

1.7 While the economic concept of sunk cost may have evolved as a tool for efficient production decisions, submissions on the transmission pricing methodology were focused on the implications of sunk costs for pricing. Static efficiency requires the price for the marginal unit to equate the willingness to pay of the marginal consumer with the marginal cost of producing the marginal unit. Hence, static efficiency conditions distinguish between variable and fixed costs (regardless of whether the fixed cost is sunk). Fixed costs are ignored at the margin - not because they are sunk - but because they need not be altered to alter production levels.

1.8 Importantly, this static efficiency condition does not mean that every unit of the good or service should be sold at marginal cost; the static efficiency condition applies only to the marginal unit. Setting all prices equal to marginal cost can easily fail to be efficient because infra-marginal prices (all prices other than the price at the margin) may not convey the full economic cost of supply.

1.9 For many economic activities, infra-marginal decisions are as important, if not more important, than marginal decisions. In sectors such as the electricity industry, with long-life assets (in generation, transport, and consumption), it is infra-marginal decisions that primarily determine the allocation and use of society's resources over time. To illustrate, a decision to invest in an activity that consumes electricity might be an infra-marginal decision and the decision as to how much electricity to use in a particular half hour might be a decision at the margin for the manager of that plant.

1.10 Economics does not provide the same definitive tests for pricing of infra-marginal decisions as it does for pricing marginal units. The debate in the economics literature is about how best to recover fixed costs (and sunk costs are fixed costs), and not whether a distinction is required between sunk and other costs for efficient pricing.

1.11 If a supplier has invested in assets to meet an expected demand, and if the demand exists for the service, there is no obvious economic efficiency reason why that demand should face a price, after the investment has been made, that is *lower* price than the full economic cost of the service (including the cost of sunk investments).

1.12 Nor is there an economic efficiency reason to argue that recovering fixed costs through variable non-marginal prices would necessarily be allocatively inefficient. The distinction between fixed costs and variable costs is important in pricing the marginal unit to align the marginal willingness to pay and the marginal cost to supply. However, for infra-marginal decisions, the marginal willingness to pay must, by definition, be above marginal cost, meaning the price charged for the service may be higher than marginal cost without inefficiently distorting the demand for the service.

1.13 Economic theory does not support the view of some submitters that prices should not reflect sunk costs, or that fixed costs should not be recovered by variable

charges, when setting infra-marginal prices. The importance of infra-marginal, as well as marginal decisions, means the total economic efficiency effects (static and dynamic) of a particular pricing proposal should be considered, and not just one aspect or one set of prices. A pricing methodology needs to be assessed on its merits.

1.14 Accordingly, with reference to the Authority's objective, if changing the methodology by which transmission prices are determined promotes overall efficiency in the electricity industry, the Authority may change the methodology, irrespective of the existence of sunk costs.

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2 Introduction

Background

2.1 The Electricity Authority (Authority) is reviewing the transmission pricing methodology (TPM), which specifies the method for Transpower New Zealand Limited (Transpower) to recover costs of operating, maintaining, upgrading and extending the transmission grid.

2.2 The Authority considers that the current TPM can be improved so as to better meet the Authority's statutory objective to promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers.

Working papers

2.3 The Authority has decided to advance the process of reviewing the TPM by developing a second issues paper following consideration of submissions on the October 2012 TPM issues paper[1] and information provided at the TPM conference held in Wellington on 29-31 May 2013.

2.4 Prior to developing a second issues paper, the Authority intends to develop and further consider key aspects of a revised TPM proposal through a series of working papers, which will form a key input into the second issues paper.

2.5 This paper is the second of the series of working papers identified by the Authority. This working paper considers the definition of sunk costs and considers the relevance of sunk costs to production decisions and for pricing decisions. The subject matter is inevitably technical and involves discussing economic concepts. The Authority has also released an accompanying non-technical paper for readers unfamiliar with economic terminology and concepts that discusses the issues addressed in this working paper.

2.6 This paper:

(a) outlines the views of submitters on the nature of sunk costs

(b) reviews the definitions of a sunk cost in economic theory

(c) considers the relevance of sunk costs to production decisions, and for pricing decisions at the margin and for infra-marginal pricing

(d) briefly outlines the transmission regulatory regime administered by the Commerce Commission (NZCC), and considers whether this regime is relevant to understanding the effects of sunk costs.

2.7 Appendix 1 summarises how New Zealand regulators have previously considered the concept of sunk costs, especially in relation to transmission.

Other working papers

2.8 Other working papers the Authority has identified include:

[1] Available from http://www.ea.govt.nz/our-work/consultations/priority-projects/tpm-issues-oct12/

(a) Approach to CBA – This paper outlines a revised approach that the Authority intends to apply to the cost benefit analysis of the next TPM issues paper. The paper was released for consultation on Tuesday 3 September 2013. Consultation closes at 5pm on Tuesday 15 October 2013.[2]

(b) Avoided cost of transmission (ACOT) payments for distributed generation – This paper will investigate the benefits and costs that result from payment of ACOT to distributed generation. This paper will also determine whether or not ACOT payments to date reflect actual avoided costs of transmission.

(c) Use of loss and constraint excess (LCE) to offset transmission charges – This paper will explore submitter suggestions that the proposed use of LCE to offset transmission charges would distort the otherwise efficient wholesale market signals.

(d) Approach to residual charge - This paper will consider whether it may be efficient to levy any residual charge on the basis of congestion rather than load during peak demand periods.

(e) Beneficiaries-pay approach – This paper will examine options for applying a beneficiaries-pay charge.

Decisions on the TPM

2.9 Section 32(1) of the Electricity Industry Act 2010 (Act) provides that the Electricity Industry Participation Code 2010 (Code) may contain any provisions that are consistent with the Authority's statutory objective. The TPM is part of the Code, so any amendments to the TPM must be consistent with the Authority's statutory objective.

2.10 To assist the Authority to make decisions about the TPM consistent with its statutory objective, the Authority developed a decision-making and economic framework.[3] The Authority applied this framework to derive the proposal for the TPM set out in the October 2012 TPM issues paper.[4] After considering submissions on the October issues paper and the responses of parties to the Authority's questions at the May 2013 TPM conference, the Authority has decided to develop and release a second issues paper which will include a revised TPM proposal and related guidelines (as referred to in clause 12.89 of the Code) to be followed by Transpower in developing a new TPM.

2.11 In developing the second issues paper, the Authority will continue to be guided in its decisions by its TPM decision-making and economic framework.

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2 Details available from http://www.ea.govt.nz/our-work/consultations/priority-projects/tpm-cba-working-paper/

3 Available from http://www.ea.govt.nz/our-work/programmes/priority-projects/transmission-pricing-review/

4 Available from http://www.ea.govt.nz/our-work/consultations/priority-projects/tpm-issues-oct12/

2.12 The Authority's Consultation Charter[5] sets out guidelines relating to the processes for amending the Code and the Code amendment principles that the Authority must adhere to when considering Code amendments.

2.13 The Authority will make decisions about the development of the TPM according to its Code amendment principles and the Authority's statutory objective.

3 Purpose of this paper

3.1 The purpose of this paper is to consult with participants and persons that the Authority thinks are representative of the interests of persons likely to be substantially affected by the TPM.

Submissions

3.2 The Authority's preference is to receive submissions in electronic format (Microsoft Word). It is not necessary to send hard copies of submissions to the Authority, unless it is not possible to do so electronically. Submissions in electronic form should be emailed to submissions@ea.govt.nz with 'Working Paper— Transmission pricing methodology: Sunk costs' in the subject line.

3.3 If submitters do not wish to send their submission electronically, they should post one hard copy of their submission to the address below.

Submissions
Electricity Authority
PO Box 10041
Wellington 6143

Submissions
Electricity Authority
Level 7, ASB Bank Tower
2 Hunter Street
Wellington

Tel: 0-4-460 8860

Fax: 0-4-460 8879

3.4 Submissions should be received by 5pm on Tuesday 19 November 2013. Please note that late submissions are unlikely to be considered.

3.5 The Authority will acknowledge receipt of all submissions electronically. Please contact the Submissions' Administrator if you do not receive electronic acknowledgement of your submission within two business days.

3.6 Your submission is likely to be made available to the general public on the Authority's website. Submitters should indicate any documents attached, in support of the submission, in a covering letter and clearly indicate any information that is provided to the Authority on a confidential basis. However, all

[5] Available from http://www.ea.govt.nz/about-us/documents-publications/foundation-documents/

information provided to the Authority is subject to the Official Information Act 1982.

4 Sunk costs in submissions on the TPM

4.1 Several submitters argued that the proposed TPM would change the way sunk costs are charged for, and doing so would give rise to economic inefficiencies. There were echoes in several submissions of the former Rule 2.4 of the Pricing Principles which dictated to Transpower and the Electricity Commission that "sunk costs should be allocated in a way that minimises distortions to production/consumption and investment decisions made by grid users."[6]

4.2 Submitters commenting on sunk costs did not consider in detail what constitutes a sunk cost, but some comments may illuminate the views of submitters on sunk costs:

(a) The Electricity Networks Association describes sunk assets as "assets that have already been commissioned and for which there is no economic alternative use".[7]

(b) Unison summarises the characteristics of the interconnected transmission grid stating that "investments are expensive, lumpy and sunk".[8]

(c) CEG, for Transpower, states that "sunk investment decisions have been made and there is now no way to reduce the cost or change the nature of those outlays".[9]

(d) Mighty River Power noted that "Both charges will be applied to sunk (already built) assets. Obviously, this will not lead to efficiency gains because it is not physically possible retrospectively to reduce the costs of sunk transmission investments or generation and load location investment decisions on these assets."[10]

(e) Castalia in a report for Genesis Energy comment that "Static efficiency is important because transmission pricing involves almost exclusively the allocation of sunk costs as most transmission costs are fixed."[11]

4.3 It would seem from these excerpts that some submitters view the term "fixed costs" and "sunk costs" as synonymous, and that the term "sunk" could be applied to all investments already made. The ENA submission is more nuanced and adds the condition that the term 'sunk' applies to assets "for which there is no economic alternative use"; this submission from the ENA appears to allow the possibility that assets which have an alternative use are not sunk and hence the possibility of a distinction between fixed assets and sunk assets.

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6 Former Electricity Governance Rules 2003, Part F, section IV, rule 2 .

7 Electricity Networks Association, *Submission on Transmission Pricing Methodology Consultation Paper*, 22 February 2013, paragraph 51.

8 Unison Networks Ltd, *Submission on Electricity Authority's Transmission Pricing Methodology Proposal*, 1 March 2013, paragraph 12(a).

9 Competition Economists Group, *Transmission Pricing Methodology – Economic Critique*, paragraph 8.

10 Mighty River Power, *Mighty River Power submission to Electricity Authority's transmission pricing methodology: Issues and proposal consultation paper*, 1 March 2013, paragraph 2.2

11 Castalia Strategic Advisors, *Review of the Electricity Authority's cost benefit analysis of the proposed transmission pricing* methodology, Report to Genesis Energy, 25 February 2013, page 8

4.4 Comments by CEG seem illustrative of the views of some submitters as to the implications of reflecting sunk costs in pricing:[12]

> "*The difficulty is that the methodology… changes the allocation of the sunk costs of past investments… There can be no dynamic efficiency benefits associated with applying a 'beneficiaries pay' approach to reallocating the sunk costs of past investments… However, sub-optimal outcomes can be created through such reallocations, since they can result in large wealth transfers that may cause market participants to act in ways that compromise both static and dynamic efficiency."* (emphasis in original)

4.5 CEG make a strong claim that "there can be no dynamic efficiency benefits" from adjusting prices to incorporate the cost of sunk assets. They argue that such prices may cause participants to act in ways that compromise both static and dynamic efficiency. That is, a pricing methodology that alters the prices charged for services provided using existing (sunk) investments can produce no efficiency gains, and may result in efficiency losses.

4.6 Allocative efficiency concerns were also raised by submitters at the May 2013 TPM conference. Several attendees expressed concern that the proposed methodology would convert a fixed or sunk cost to a variable charge and that this would result in allocatively inefficient pricing signals.[13]

4.7 To assess the validity of these claims, this paper reviews the definitions of a sunk cost in economic theory and considers the relevance of sunk costs to efficient production and pricing decisions.

5 What is a sunk cost in economics?

Concept of sunk cost is often not well explained in economic theory

5.1 Writing recently, University of Tampa academic, John Stinespring, commented:[14]

> "*The distinction between fixed and sunk costs is one of the most important concepts in production theory and one of the most likely to frustrate students. It is built upon the foundation of opportunity cost and is crucial to the construction of the total cost curve, the firm supply curve, the notion of economic profits, and the firm's shutdown condition. Common textbook presentations of fixed and sunk costs, however, are often unclear and theoretically inconsistent."*

5.2 Other authors have commented on how the terms 'fixed costs' and 'sunk costs' are blurred, confusingly, in entry level economic texts.[15] There are of course many text books that dedicate pages to discussing the distinction between sunk

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12 Competition Economists Group, op cit, paragraphs 7 & 8.

13 http://www.ea.govt.nz/about-us/news-events/events-calendar/transmission-pricing-methodology-conference/ - see for example comments from representatives from Vector, Pioneer Generation, and Mighty River Power, pages 72, 211, 244, and 245.

14 Stinespring, John Robert "Fixed versus sunk costs: creating a consistent and simplified cost framework" in *Journal of Economics and Economic Education Research,* Volume 12, Number 1, 2011, pp. 11-26, p.11.

15 See for example, Wang, X Henry and Yang, Bill Z, "Fixed and sunk costs revisited" in *Journal of Economic Education*, (Spring 2001), pp178-185.

costs and fixed costs.[16] But even papers written for the purpose of clarifying the concept of sunk costs have themselves been the subject of critical comment for developing tests that do not apply in all circumstances.[17] However, if distinctions between sunk and other forms of cost have the implications for pricing that CEG and others submit, these distinctions are not mere terminological quibbles.

Costs relevant to economic decisions are opportunity costs

5.3 As Stinespring observes in the above quotation, the economic concept of sunk cost is built on the foundation of opportunity cost. Economics students are taught that opportunity costs are the only costs to be considered when making decisions.[18] One of the basic themes of economics is that the resources of decision-makers, no matter how large they may be, are always limited and that as a result everyone has some hard decisions to make. With limited resources, a decision to have more of something is simultaneously a decision to have less of something else. Hence, the opportunity cost of any decision is the foregone value of the next best alternative that is not chosen.

5.4 Opportunity cost is therefore an important concept because it assists economists in evaluating whether decisions will result in scarce resources being used in their highest value use from the perspective of society. If resources would have a higher value in an alternative use, or be valued higher by an alternative user for the same use, an opportunity exists to make some individuals better off in their own estimation while not worsening the lot of anyone else. Economists would view such a situation as an opportunity to increase efficiency.

5.5 The difficulty in applying the concept is that opportunity cost is not always observable or explicitly priced. For example, the opportunity cost to a student of attending university is not just the money cost of tuition fees, but also the value of the student's time; that is, the wages he or she could have earned by working instead of attending university. These foregone wages, which are given up by students to acquire an education, are part of the opportunity cost of a university education along with tuition payments.

5.6 As the concept of sunk cost is built on the concept of opportunity cost, it gives rise in practice to some of the same real world difficulties – the difficulty of understanding and specifying fully the costs of any decision and whether and who would incur those costs. The sections below review the specification of sunk costs in the economics literature; this literature generally developed out of other conceptual debates (such as identifying barriers to entry) and arguably does not offer a clear, unifying, definition of a 'sunk cost'.[19] A consistent theme, however, is that expenditure which has been irrevocably committed is sunk; if there is no

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16 See for example, Baumol, W. J, and Blinder, A. S, *Microeconomics: Principles and policies*. 7th ed. Fort Worth, Texsis, Dryden (1997); Carleton, D. W and Perloff J. M, *Modern industrial organizational theory*, 3rd ed. Reading, Mass, Addison Wesley Longman; Samuelson (2000), P. A, and Marks, S. D, *Managerial economics*. 3rd ed Fort Worth, Texas, Dryden (1999); Tirole, J. *The theory of industrial organization*. Cambridge, Mass. MIT Press (1988).

17 Colander, D. "On the Treatment of Fixed and Sunk Costs in the Principles Textbooks", Journal of Economic Education, (Fall, 2004), pp 360 – 364.

18 Stinespring, John Robert, op cit p. 11.

19 The lack of a clear definition of sunk cost in the literature is discussed in Wang and Yang, op cit.

alternative use for an asset, and no demand for the asset in its current use, the costs committed to that asset are sunk under all definitions of a sunk cost.

Sunk costs and the market for incumbency

5.7 A business may be comprised of specialised assets – that is, assets which would have little or no value in an alternative use (that is, a use different to that for which the asset was designed). However, it may be possible for the business entity to be sold and its owner to liquidate some or all of his or her holding. This ability to sell the business is termed by Beesley as "the right to commit". [20] The marketability of the right to incumbency is rarely touched on in the academic literature on sunk costs. However, as Beesley notes: [21]

> *An implication of such an implicit property right is that the committed costs in question can always be liquidated (that is, turned back into cash), so long as they convey an equivalent value realisable by selling the right, or the firm owning it, and there is competition for that right or firm. An incumbent can always sell out, perhaps to a would-be entrant, and get at least the value put in, so long as nothing else changes in the meantime.*

5.8 Beesley uses the example of a (short-lived) charter airline London Express Aviation Ltd (LEX), which was set up in 1984 to provide services between Stansted and Singapore, and Stansted and Hong Kong. He observes that LEX's ability to obtain substitute investors over time confirmed the proposition that it is possible to liquidate committed costs, if circumstances affecting profitability are unchanged.[22] A market for liquidating may be "thin" and subject to various limitations, but exists when demand remains (or is expected) for the service produced by the specialised assets.

5.9 Hence, from the perspective of investors in an entity, there is an opportunity cost to holding the investment because the costs they have incurred could be liquidated: [23]

> "*Investors would be willing to pay up to the present value of the stream of profits earned by an incumbent firm in order to acquire that stream of profits. This rent can be counted as an (opportunity) cost of remaining in the industry*."

5.10 There is undoubtedly an opportunity cost to the Crown in retaining its investment in Transpower. If it were to sell the firm to another party to use the assets in their current use, the Government would free up financial capital which could be applied to its other priorities. From the perspective of the owners of Transpower, and potential investors, the capital employed in the transmission grid cannot therefore be considered sunk.[24] Whether an investor would get back the

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20 He uses the term "committed costs" interchangeably with "sunk costs", the author does not appear to make a distinction between the terms 'sunk' and 'commitment'.

21 Beesley, ME (1986) "Commitment, sunk costs, and entry to the airline industry, Reflections on experience" in *Journal of Transport Economics and Policy*, (May) pp.173-190, p 176.

22 Ibid, p.184.

23 Varian, Hal R., Microeconomic Analysis, Third Edition, 1992, p.221.

24 For a discussion of the economic concept of capital, see Hernando de Soto, H. (2000). *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*, New York: Perseus Books

equivalent value of the amount invested will be determined by the regulatory environment and the market demand for the services provided by the assets.

5.11 At one end of the spectrum of decision possibilities, the opportunity cost of owning the transmission grid might dissipate should demand for transmission evaporate, say because of a radical technological change, and there was no alternative use for the assets. This spectrum of possibilities illustrates that whether an asset has an opportunity cost may involve a market test; that is, whether anyone else is willing to pay a price for it.[25]

Sunk costs and entry barriers

5.12 Sunk cost have also featured in the literature on market entry and entry barriers.

5.13 Economic theory suggests several definitions of a barrier to entry. In general terms, a barrier to entry is something that gives the incumbent an advantage over an entrant. Where entry to an industry requires significant costs, a difference is created between the incremental cost and incremental risk facing the entrant and the incumbent. Baumol, et al, argue that expenditure required by a new entrant, but not required by an incumbent, and which cannot be recovered on exit, is a barrier to entry.[26] Baumol refers to these costs, which may be a "bygone" cost to the incumbent, as 'sunk' costs.

5.14 Dixit gives the example of investment in capacity as an example of a commitment that deters entry. He emphasises the importance of two requirements: that the commitment is made prior to the entrant's decision and that it is irreversible:

> *"Irreversibility is a matter of technology and institutions. For example, capacity serves the purpose* [as an entry barrier] *only if it cannot be costlessly liquidated. Capital goods that depreciate rapidly, or ones for which an efficient resale market exists, are not useful instruments for an entry-deterring commitment"*.[27]

5.15 On the other hand, fixed costs, which can be characterised as costs that do not alter with changes in production, are not considered an entry barrier by these authors:

> *"Fixed costs affect incumbent and entrant alike. They offer an advantage to the incumbent only to the extent that his output is greater, and this permits him to spread his costs more thinly than the entrant can.*"[28]

5.16 The key theme from the literature on barriers to entry, as it relates to sunk cost, is that sunk costs are the difference between entry and exit thresholds. Stefanadis provides the example of a railroad corridor:[29]

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25 Note there would be a circulatory in relation to the value of assets owned by a monopoly subject to a regulated return, as the value a party would be prepared to pay for the asset would reflect the allowed return on the asset.

26 Baumol, William J., Panzar, John C., and Willig, Robert D. (1988) *Contestable Markets and the Theory of Industry Structure*, Harcourt Brace Jovanovich p.282

27 Dixit, Avinash "Recent developments in oligopoly theory" in *The American Economic Review*, Vol. 72, No. 2, Papers and Proceedings of the Ninety-fourth annual meeting of the American Economic Association, (May, 1982), pp 12- 17, p.13.

28 Baumol et al, op cit p.289

"… the amount recovered when a railroad corridor is abandoned is very low compared with the amount that would be required to reassemble the corridor."

5.17 From the perspective of a new entrant, an asset would be sunk to the extent the entrant could not recover the cost of its investment on exit; that is, the investment would be irrevocably committed if the entrant could not sell the asset to the incumbent, apply or sell the asset to some alternative use, or recover the cost from the parties that sought the investment.

Sunk cost and irrevocable commitment

5.18 This theme of sunk costs being irrevocably committed builds from the work of early 20th century economists who converged on the insight that only avoidable costs incur an opportunity cost. This distinction was important to authors writing during the Great Depression; understanding the costs of a firm was critical to thinking about policies that could stimulate production and demand.[30] In 1934, Fritz Machlup wrote:[31] *"What one has to spend if one produces, and does not have to spend if one does not produce, is the cost of production."* Nobel Laureate, Ronald Coase, wrote in 1938:[32]

"[w]e may, however, lay down as a general rule that it will pay to expand production so long as marginal revenue is expected to be greater than marginal cost and the avoidable costs of the total output less than the total receipts…This particular concept of costs would seem to be the only one which is of use in the solution of business problems, since it concentrates attention on the alternative courses of action which are open to the businessman."

5.19 Sunk costs could be excluded from these production decisions because they are costs that have been irrevocably committed and cannot be avoided.[33] As sunk cost cannot be avoided in the relevant timeframe, even if production were to cease entirely, a sunk cost is not an opportunity cost of production. Baumol et al express the concept as follows:[34]

Sunk costs … are costs that (in some short or intermediate run) cannot be eliminated, even by total cessation of production. As such, once committed, sunk costs are no longer a portion of the opportunity cost of production.

5.20 Wang and Yang sought to change the way academics present the concepts of sunk costs and fixed costs in economic principles texts, which often make simplifying assumptions, such as assuming that all fixed costs are sunk:[35]

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29 Stefandadis, Chris (March 1999) *Sunk costs, contestability and the latent contract market,* Staff Report No 75, Federal Reserve Bank of New York.

30 Ibid. p. 14.

31 Machlup, F, "A note on Fixed Costs" in *Quarterly Journal of Economics*, Vol 48 (3), 559-564, p. 561.

32 Coase, R, "Business Organization and the Accountant", in *The Accountant*, October 1-December 17, 1938.

33 Wang, X Henry and Yang, Bill Z, op cit, p.182.

34 See Baumol, William J., Panzar, John C., and Willig, Robert D. (1988) *Contestable Markets and the Theory of Industry Structure*, Harcourt Brace Jovanovich, p.280

35 Wang, X Henry and Yang, Bill Z, op cit, p.180.

Sunk costs vs avoidable costs and fixed costs vs variable costs classify total costs from two different perspectives. A cost is sunk (over a given time period) if it has been irrevocably committed (as of a given time point), otherwise it is avoidable. Sunk and avoidable costs are therefore concepts related to time and timing, which is a dynamic issue.

5.21 Wang and Yang conclude that by definition all sunk costs must be fixed*: "When a cost is sunk, it cannot be varied at all and hence does not vary with the scale of production".* However, there may be long-run avoidable fixed costs as the fixed investment is required for as long as there is demand for the service (and hence, for example, assets are replaced as they depreciate).

5.22 Calton and Perloff provide an example of a lawyer signing a lease agreement.[36] The monthly payments are a fixed cost, as they do not vary with the lawyer's output. But they are not sunk – provided the lawyer could, on exit, sublet to someone else or pay a penalty for breaking the lease. Only the unavoidable part of the rent or penalty fee is sunk from the perspective of the lawyer. While the lawyer remains in business, the monthly payments are a fixed cost that needs to be recovered in fees for legal services.

Sunk costs defined by legal system not just technology

5.23 From the discussion above, a fixed cost can be characterised as a cost that does not alter with changes in production. A sunk cost is a cost that is committed irrevocably. Whether a cost might be viewed as fixed or sunk might depend on the legal or contractual obligations associated with that cost and not just its technological characteristics. This view of sunk costs is evident in Stinespring's examples of non-refundable licenses and insurance policies:[37]

A sunk cost is a fixed cost that cannot be avoided... A cost that is "fixed" in the sense that its associated input cannot be varied and has no alternative use, is sunk because it is unavoidable. Examples include a non-transferable, non-refundable license to fish or practice law and a firm-specific asset that is undesirable to other firms and has no other productive use (e.g. a machine tool designed specifically for a particular plant or product).

5.24 An insurance policy, for instance, that can be cancelled and the premium refunded for the remaining time of the policy would be a fixed cost and not a sunk cost. Wang and Yang similarly conclude that: "*Fixed and variable costs are … concepts determined by technology and the legal system*."[38]

6 Sunk costs and production decisions

6.1 As evident from the work of economists during the Great Depression, the reason economic theory attempts to distinguish between sunk and other forms of cost is

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36 Carlton, D and Perloff, J (2000), *Modern industrial organizational theory 3rd edition*, Addison Wesley Longman. Reading, Mass, p28, pp 59-61.

37 Stinespring, John Robert, op cit, p.15

38 Wang, X Henry and Yang, Bill Z, op cit, p. 180.

because sunk costs should not be taken into account in production decisions after the sunk costs are incurred. When people are influenced in production decisions by costs that are to them sunk, they are said to be committing the "sunk cost fallacy."[39]

6.2 The classic example is research and development expenditure. If the R & D expenditure fails to develop a successful product, the costs are sunk. The sunk costs of the failed R & D are not relevant to production decisions resulting from successful R & D expenditure. Unsuccessful R&D is a sunk cost because whatever decision is made going forward, no opportunities are said to be foregone in relation to that past expenditure.[40] As long as the revenue received for the 'successful' product exceeds the cost of producing the product, the firm is better off continuing to supply the product even if the revenue does not cover the costs of unsuccessful R&D.

6.3 A simple example might help illustrate the implication of sunk costs for production decisions. Consider a service that required an investment in two assets and incurs some operating costs as shown in the table below.

Asset	**Cost**	**Value in alternative use**
Transferable asset (say motor vehicle)	$100	$100
Specialised asset	$100	Nil
Operating cost	$10	$10

6.4 If it turned out there was no market demand for this service, the specialised asset would be a sunk cost under all of the tests discussed in section 5 above; the asset would have no value in an alternative use or to an alternative user.

6.5 To avoid the "sunk cost fallacy", the supplier should ignore the cost of the sunk asset in deciding whether to continue to *produce* the service. As long as the revenue received for the service exceeds the non-sunk costs of producing the service (in the above example, the cost of the motor vehicle and the operating costs), the firm is better off continuing to supply the service. If its revenue does not cover the non-sunk costs, the supplier would be better to stop producing the service and sell the motor vehicle and avoid the operating costs.

6.6 Hence, sunk costs are an important consideration in *production* decisions. The relevance of sunk costs to *pricing* decisions is considered in section 7 below.

6.7 The example becomes more complicated where production involves long-run avoidable fixed costs; that is, where a decision to provide the service means a decision to commit to replacing the fixed costs (including specialised assets) as they depreciate, while there is a demand for the service. In these circumstances,

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[39] See for example, R. Preston McAfee, Hugo M. Mialon, and Sue H. Mialon, 'Do Sunk Costs Matter". *Economic Inquiry*, Western Economic Association International, vol. 48(2), pages 323-336, 04

[40] In reality, the decision-maker may never be sure that there is not some other valuable use for the R&D (that is, no opportunity cost) unless the research is offered to the market in some form, which the researcher may be unwilling to do – for example, because the release of the research may disclose commercially valuable research techniques or areas of research interest.

the firm should continue to produce the service if it expects the revenue from the service to cover the full cost of the service, including the cost of replacing specialised and non-specialised assets as they depreciate. It does not matter for this decision whether the service is provided by assets purchased in the past, assets purchased recently, or replacement assets that must be acquired to maintain the service over the period demanded by the consumer of the service. As Wang and Yang observe:[41]

> *"In the long run, there are no sunk costs, because all inputs are avoidable. However, there may easily be long-run fixed costs.*

Hence, for production decisions involving a commitment to replace assets (including specialised assets) as they depreciate, no useful distinction can be made between sunk and other forms of fixed costs for production decisions.

7 Sunk costs and pricing

7.1 While the economic concept of sunk cost may have evolved as a tool for efficient production decisions, submissions on the transmission pricing methodology proposal were focused on the implications of sunk cost for pricing. This section considers what implications sunk costs have for pricing at the margin, and for non-marginal pricing. Marginal pricing refers to the price set for an additional unit of the service.

7.2 Standard welfare economics provides economists with tests for whether marginal prices are (Pareto or statically) efficient – that is, where no consumer could be made better off without making some other consumer worse off. A *necessary* condition for Pareto efficiency is that the *marginal willingness to pay* must equal *marginal cost*. Each of the italicized terms has a formal meaning in economics..

7.3 A 'necessary' condition means that the condition must hold for the situation to be economically efficient, but the condition may hold in circumstances without implying that the situation is efficient. As discussed further below, setting all prices equal to marginal cost can easily fail to be efficient. The phrase, 'marginal willingness to pay', refers to the willingness of the customer to pay for an incremental unit of the service. 'Marginal cost' refers to the cost of providing an incremental unit of the service.

7.4 Hence, if any consumer values an additional unit of service at more than it cost to produce that unit, then it is possible to make that consumer better off by producing an extra unit of the service and selling it to that consumer at some (consumer-specific) price greater than or equal to the cost of producing the incremental unit. Such a transaction would make the consumer in question better off without making anyone else worse off, showing that the original configuration was not Pareto efficient.

7.5 In the simple example in paragraph 6.3, the statically efficient marginal price would be $10, as the marginal cost concerns only the operating costs. The fixed costs of the motor vehicle and the specialised asset do not change at the margin.

[41] Wang, X Henry and Yang, Bill Z, op cit, p. 181.

7.6 As this example illustrates, static efficiency considerations do not distinguish between fixed and sunk costs. Static efficiency distinguishes between variable and fixed costs (regardless of whether the fixed cost is sunk). As Stinespring notes, fixed costs are ignored at the margin "*not because they are sunk, but because they need not be altered to alter production levels*."[42]

Static efficiency requires only that the marginal unit is priced at marginal cost

7.7 The static efficiency requirement, that the price for the marginal unit equate marginal willingness to pay and marginal cost, does not mean that every unit of the good or service be sold at marginal cost. Consider, for example, the illustration provided by Professor Varian of the University of California at Berkeley.[43] In this example, a supplier offers a service that has fixed costs of $10 and marginal costs of $2 per unit supplied. Two customers each want to purchase one unit of the service. Customer A is willing to pay $12 for the service; customer B is willing to pay $5.

7.8 A number of pricing scenarios are possible, including:

(a) The service could be sold at marginal cost - in this case the producer would sell the service at a price of $2 to each of the customers, but would fail to recover its fixed costs, which is not economically viable.

(b) The service could be sold at a flat price - in this case the supplier would find it most profitable to set a price of $12 and sell only to customer A. Customer B would not purchase the service even though it would be willing to cover marginal cost.

(c) Different prices could be charged to A and B - the supplier could set a price of $10 for customer A and $2 for customer B. Each customer would be served and the supplier would be able to cover its full costs.

7.9 The variation in prices under scenario (c) is consistent with the condition for static efficiency, as the price at the margin equals the marginal willingness of customer B to pay (and customer A pays a price less than its willingness to pay, resulting in a consumer surplus).

7.10 Price discrimination of this nature is ubiquitous in industries that exhibit large fixed costs; airlines, for example, operate sophisticated yield management systems whereby two passengers flying at the same time and in the same cabin class may have paid very different prices for their tickets. According to Professor Damien Geradin and Nicolas Petit of the University of Liege:[44]

> *A key insight of economics is that price discrimination is most likely to expand output where the seller has declining average total costs. Expanding output through price discrimination is an essential strategy for firms facing problems of fixed cost recovery. Price discrimination allows firms facing large fixed*

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42 Stinespring, John Robert, op cit, p 19

43 H. R. Varian, Differential Pricing and Efficiency, First Monday, vol 1, number 2-5 August 1996. The example has been modified to ensure revenue does not exceed total cost, as per the regulatory regime applying to Transpower.

44 Geradin & Petit, (2006), Price Discrimination under EC Competition Law: Another antitrust doctrine in search of limiting principles? Journal of Competition Law and Economics, 2(3), pp. 484-485.

costs (in practice all firms that make substantial investments) to expand their output and thus spread fixed costs over a large number of units.

Sunk costs and infra-marginal pricing

7.11 Economics does not provide the same definitive tests for pricing of infra-marginal decisions as it does for pricing marginal units. The economic efficiency implications for infra-marginal pricing may differ from those for marginal pricing, especially where the activities being priced involve commitments over extended periods. It is the infra-marginal decisions that often determine which activities are engaged in and whether or not to engage in an activity; marginal decisions tend to allocate resources within a pre-determined set of activities.[45]

7.12 To illustrate, before a student enrols in a university, he or she chooses a major field of study. If she chooses economics as her major, then typically she would take microeconomics and macroeconomic classes rather than, say, chemistry or physics. Her choice of major, and associated choices of subject courses, are infra-marginal decisions and involve deciding the activities within which she will engage. Her decisions on allocating time to the chosen courses are marginal decisions, and involve deciding the quantity of resources (in this case, time) devoted to each activity, given the activities she has chosen.

7.13 For many economic activities, infra-marginal decisions are as important, if not more important, than marginal decisions. In sectors such as the electricity industry, with long-life assets (in generation, transport, and consumption), it is infra-marginal decisions that primarily determine the allocation and use of society's resources over time.

7.14 Distinctions between marginal and infra-marginal pricing can also be important where an attribute of a service is necessarily common to a large group of customers, such as the quality of supply across a transmission grid. For service attributes that are common, decisions that are efficient at the margin may, in some circumstances, lead to choices that are welfare reducing.[46] Setting prices for the marginal unit at marginal cost might be a necessary condition for static efficiency but it may not be a sufficient condition.

7.15 In many real world settings the distinction between infra-marginal and marginal decisions may not be clear cut because it depends on the timeframe for the analysis. Investment decisions often involve infra-marginal and marginal decisions being made at the same time, with adjustments to those decisions subsequently as conditions change. When a firm decides whether or not to invest in a durable asset, it looks at how the outlay would be recovered, so the infra-marginal decision of whether to invest is made at the same time as the marginal decision of how much to charge. For these decisions, a distinction between fixed and sunk costs does not arise as no cost is committed at the time of the decision.

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45 Cheng, W., Yang, X., "Inframarginal analysis of division of labour: A survey", *Journal of Economic Behaviour & Organisation*, vol. 55 (2004) pp 137-174, p 138.

46 Judge Richard Posner provides an example on his shared blog with Nobel Laureate Gary Becker, of air transport, which like electricity involves large fixed costs and aspects of shared service quality; it may be profitable for an airline to lower quality (e.g., increased flight delays) to reduce costs and to offer lower prices to attract a marginal customer while making infra-marginal customers worse off, resulting in a net reduction in economic welfare, see http://www.becker-posner-blog.com/2007/08/air-transportation-delay--posner.html

7.16 Returning to the simple example in paragraph 6.3 may help illustrate why a sunk cost classification is unlikely to inform infra-marginal pricing decisions. In that example, the supplier would have assessed whether its customers would be willing to pay the full opportunity cost of the service, including the costs of the specialised asset (which may become sunk after the investment is committed). If the investment proceeds, and if the demand exists for the service, there is no obvious economic efficiency reason why that demand should face, after the investment has been made, a *lower* price than the full economic cost of the service.

7.17 Nor is there an economic efficiency reason to argue that recovering fixed costs through variable non-marginal prices would necessarily be allocatively inefficient. Fixed costs may be ignored when pricing the marginal unit because the cost of producing the marginal unit does not alter with the change in production levels and this is an important consideration in pricing to align the marginal willingness to pay and the marginal cost to supply. However, for infra-marginal decisions, the marginal willingness to pay must, by definition, be above marginal cost, meaning the price charged for the service may be higher than marginal cost without inefficiently distorting the demand for the service.[47]

7.18 Economic theory does not support the view of submitters that prices should not reflect sunk costs, or that fixed costs should not be recovered by variable charges, when setting infra-marginal prices. The debate in economics is about how best to recover fixed costs (and sunk costs are fixed costs), and not whether a distinction is required between sunk and other costs for the purposes of infra-marginal pricing.

7.19 Economists would perhaps agree that it is desirable that infra-marginal prices should in general cover full economic costs.[48] The importance of infra-marginal, as well as marginal decisions, means it is necessary to consider the total economic efficiency effects (static and dynamic) of a particular pricing proposal, and not just one aspect or one set of prices. A pricing methodology that alters infra-marginal prices (that is, any price other than for the marginal unit) for services provided using existing (including sunk) investments may enhance dynamic efficiency and be consistent with the conditions for static efficiency.

8 Transpower's individual price-quality path

8.1 Transpower is subject to individual price-quality regulation in relation to the supply of electricity transmission services as the asset owner; its system operator role is excluded. It is subject to a revenue cap (net of certain pass-through costs and recoverable costs). The Commerce Commission (NZCC) administers this regulation. Input methodologies (IMs) specify how the revenue cap is estimated.

8.2 One submitter argued at the May 2013 TPM conference that the regulatory regime applying to Transpower had the economic effect of ensuring that once an

47 At the extreme, a perfectly discriminating monopoly could price down the demand curve and maintain allocative efficiency.

48 Coase, R. H, "The Theory of Public Utility Pricing and Its Approaches", The Bell Journal of Economics and Management Science, vol. 1 No. 1 (Spring, 1970) pp. 113-128, p118 and p 122.

investment had been made by Transpower the asset was sunk because it had to be paid for.[49] This section summarises the regulatory regime applying to Transpower and whether it alters the implications of sunk and fixed costs for efficient pricing of transmission services.

Maximum allowable revenue

8.3 Transpower's revenue cap is set in the *Commerce Act (Transpower Individual Price-Quality Path) Determination 2010* (IPP). Schedule D presents the building block components that comprise the forecast maximum allowable revenue (MAR), which is specified as follows:

Maximum allowable revenue = capital charge[50] + operating expenditure[51] + depreciation + term credit spread differential allowance[52] + tax + EV adjustment[53]

8.4 Transpower's total revenue is the sum of its approved MAR plus pass-through costs[54] plus recoverable costs.[55]

8.5 Transpower calculates the forecast MAR. The NZCC reviews Transpower's forecast, forms its own view and consults on this view. It then makes a final determination, which is implemented through a change to Transpower's Individual Price-Quality Path (IPP).

8.6 The forecast MAR is set at the start of each regulatory period, and is subject to an annual update to reflect the incremental revenue impact of any major capital expenditure projects approved by the NZCC, and any EV adjustment for unapproved capital expenditure. Minor capital expenditure and operating expenditure allowances are not reviewed (see clause 5.4 of the IPP).

8.7 The effect of this is that Transpower is able to recover in its annual revenue a capital charge relating to all its capital expenditure as long as it is approved by the NZCC.[56] Approval may be given for small projects in an aggregate "minor capital expenditure" amount at the start of the regulatory period; Transpower may submit for approval more detailed specific proposals for larger projects at any

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49 Comments by Alex Sundakov, page 81, transcript, op cit.

50 Capital charge is the product of the weighted average cost of capital (WACC) and Transpower's regulatory asset base (RAB).

51 Operating expenditure includes "expenditure incurred in relation to departmental costs, investigations costs, communications and control costs; information system and technology operations; instantaneous reserve 'event charges' (as that term is defined in the Code); operating lease costs; transmission and substation maintenance; insurance premiums; black start and over-frequency arming costs; and any ancillary services costs that are not recoverable costs;" *Commerce Act (Transpower Individual Price-Quality Path) Determination 2010 – Amended and consolidated 31 October 2012, p. 12.*

52 This represents the additional costs (if relevant) of a longer term debt portfolio (i.e. one that exceeds the regulatory period of five years).

53 This adjustment offsets the revenue impact of any unapproved capital expenditure that is included in the RAB over the life of the assets.

54 Pass through costs comprise local government rates and regulatory levies specific to electricity transmission services.

55 Recoverable costs are changes and adjustments carried forward from the previous year, instantaneous reserves availability charges (with certain restrictions) and transmission alternative operating costs (with certain restrictions).

56 This includes transmission investments previously approved by the Electricity Commission.

time. Approved amounts are added to Transpower's Regulated Asset Base and recovered through the building blocks MAR described above.[57]

8.8 In approving major capital expenditure, the Commission applies the investment test specified in Transpower's capex IM determination.[58] Expansions to the non-core grid are reviewed against a net market benefits test (a form of net economic benefits test). Investment required in the core grid to maintain the reliability standards must be demonstrated as the most efficient means of achieving that quality standard, but Transpower is not required to provide a net positive market benefit (in effect, investments to maintain the reliability standard are deemed to have a net benefit).

8.9 One of the economic effects of the regulatory regime is to largely allocate the risk of demand variations to transmission customers. Under the former valuation method, of optimised depreciated replacement cost, Transpower carried greater demand variation risk as its asset base would be periodically optimised for the purposes of valuing its regulated asset base. Transpower remains obliged under the State Owned Enterprises Act 1986 and under its Statement of Corporate Intent to invest and operate efficiently.

Sunk costs and Transpower's regulatory regime

8.10 The discussion in sections 6 and 7 concluded that:

(a) sunk costs are relevant to production decisions when revenue from a service is not sufficient to meet the full economic costs of the service

(b) there is no a priori reason to distinguish between sunk and fixed costs for the purposes of setting efficient prices.

8.11 The regulatory regime applying to Transpower is consistent with these conclusions.

8.12 Transpower is required to operate efficiently and would be expected to consider the extent to which its costs are sunk when it decides whether to continue providing a service in which it has already invested. The mechanism that applies to costs incurred by Transpower on an approved project, where that project either does not proceed or is not completed prior to the approval expiry date, complements this efficiency requirement. The 'major capex sunk costs adjustment' is intended to provide Transpower with the incentive to correctly abandon projects. This incentive is provided "by allowing Transpower to recover its costs, up to the point that Transpower becomes aware that the project is no longer economic."[59]

8.13 For services for which a demand exists, Transpower has a regulatory right to recover its approved costs. This regulatory right is akin to a property right and means that, for Transpower, no cost is irrevocably committed; all approved costs can be recovered. From Transpower's perspective, all costs in providing transmission services can be recovered, hence the regulatory right would seem

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57 Unapproved capex and excess spending on minor capex is also included in the RAB, but an adjustment is made to Transpower's MAR (the EV adjustment) so revenue is not recovered for these unapproved assets.

58 *Re Transpower Capital Expenditure Input Methodology Determination* [2012] NZCC 2.

59 Commerce Commission, *Capital Expenditure Input Methodology – Reasons Paper*, 31 January 2012, p.61

to ensure that expenditure by Transpower on long-lived assets take the economic characteristics of fixed costs rather than sunk costs.

8.14 Transmission customers may collectively be required to pay for transmission services, but only while they continue to take the service. As with Carlton and Perloff's example of a lawyer signing a lease agreement, the cost of transmission services to a customer may be a fixed or variable cost, but it is not a sunk cost from the perspective of the customer.

9 Conclusion

9.1 Several submitters argued that the proposed TPM would change the way sunk costs are charged for and doing so would give rise to economic inefficiencies. Some submitters also expressed concern that the proposed methodology would convert a fixed or sunk cost to a variable charge and that this would result in allocatively inefficient pricing signals.

9.2 A consistent theme in the literature is that expenditure which has been irrevocably committed is sunk; if there is no alternative use for an asset, and no demand for the asset in its current use, the costs committed to that asset are sunk under all definitions of a sunk cost. A fixed cost can be characterised as a cost that does not alter with changes in production. All sunk costs are fixed, but not all fixed costs are sunk (because the fixed costs can be recovered or avoided).

9.3 Sunk costs are an important consideration in *production* decisions. A supplier should ignore the cost of a sunk asset in deciding whether to continue to *produce* a service. As long as the revenue received for the service exceeds the non-sunk costs of producing the service, the firm is better off continuing to supply the product. If its revenue does not cover the non-sunk costs, the supplier would be better to stop producing the service.

9.4 Categorising costs as sunk or otherwise has few if any implications for efficient pricing. Fixed costs are ignored in setting efficient prices for the marginal unit of service not because they are sunk, but because they need not be altered to alter production levels. Hence, the important distinction for static efficiency considerations is between variable and fixed costs.

9.5 However, the static efficiency requirement, that the price for the marginal unit equate marginal willingness to pay and marginal cost, does not mean that every unit of the good or service be sold at marginal cost. This static efficiency condition applies only to the marginal unit.

9.6 Economics does not provide the same definitive tests for pricing of infra-marginal decisions as it does for pricing marginal units. The debate is about how best to recover fixed costs (and sunk costs are fixed costs), and not whether a distinction is required between sunk and other costs. If a supplier has invested in assets to meet an expected demand, and if the demand exists for the service, there is no obvious economic efficiency reason why that demand should face a price, after

the investment has been made, that is *lower* than the full economic cost of the service.

9.7 Economic theory does not support the claim in submissions that “there can be no dynamic efficiency benefits” from adjusting prices to incorporate the cost of sunk assets. Nor is there an economic efficiency reason to argue that recovering fixed costs through variable non-marginal prices would necessarily be allocatively inefficient.

9.8 Accordingly, with reference to the Authority’s objective, if changing the methodology by which transmission prices are determined promotes overall efficiency in the electricity industry, the Authority may change the methodology, irrespective of the existence of sunk costs.

Appendix A NZ regulators consideration of sunk costs

A.1 Both the Commerce Commission and the Electricity Authority's predecessor the Electricity Commission have taken views on what sunk costs are and in particular with respect to transmission assets. This section sets out some of these views.

A.2 In 2002, the NZCC released its final report on its airfield inquiry.[60] This inquiry discussed sunk cost in the context of specialised non-land airfield assets (such as sealed surfaces and civil works). In that report, the NZCC relied on the zero opportunity cost description of sunk costs, as well as discussing sunk costs in the context of the difference between entry cost and exit cost recovery.

A.3 The report stated that "economically, these assets are sunk as the investment in them cannot be recovered by resale. In the case of sunk assets, opportunity costs are zero. Such assets are being used in their best use, and there is no alternative use."[61] The NZCC took further pains to explain what it meant by opportunity cost: "for sunk assets, replacement costs cannot be a measure of opportunity cost, as by definition such assets have no alternative uses once built. The principle that the opportunity cost of an asset is its value in its next best alternative use is well established in economics. The next best alternative use is, by the ordinary meaning of the words, a use different from its current use."[62]

A.4 It went on to say that "entry would require a large, long-term investment in land, runway, and other infrastructure. A substantial proportion of that investment would be sunk, meaning that it would not be recoverable upon exit, especially where exit was induced by excess capacity and inability to gain market share from an incumbent. Hence the barriers to exit would be high, and that realisation would in turn discourage entry in the first place."[63]

A.5 The NZCC describes what we call here sunk assets as 'specialised assets' and makes reference to the approach of the New Zealand Institute of Valuers (NZIV) to the valuation of specialised assets. The description of specialised assets by valuers seems quite pertinent to the current issue:

A.6 Specialised assets are those that are rarely if ever sold on the open market, except by way of a sale of the business of which they are a part, due to their uniqueness, which may arise from the specialised nature and design of the buildings, their configuration, size or location or other factors.

A.7 Key characteristics of specialised assets are that they

(a) are useful to a limited number of uses or users

(b) rarely, if ever, sell on the open market, except as part of the business entity

(c) are generally specialised structures, and

(d) earn revenue that has not been derived from an open market and for which market based evidence does not exist.

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60 Commerce Commission, Final Report, Part IV Inquiry into Airfield Activities at Auckland, Wellington, and Christchurch International Airports, 1 August 2002,.

61 Ibid, paragraphs 37 and 38.

62 Ibid, paragraph 5.11

63 Ibid, paragraph 3.42

A.8 In general, specialised assets are those that, due to some specialised physical or geographical factor, offer very little utility for any purpose other than that for which they were originally designed.

A.9 The NZCC considered that the NZIV does not emphasise the lack of alternative uses sufficiently strongly. We note though it is consistent with the market for incumbency discussion above, that is that it recognises that the sale of the business as a whole does not affect the classification of the asset or cost.

A.10 The NZCC also discusses sunk and specialised assets in the Reasons Paper related to the Input Methodologies (IMs):[64]

> *[I]nvestments in infrastructural markets tend to be durable and indivisible (i.e. 'lumpy'), and have no alternative use other than in the supply of the current services (i.e. once capital is committed, such service- or market-specific investments are sunk). These factors create substantial barriers to entry and exit in the relevant market. Barriers to exit can occur when an incumbent supplier cannot transfer its assets out of supplying services in a particular market. Such barriers to exit will also deter new entrants as, following entry, entrants would expect the incumbent to remain in competition with them and engage in retaliatory price changes.*

A.11 The NZCC went on to say:[65]

> *"To the extent that assets are specialised, they have little value in alternative use – once capital is committed such service or market specific assets are sunk. Where sunk costs are significant, physical capital is not mobile between different uses. In the markets regulated under Part 4, assets can be considered to be highly specialised. These assets have little value in alternative use and no assets in alternative uses could fulfil a similar specialised function. This characteristic causes barriers to entry into, and exit from, regulated markets to such an extent that competition is not workable."*

A.12 The Electricity Governance Rules 2003 (the Rules) were the forerunner of the current Electricity Industry Participation Code 2010. They were based on the electricity industry's self-governance arrangements and the Electricity Commission was charged with further developing the Rules to foster workable and effective competition. In the Rules, Part F, section IV, rule 2 a set of Pricing Principles was specified to be applied by Transpower in developing a transmission pricing methodology (TPM) and the Electricity Commission's Board in approving a TPM. Rule 2.4 specified that: sunk costs should be allocated in a way that minimises distortions to production/consumption and investment decisions made by grid users

A.13 The Rules did not make explicit what was meant by sunk costs. However, during the process of Transpower developing its TPM around 2005, there was discussion of how this principle should be interpreted. In August 2005, the High Court instructed the Electricity Commission to set aside some TPM guidelines that it had published in December 2004. The Electricity Commission was instructed to reconsult on the allocation of the HVDC charges. In February 2006,

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64 Commerce Commission, Input Methodologies (Electricity Distribution and Gas Pipeline Services), Reasons Paper, December 2010, paragraph 2.6.8 and footnote 85.

65 Ibid, paragraphs 4.2.11 and 4.2.12.

having received submissions on the HVDC, the Electricity Commission released an explanatory paper summarising submissions and its decisions. In that paper the Electricity Commission notes that Contact Energy submitted that the HVDC link was not a sunk cost, a proposition that the Electricity Commission explicitly rejected:[66]

> *[T]he existing HVDC and HVAC assets should be considered as fixed costs, as they have economic value. Sunk costs are those part of a purchase cost that cannot be salvaged or modified through resale or other changes in operation, such as marketing costs. Therefore efficiency requires the same pricing methodology for existing and new assets and the full opportunity cost of existing fixed costs should be reflected in prices (Contact).*

A.14 The Commission disagreed with Contact's argument that the HVDC asset is not a sunk cost. The Commission considered that the HVDC link could not be sold or modified to another use without destroying most of its value; therefore they considered the existing HVDC asset can be treated as a sunk cost.

A.15 The Electricity Commission goes on to say:[67]

> *The Commission considers that sunk costs are closely related to fixed costs but the essential characteristics of sunk costs are that they are not recoverable, have minimal salvage value and therefore have close to zero opportunity cost.*

A.16 The Pricing Principles became part of the Code when it came into force in 2010. This framework continued to be reflected in the Authority's work after this. The Transmission Pricing Advisory Group (TPAG), which was established specifically to recommend a preferred TPM, distinguished fixed and sunk costs, and explicitly considered allocative inefficiencies associated with price signals for sunk assets. However, they did not define what a sunk asset was (either implicitly or explicitly). TPAG's findings were released on 7 June 2011.

A.17 Darryl Biggar was commissioned by the Authority to review the TPAG Discussion Paper. He simply observed "it is well known, of course, that transmission service providers must make a substantial sunk investment in network assets."[68]

A.18 The Pricing Principles relating to the development and approval of the TPM were removed from the Code on 1 June 2011, when clause 12.79 was substituted requiring the Electricity Authority to assess the TPM against its statutory objective in s.15 of the Electricity Industry Act 2010. This removed explicit reference to the allocation of sunk costs from the Authority's assessment.

A.19 The Authority did not explicitly consider sunk costs in either the Decision-making and Economic Framework for the TPM or the issues paper relating to the TPM itself. However, many submitters focus substantial attention on this matter, and it was discussed at the May 2013 TPM conference.

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66 Cited in Electricity Commission, Explanatory paper – summary of submissions and cross submissions and draft decision: HVDC transmission pricing methodology, February 2006, paragraph 6.12.25(b).

67 Electricity Commission, Explanatory paper – summary of submissions and cross submissions and draft decision: HVDC transmission pricing methodology, February 2006, paragraph 7.3.44.

68 Darryl Biggar 'Independent Review of Transmission Pricing Advisory Group: Transmission Pricing Discussion Paper, 7 June 2011, Final Report, 14 July 2011.