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Prepared at Request of Counsel

Memo

To: Gillian Blythe, Meridian Energy Limited
Date: 28 April 2011
From: Lewis Evans
Subject: The Implications of the 26 March 2011 price spike for the Dynamic Efficiency of the NZEM

Summary

1. You have asked me to assess the economic efficiency of the event of 26 March in which Genesis Energy Limited (Genesis) offered in very high-priced generation at a time when the market knew there was a planned network outage that conferred very significant market power on Genesis.

2. I conclude that the nature of this event is such that, if it is admitted under the Code, the changes in Participant behaviour that it has induced will continue, and will reduce the dynamic efficiency of the New Zealand electricity market.

3. I understand that the event is being assessed by the Electricity Authority (EA) against the criteria of an undesirable trading situation (UTS). As a proper analysis of the place of, and criteria for, a UTS is partly a legal matter I do not formally recommend whether this event amounts to a UTS. However, I draw the following conclusions.

4. First, the UTS rules can be thought of as efficiently filling unavoidable gaps in the Code. That is, by addressing behaviour not codified precisely, a UTS reduces the need for such codes, and enables independent Participant decision-making that promotes a workably competitive market in electricity.

5. Second, unless it is prevented by the UTS rules, I consider that the Genesis event will continue to spawn Participant actions that render a reduction in competitiveness, and wider credibility, of the New Zealand electricity market.

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Introduction

6. The purpose of this report is to examine an event that is presently being tested by the Electricity Authority (EA) against the criterion of an "undesirable trading situation" (UTS). A UTS for the New Zealand Electricity Market (NZEM[1]) is described by the EA[2] (p.1) as arising

    a. "when there exists a threat to orderly trading or settlement that cannot be resolved under the Electricity Industry Participation Code 2010[3]. ……"

    and, by way of elaboration,

    b. "These situations …. can appear to be quite routine problems but, if left unchecked even in the short term, could escalate to become significant issues for the market. …"

7. I do not consider all the ramifications – e.g. legal issues – in assessing whether the event constituted a UTS. Rather, I assess whether the event and repetitions of it would be in concert with the social benefit of a dynamically efficient electricity market.

The Event

8. On 26 March 2011 Transpower undertook planned maintenance on three 110kV circuits between Arapuni and Bombay and two 220kV circuits between Otahuhu and Whakamaru. The maintenance had previously been announced to NZEM participants pursuant to the NZEM Code. The effect of the maintenance activity was to severely curtail electricity transmission capacity between the Waikato and Auckland regions. During the outage, dispatch prices in the constrained region rose to between $19,000 and $20,000/MWh: a level that is some 300 times higher than prices would normally be at the relevant time.

9. The high prices reflected offer prices of Genesis for Huntly Units 2, 5 and 6 that lay in the range $19,000-$20,000/MW/h over the relevant period.

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1 I use NZEM to mean the present New Zealand electricity market.

2 *Guideline for Participants on Undesirable Trading Situations*, v2.1, Electricity Authority, 9p., http://www.ea.govt.nz/search/?q=undesirable , accessed 20 April 2011.

3 Among other things this Code sets out the operational rules of NZEM.

10. After Transpower completed its maintenance, prices returned to levels seen before the outage.

11. The event then consists of Genesis, knowing that during the defined maintenance period it would be the marginal generator and have very significant market power in the Auckland region, offering in generation at abnormally very high prices with the effect that NZEM prices were extraordinarily high by any standard, in that region particularly.

Criteria for Market performance

12. I assume that the preferred market structure is one of competition among de-centralised agents (firms and consumers). Decentralisation allows decisions taken by agents that are accountable for these decisions, and close to where the relevant information resides. It also allows for different competing expectations, operational and investment strategies. The environment for these effects is a workably competitive market.

13. A useful definition of a workably competitive market is that of Heydon (1989, p.1548: *Trade Practices Law*)

> *"….. a market framework in which the pressures of other participants (or the existence of potential new entrants) is sufficient to ensure that each participant is constrained to act efficiently and in its planning to take account of those other participants or likely entrants as unknown quantities. To that end there must be an opportunity for each participant or new entrant to achieve an equal footing with the efficient participants in the market by having equivalent access to the means of entry, sources of supply, outlets for product, information, expertise and finance."*

Given the mismatch of consumers and sources of generation across regions in New Zealand, a workably competitive market in electricity requires transmission such that there is "one" nationwide market with de-minimis, transitory impediments to the transfer of electricity between regions.

Workable competition can be equated to the conditions for dynamic efficiency.[4]

14. Economic efficiency is commonly classified into two broad categories:

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[4] Markham, Jesse, 1950, "An Alternative Approach to the Concept of Workable Competition", *American Economic Review*, 40(3), 349-361.

a. Allocative efficiency, which is that resources are allocated in a socially desirable manner at a point in time. It means the amounts of products produced and inputs used are such that the opportunity costs of each resource in all its uses are equal, and that the social benefit to consumers of the last unit consumed is equal to the total opportunity cost of resources used in its production.[5] Put another way, the level of output produced is allocatively efficient if a socially desirable amount of it is provided.

   It includes within-firm allocative efficiency, often termed productive efficiency, where firms organise their affairs to produce output at minimum cost; and

b. Dynamic efficiency, which is allocative efficiency achieved through time into the foreseeable future.

15. From the perspective of society the market performance criterion most preferred is dynamic efficiency. Dynamic efficiency is the most important measure of performance because it is the source and outcome of investment and innovation. Without dynamic efficiency society may lose, or have delayed, entire markets.[6] Dynamic efficiency is synonymous with workable competition, rather than perfect competition or monopoly. Dynamic efficiency is necessarily forward looking and entails decisions in the context of imperfect information and risk. It therefore has a much stronger role for the possibility of profit, than does allocative efficiency. Expectations of profit provide the incentive for, and realised profit the source of, innovation, investment and entry.

16. Allocative and dynamic efficiency are often in conflict because the conditions for investment and innovation place weight on future benefits, whereas allocative efficiency is a static concept. A reasonable balance between the (static) present and the future is achieved, and dynamic efficiency enhanced, by a workably competitive market.

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5 This rule yields the maximum total – consumer plus producer – surplus in certain circumstances. It is modified – but remains as the maximum of total surplus – in cases where there are features of the market such as economies of scale. For discussion of the application of this criterion in competition law see "The Efficiency Test Under Competition Law and Regulation in the Small Distant Open Economy that is New Zealand", *New Zealand Economic Papers*, 38(2), December, 2004, 241-264., and for regulation, Michael L. Katz, *Competition, Efficiency, and the Long-Term Benefit of End-Users*, Report before the NZ Commerce Commission 30 November 2004, 29p. (*www.comcom.govt.nz//IndustryRegulation/Telecommunications/Investigations/MobileTerminationRates/ContentFiles/Documents/Annex%20D.pdf*).

6 See for example, Baumol, William J., David B. Audretsch, and Andrew E. Burke (2001), "Competition policy in dynamic markets", *International Journal of Industrial Organization*, 19, 613-634, and Jerry A. Hausman, Ariel Pakes, and Gregory L. Rosston, Valuing the Effect of Regulation on New Services in Telecommunications *Brookings Papers on Economic Activity. Microeconomics*, Vol. 1 (1997), pp. 1-54; and Austan Goolsby, "The Value of Broadband and the Deadweight Loss of Taxing New Technology", *Economic Analysis & Policy (*B.E. Press Journals), 5(1), 2006.

Modern Electricity Markets

17. The benefit of modern electricity markets is their balance of centralized and decentralized decision-making. The changes wrought since the early 1990s in electricity market structures were designed to move to less centrally organized systems by retaining a governance structure for that which requires central administration, and devolving autonomy to the individual supply and demand side units. In this, spot markets have played a major role. Although they vary in their detail,[7] they have the common feature of a governance structure that facilitates decentralized decision-making.[8]

18. Firms operating legally in a workably competitive market are, in particular, meeting the generic strictures of competition law. In addition, industries may have specific operational rules that have various justifications: some of which may have a statutory basis.[9] In the case of electricity, operational rules and processes are codified by the EA by the force of statute. The Code embodies spot market rules that spot market participants are required to abide by. It is these spot-market rules that enable a workably competitive market in electricity.

19. Spot markets arise naturally in many markets concomitantly with rules of operation. They arise when there are many homogeneous transactions and they possess rules that reduce transactions costs.[10] Electricity has peculiar features that render a spot market with particular features essential if there is to be a workably competitive market in electricity.

20. The importance of the spot market lies in the market resolution of potential mismatches in supply and demand in the trading of electricity. The well-known facts that:
    a. electricity cannot be stored at reasonable cost, and consequently supply must equal utilization at each point in time,
    b. quality standards of electricity should be maintained in real time;
    c. departures from b, are typically extremely costly; and

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7 See Evans, Lewis and Richard Meade, *Alternating Currents or Counter-Revolution? Contemporary Electricity Reform in New Zealand*, with Richard Meade, VUW Press, 346pp., 2005.

8 I shall not comment on the management of transmission which itself has particular externalities, although the principles of governance also apply to it.

9 For example, the dairy industry is subject to the Dairy Industry Restructuring Act of 2001.

10 For example, the New Zealand stock exchange (NZEX) has trading and information provision rules that must be adhered to by participants in that market.

d. transmission of electricity through a network has significant in-appropriable network effects;

imply the necessity of a spot market and centralized governance structure that enables electricity spot and contracts markets to function in the manner of a workably competitive market: that is, enable decentralized trading of electricity.[11] The compulsory pool of NZEM illustrates the desirability of jointly available electricity contract and spot markets. As with some other spot markets, electricity spot market rules include fiduciary security standards on market participants.

21. There are other, particular, features of electricity that affect the governance structure of electricity markets and reflect societal concerns about the functioning of these markets. These include the conjunction of:

a. *Unresponsive demand in certain circumstances*; in circumstances where demand is not much responsive to price, there is opportunity for generators to raise their prices either singly or in tandem with negligible (allocative) efficiency effect.[12] The circumstances include unanticipated short-term events, and transmission impediments. Whether or not there are significant transfers from consumers to producers depends upon the structure and coverage of fixed-price contracts: the prices of these contracts will be higher the higher the likelihood of these events;

b. *Homogeneity of the commodity being traded;* in an electricity spot market the units of electricity transacted differ only in location. Thus competition is purely on price which, while similar to commodity markets, differs from many markets where product differentiation is endogenous to firms and competition may be on various dimensions; and

c. *The ubiquitous nature of electricity and uncertain demand and supply side factors*: households and firms require electrical energy of a certain specification at all times of the day. Their demands vary significantly systematically and non-systematically across time for various reasons. Furthermore the supply side has considerable

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[11] The mix and nature of spot and contract markets vary significantly across jurisdictions (see Evans, and Meade, op cit): but where they admit decentralised trading – which is the situation in a great many jurisdictions - they meet the principles enunciated here. My use of the terms spot and contract markets include the possibility of separate energy and capacity markets.

[12] See the report of electricity experiments in Stephen J. Rassenti, Vernon L. Smith, and Bart J. Wilson USING EXPERIMENTS TO INFORM THE PRIVATIZATION/DEREGULATION, MOVEMENT IN ELECTRICITY, *Cato Journal*, Vol. 21, No. 3 (Winter 2002), 515-544. The effect of passive demand in these experiments is for prices to rise even where there are independent suppliers. Participants "tacitly" cooperate in this situation. Where there is active demand that is price responsive and/or varying unpredictably efficient prices result.

uncertainties that include fuel supplies and prices, and the availability of regional import/export energy.[13]

Particularly, when these facts are combined with modern economies' network deliveries of electrical energy it is clear that the industry has features different from other industries. The ubiquity of demand means that there is wide interest and concern among the populace in the perceived and actual performance of electricity markets.

22. The peculiar features of electricity, and the desire for the benefit of decentralized decision-making has led to the evolution of an electricity governance structure in New Zealand that has culminated in the Code that is administered by the EA.[14]

Risks in a Workably Competitive (Electricity) Market

23. Risks can be classified into two camps: risk of nature and strategic risk. Risk of nature includes intrinsic uncertainty in demand and in supply-side factors such as the weather, fuel availability and prices. The large, and to a considerable extent irreversible, character of electricity plant investments combine to render setting conditions for dynamic efficiency even more important. Dynamically efficient investment thresholds for investment in risky industries requires assessment of timing and strategic options of action when the investment will be sunk once made and has some probability of being stranded; even where there is competition.[15] Nature risk is addressed in decentralised electricity markets by the conjunction of spot and contracts markets, and the different strategies of generator and demand agents: for example, different generators seek different portfolios and experience relatively different fuel – e.g. reservoir inflows – availabilities over time. Risk of nature has a benefit in that it enhances competition in electricity markets.[16]

24. Strategic risk stems from uncertainty about the behaviour or strategies of competitors in the market place. There are strategic risks in a workably-competitive market as well as one that has limited competition. It is often disguised by interaction with the risks of nature.

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13 Note that these too are subject to supply- and demand-side uncertain climatic effects.

14 It also includes the price setting and investment approval activities of the Commerce Commission under Part 4A of the Commerce Act 1986.

15 See for discussion ch. 8 of Dixit, Aninash, K. and Robert S. Pyndyck, *Investment Under Uncertainty*, Princeton University Press, 1994.

16 Rassenti, Smith, and Wilson, *op cit.*

25. The NZEM Code prescribes strictures on behaviour – for example the UTS – that are additional to limitations posed by competition law. They are present to enable the operation of the spot and contract markets that produce workable competition in the presence of the risks of the electricity market. The rules provide flexibility for the management of risks of nature and strategic risk.

26. The place of electricity spot – and associated contract – markets are sanctioned by society in society's acceptance of the market rules (Code). If the market rules become perceived as not being robust to commercial competition, because they are actually and/or perceived to be prone to be the object of strategic decisions in which some Participants systematically benefit at the expense of others for actions that would not be expected in a workably competitive market, the form, even the existence of the market, in the longer term will be threatened.

27. Since the Code admits a workably competitive market it is "incomplete" in that it allows strategic risk and does not attempt to foresee or provide for every potential relevant contingency. The mechanism of the UTS might be construed as completing an incomplete set of rules,[17] for it enables action to be taken about issues that are not specifically proscribed under the rules. With this function, it will help preserve the credibility of the spot market rules, given that these, by design, promote a workably competitive market or dynamic efficiency and hence permit a wide range of individual agent actions.

28. Under the UTS the EA will be called upon to make judgements about intangible issues, such as the credibility of the decentralized market structure to the New Zealand populace under certain market behaviour. The EA is not helped in this regard by the fact of New Zealand's predominance of SOEs in the electricity market. Firms with shares held by the public and available for transparent trading have much sharper enquiry into, and assessments of, their actions, and incentives for longer-term strategies and for the management to be cognizant of the long-term economic health of the market. Thus the EA must have a narrower basis of assessment than it would have in some markets. By its nature there cannot be a bright-line test of a UTS. Nevertheless, the performance and viability of the market depend upon the EA finding a UTS in situations where on the information before it behaviour under the Code impedes performance of the market.

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[17] In the same way as contracts are typically "incomplete" of necessity and by design. Incomplete contracts arise because there are necessarily transactions costs and the impossibility, at any reasonable cost, of negotiating a perfect contract that has terms that prescribe for every future contingency (see Cooter Robert, and Thomas Ulen, *Law and Economics*, 4th Edition, Pearson Addison Wesley, 2004, at Ch.6).

29. Whether or not the rules are wholly successful, the preservation of the credibility of the rules and the rule change process will be in the interest of the dynamic efficiency of the market. Small-consumer advocates and large industrial consumers monitor the wholesale electricity market looking to their own advantage, and are likely to be politically effective at achieving change if they perceive outcomes not consonant with a workably competitive market.

Analysis of the Event

30. Offering in generation at 300 times normal market prices would normally equate with withdrawing the generation from offer at all: an approach that is permitted under the Code and that would be in accord with an action in a workably competitive market. However, due to the planned outage at the relevant time the "Auckland regional electricity market" would have been known to have departed from normality and not be workably competitive at time of the outage.

31. The Genesis offer prices were significantly greater than the value of lost load to (VOLL) households, though commonly less than estimates for industrial and entities: based upon estimates reported by the EA (at Figure 21)[18]. On this basis, if the spot market was the sole market and admitted a normal demand response – one consonant with a workably competitive market – there would be no consumption of electricity at the relevant Genesis offer prices by other than some commercial and industrial entities.[19] However a large fraction of these consumers would purchase electricity on fixed price contracts and only a relatively small proportion of the electrical energy going to final consumers would be priced at the spot price: thus, electricity consumption during the high price period would have remained substantial even if the spot prices were higher than the VOLL to the entities concerned.

32. The high prices would have imposed substantial costs on electricity retailers in the Auckland region that were not vertically integrated in that region.[20] To the extent that these retailers had to purchase at the spot price and meet customer demand at prices fixed in retail contracts the very high spot prices would have been very costly indeed. I am not privy to information about the quantum or nature of hedge positions in the Auckland region; but it is almost

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[18] The EA *Consultation Paper, Scarcity Pricing Proposed Design*, March 28, 2011, 154pp.

[19] The VOLL estimate is subject to various factors and is directly applicable to final consumption of electricity by households, commercial and industrial entities.

[20] In fact, I am informed that the event was associated with exceptionally high prices at various nodes in the North Island, including the Haywards node.

certain that non-vertically integrated retailers in this region would have found the episode extremely costly.

33. The event was most unusual if only for the reason of the very high prices at which trading took place in the spot market. I am informed that it was also unusual in that it has been the practice of generators to not price offers at extreme levels when there is notified transmission network maintenance or upgrades that reduce competitive supplies to regions. In this event, a planned, notified and well-understood situation had applied to it an extreme departure from standard practice.

34. I have not been informed of any risk of nature that was managed by the extremely high prices of the event. This is a rationale for high price episodes in the NZEM: in particular, such prices eking out limited stored fuel – particularly water – are in accord with workable competition. Were there some such explanation it would in the short run relate to Huntly fuel supplies and water heating issues. Given the history of management of these issues these are unlikely explanations, and indeed I am informed that they were not causal factors in the event.

35. Turning to the longer term, speculatively, one might conjecture that certain Huntly units have not been profitable at normally received market prices even where these include high-price episodes brought about by low lake inflows. If the event was implemented to shore up the profitability of Huntly:

    a. It and the history of prices imply that the relevant Huntly units are uneconomic; and

    b. Possibly Genesis viewed itself as instituting a de-facto capacity market that is unsanctioned, by planning to insert high prices periods in which it was informed by the market it had market power.

    Neither of these explanations are consonant with a workably competitive market.

36. The event has materially augmented strategic uncertainty in NZEM. As matters stand it cannot be regarded as one-off. Events in which regions become relatively isolated markets due to sanctioned Transpower actions, and perhaps for other reasons, become opportunities for a market participant to gain at the expense of other participants and consumers. It, and events like it, are present in the minds of all market participants now and, absent the finding of a UTS, will be part of Participant strategy from this point forward.[21] Plainly existence of

[21] I am informed that Participant strategies have already changed: for example, another Participant offered in at prices in the order of $20,000/MWh on the 2nd of April 2011 at the time of a planned network outage.

the event has always been possible. It is the probability of such events that has increased, thereby raising strategic uncertainty for NZEM.

37. The effect of heightened probability of market participant exploitation of regional markets, isolated by planned electricity market activities, will be reduced participation by retailers in retail activity in regions where vertical integration is not present.[22] It will also affect the price and terms of hedge contracts that facilitate, even enable, competition in electricity retailing in regions. The terms of trade of these hedges will turn against retailer entrants to regions.

38. The increased strategic uncertainty may also affect participation in the spot market by consumers and firms. It will also affect the contract positions of large industrial electricity consumers. It is likely that contracts for these consumers will cost more, or expressly exclude these predictable, high-priced episodes. The signaling of these planned episodes may give a few industrial consumers the opportunity to organize their affairs so that they may profit from such episodes: but there will be associated transactions costs and such firms are likely to be in the minority.

39. If the event yields an increase in strategic uncertainty of the sort described, looking forward over the medium term it will very likely result in reduced electricity retailer entry into regional markets; more profit for the incumbent vertically integrated generator in that market; and higher contract and average spot prices for consumers in that region. In the long run it is likely to limit entry to regional markets to vertically integrated incumbent retailers.

40. Transpower provides the nationwide platform on which other electricity market participants compete. It is heavily regulated in that its price structure, price level, and investments are all subject to approval by some regulatory body. It does not retain loss and constraint rentals and supplies "auctioneer dispatch" services and electricity quality maintenance services at cost. It thus may be viewed as a platform provider with no direct financial incentive tied to the strategies of generators and retailers that use the platform. However, it does have a requirement to maintain the performance of the network that provides it with a direct incentive for timely maintenance and enhancement of the network.

41. The event means that Transpower also faces enhanced strategic risk arising from its role as dispatcher – e.g. the availability of reserves – as well as network maintenance and

[22] The reduction will be as compared to the situation had the event not taken place.

enhancement. Any consequent delay in maintenance[23] and upgrades will of themselves reduce the ability of the nationwide NZEM to be "one" market. Transpower – with the approval of its regulators – could perhaps enhance the redundancy of interregional networks that might relax the capacity restrictions applied to lines under maintenance. I have no knowledge of the feasibility of this possibility; but if it were feasible it is most unlikely to be an economic solution.

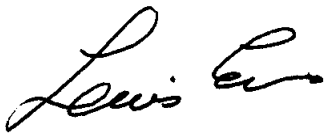
Conclusion

42. The appearance of prices for dispatched generation that were 300 times their normal level and that were predictable will adversely affect public perception of the functioning of the electricity market, and place at risk the form of this market and the decentralized workably competitive structure of it.

43. Unless explainable by factors not covered in this analysis, the event reduced for the period it had effect, and for the foreseeable future, the ability of the NZEM to perform as "one" nationwide market and therefore reduces the ability of this market to be workably competitive.

44. From the point of view of dynamic efficiency, economic and market damage would be limited by the finding of a UTS and certain consequent actions. In my view the market damage case for a UTS is unambiguous in this case.

45. The fact that SOEs make up the bulk of the market and that Genesis is an SOE means that the public will have less analysis of the event, and the EA and Genesis will have less information about the public view of the event than were these firms listed. This fact increases the import of the EA's UTS decision for the dynamic efficiency of the market.



Lewis Evans

[23] Transpower logistically as well as pursuant to the Code is constrained to give periods of notice for grid maintenance and enhancement activity that requires reduction in capacity.