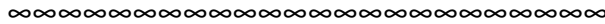


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Comments on Options Paper

Market Development Advisory Group

Price Discovery in a renewables-based electricity system

Appreciation, Introduction

- 1 The Options Paper and the supporting documents are a comprehensive and commendable accumulation of information.
- 2 However, some apparent gaps, even some confusion in areas that are important, motivate offering these comments.

Electricity System Basics

- 3 At its core, the wholesale electricity market is not complex. Each supplier of electrical energy, except minor suppliers and those independent of the transmission system, makes bids 48-times every day to a single buyer, the System Operator. The System Operator ranks the bids for each half-hour by price and, beginning with the lowest price, selects enough bidders to match the expected demand for that half-hour. The marginal price that gives the balance between supply and demand is the Spot Price for that half-hour. Each selected bidder is paid the Spot Price for the electricity provided by the bidder that half-hour.
- 4 The generator whose bid price became the Spot Price is, in effect, the price setter for that half-hour.
- 5 The System Operator on-sells the electricity each half-hour to users and retailers, at the Spot Price.
- 6 The Spot Price is a price for energy; suppliers are not compensated separately for the rate at which they can deliver energy.
- 7 The electricity supply industry is sponsored, governed, and regulated by the Electricity Authority. The mandate of the Electricity Authority is to promote competition in the electricity industry, promote the reliable supply of electricity, and to promote the efficient operation of the electricity industry.
- 8 The Electricity Authority exercises its mandate primarily by establishing an environment in which it can leave the making of operational and investment decisions in the hands of the industry participants, thereby avoiding potential constraint on entrepreneurial processes. (This is in contrast to the Commerce Commission, which deals with situations characterised by a lack of competition.)
- 9 Each of the three elements of the Electricity Authority's mandate requires specific comment in the context of the Market Development Advisory Group's work on price discovery.

Reliable Supply

- 10 First, the aspect requiring the promotion of reliable supply needs comment. Without including a thorough supporting analysis, the Market Development Advisory Group takes a view on a necessary condition for the "energy-only approach to work". That condition is public and political acceptance that high wholesale prices in times of scarcity are in the best long-term interests of consumers.

- 11 However, twenty-first century consumers see as fundamental to their wellbeing the continuous availability of electricity for the uses that are not “flexible”. A lack of supply can be grudgingly tolerated if it is the result of a rare and unpredictable event, but a failure of governance or system design is not acceptable. Scarcity that threatens or results in a lack of supply is seen as a failure of governance or system design. High prices caused by that threatened or actual lack of supply will not be accepted. Reliability and achieving public acceptance must be considered on this basis, and the system developed so that it does not ever have practicably avoidable shortage conditions.
- 12 Getting the public to understand that a moderately elevated price is a signal to delay a use of electricity is possible. Getting acceptance that high prices, either wholesale or retail, are just a way to say, “Oops. We may have to turn the lights off”, is not a realistic approach to reliable supply.
- 13 When the implications associated with reliable supply come into better focus, the persistent conversation can move away from cash-flow “risk management” to “reliability enhancement”.

Efficient Operation

- 14 Second, promoting efficient operation needs a comment. The efficient operation of the electrical industry, both short term and long term, is promoted primarily by the arrangement whereby each seller and buyer in the wholesale market sees the cost, including the recovery over time of the fixed costs, of producing the next unit of energy. The Options Paper of the Market Development Advisory Group credibly expands on the reasons that the Spot Price system should be retained.

Competition

- 15 Third, the promotion of competition needs comment. In the context of the evolving generator mix, competition in the wholesale market needs to be kept in perspective. While the industry has myriad generating units, the number of bidders to sell into the wholesale market is comparatively small, inevitably so because of the need for an effective organisation of assets. The number of bidders in a position to be price-setters is even more limited, because the value of stored water dictates the marginal price much of the time. Meridian and, less often, Contact are the dominant users, or conservers, of stored water, depending on how plentiful it is.
- 16 Those market dynamics guide the competition between price-setting bidders, and the decisions on the future value of stored water. In this market, aggression to the point of trying to drive a competitor from being a player is not a viable business plan, and even trying to undermine a competitor’s profitability is more likely to be mutually harmful than individually beneficial.
- 17 The availability of fossil fuel and the plant to use it provides a back-up for water storage. While that back-up continues to be available, the value that can be ascribed to stored water has an effective upper-bound, and price discipline is reasonably assured.

Four Basic Issues

- 18 This focus on the core dynamics of the electricity system points to four basic issues for the Electricity Authority as it looks forward to the lengthy transition that eventually ends in the phasing-out of generation powered by fossil fuels. Those issues are:
 - a North Island peak winter evening demand.
 - b Deciding between the bids of equally priced generating plants when the System Operator cannot accept all those bids.
 - c Ensuring that price discipline will be maintained when fossil fuel is no longer providing a benchmark for limiting the value ascribed to stored water.
 - d How much storage?

North Island Peak Winter Evening Demand

- 19 If the water storage outlook has not required base-load fossil-fuelled thermal generation to be operating, peak demand and reserve needs on a winter evening in the North Island must be met by the Cook Strait link from the South Island; geothermal generation; North Island hydro generation; and North Island wind generation. Recent history appears to say that the North Island winter peak, even after load that can be sensibly shed has been shed, has now increased to the point where that generation is not sufficient if wind speeds are low.
- 20 The capacity of the Cook Strait link is fixed for the foreseeable future. The capacity of geothermal generation plant is constrained by the availability of the geothermal resource. The capacity of North Island hydrogeneration has plateaued. Adding to the capacity of installed North Island wind generation will give limited gains when wind speeds are low.
- 21 The Electricity Authority has recognised this issue and has sought consultation, particularly on short-term measures. A short-term fix that is entirely satisfactory is not looking likely.
- 22 One apparent short-term approach is the use of base-load fossil-fuel generators to augment the supply during peak periods even when water storage levels have not required them to be operating. On days of potential shortage, this approach would require the start-up and running of the plant for perhaps half a day or longer so that it is ready for an hour or so that it may be useful at a peak time. Start-up costs are large. No mechanism exists to make this financially viable for a plant operator and, anyway, it would detract from the ongoing reliability of the plant to perform its intended role.
- 23 Another approach that is mentioned is investing in new thermal plant that is designed to be suitable for start-stop service during peak periods. But that plant, being dependent on thermal fuel, would be comparatively expensive to operate and, since it would operate for a few brief periods in a normal year, it could never be expected to be a viable investment.
- 24 Plant located in the North Island that uses batteries to store, and later release, electricity is another possible contributor to peak demand, once it could be built. Battery plant would not be as expensive to operate as new thermal plant and could therefore contribute both during the times of winter evening peaks and at other times when market prices are high enough. Investment costs will still be significant but could be justified by an expectation of reasonably frequent cycles of charging and discharging. Confidence in having those cycles of charging and discharging may not be realistic in the near term, though. The prospect looms of having to compete, at times when inter-island transmission capacity is available, with a large-scale pumped storage system at Lake Onslow. The feasibility investigation costs of that system are currently charged to the tax-payer account and the possibility of continuing subsidies for the scheme, if its feasibility is established and it is built, together with its scale, could turn investors in other storage schemes away from proceeding with plans.
- 25 A new wholesale market reserve “product” seems to be being proposed as a response to the emerging difficulty in having enough electricity to satisfy the North Island evening peak. While contracting to have generation in reserve is a proven method of co-ordinating generation in readiness for a potential sudden shortage, the reserve contracts do not create any new generators. Those contracts merely co-ordinate generators that are already there. The indications are that the current issue arises because of a lack of enough output from the existing generators to supply both the peak load and the short-term reserve requirements. A new, slightly longer-term reserve market is not going to help much when generators are not there to enter the new market.
- 26 The existing reserve arrangements already enable the System Operator to sustain the integrity of the system in the event of the sudden loss of a large generator or of a major transmission link, a significantly more demanding event than a decline in generation dependent on wind or sun.
- 27 The description of the proposal in the Market Development Advisory Group’s Options Library talks of “sudden changes in supply from intermittent sources”. But nothing suggests that significantly

widespread changes in wind speed are “sudden”. Similarly, significantly widespread changes to the radiation received from the sun are not “sudden”.

- 28 Even if generator capacity did exist to enter into the proposed contracts, the proposed reserve arrangements appear to be a solution without a matching sudden problem in the real world.
- 29 The apparent current lack of robustness in the electricity system’s ability to cope with North Island evening peaks also suggests a problem with the mechanisms to signal capacity pressures in advance. The Electricity Authority uses the System Operator to monitor and report on system reliability. Understandably, the System Operator focuses on installed capacity in the North Island, whereas the concern now is that sometimes the capacity of wind generation is more nominal than actual. Perhaps the Electricity Authority is unwise to be dependent on the System Operator for the wisdom and insight to deal with the vagaries involved. The Electricity Authority may not have in-house the experienced expertise needed to take charge of predicting reliability, but the Electricity Authority does have options to find it and to have it closely accountable.
- 30 Electricity demand will rise steadily and strongly, but not necessarily smoothly, as industries and transport move to electricity to phase-out fossil fuels as their energy source. New non-fossil electricity generation will be built both in response and also in preparation for the eventual phase-out of fossil fuel electricity generation. Having robust and realistic monitoring of supply and demand trends will be both challenging and even more important.

Determining Which Plant Must Spill

- 31 The electricity system is evolving towards a point where generators with low operating costs will predominate. Their capacity will have to be sufficient for the system to match high demand, on a weekday in winter, for example. That capacity will exceed demand during a weekend in summer, for example.
- 32 In lower demand situations those low-operating-cost generators can be expected to be bidding quantities of low-priced electricity to the System Operator that together are significantly more than the demand at the time. To have a reasonable prospect of being selected by the System Operator in those circumstances, generator participants can be expected at those times to sacrifice some recovery of fixed costs and bid very low prices, in the expectation that the fixed costs will be recovered at other times. Prices will bunch at the low end of the scale and several bidders offering the same price can be expected.
- 33 The System Operator will have to decide between bidders with equal prices, a decision that has been needed relatively rarely historically. The existing provision for selecting which generator feeds its output into the system and which equally priced generator must “spill” its source energy is not commercially based and is essentially arbitrary. It will not be fit-for-purpose as the system evolves. As selecting between equally priced bids becomes a regular event, the mechanism will surely be seen as lacking fairness and will be discredited.
- 34 Suitable alternative mechanisms are not obvious, but a change will eventually be desirable. The solution will need the acceptance of generator participants. In due course, the Electricity Authority should initiate discussion with the System Operator and the generator participants. The nature of the issue suggests that an approach that is much less formal than the usual consultation process would be beneficial.

Stored Water Value – Upper Bound

- 35 When water storages are full or when storage levels are rising towards full storage, hydro generators will have either no ability or little incentive to store in-flowing water and hold it for later use. Water inflows will have little value, and the hydro-generators will bid low prices.
- 36 But when water storages are not full or close to full, hydro generators will prefer to increase storage, particularly if storage is declining, so that water is available later when demand and prices are higher.

Water will be more valuable at those times, increasingly as storage declines. Prices bid by the hydro-generators will reflect the high value of the water.

- 37 Historically, the primary function of stored water has been its use when inflows are low in the hydro catchments. As intermittent generation becomes a substantial component of the generator mix, stored water will increasingly also provide the backup for the periods when intermittent generation is limited by lack of wind or lack of the sun's radiation.
- 38 Fossil fuel generation has been used historically to supplement stored water and it has had to do so reasonably commonly. The eventual phasing-out of fossil fuel generation and its replacement by intermittent generation will have two effects relevant to stored water, assuming, as is likely, that water storage capacity will not be increased by the building of a substantial pumped storage system.
- 39 First, because stored water will often have to be used to satisfy demand when the output from intermittent generation is low, in addition to the previous role of sustaining hydro-generation at times of low inflows, more stored water will have to be kept available.
- 40 To maintain the current levels of confidence that storage will be available when it is needed, the storage risk profiles that are the mechanism used to manage security will have to be raised. This will result in storage levels being managed to be always higher than they have previously been, and significantly more water spillage will occur when storages are full.
- 41 The results of the Market Development Advisory Group's simulations are consistent with this analysis, boosting confidence in the model and the assumptions, analogies and analogues on which the simulations are based.
- 42 Second, the hydro generators managing the water storage will spill significantly more often than currently and therefore generate less. Revenue will have to be sustained from a lesser output.
- 43 In addition, even the water that is not spilled will often be used at the times when the intermittent generators are struggling to have their bids accepted and market prices are low. Revenue producing opportunities for the hydro-generators with storage will be further reduced.
- 44 The role of the hydro-generators with water storage as market price setters when their output is the last resort will not change, a role that should enable them to bid prices that will generate revenue to counteract the revenue decline at other times. But the existence of the fossil-fuel generators and their assistance with price discipline will eventually disappear. Will price discipline remain reasonable?
- 45 The Market Development Advisory Group has noted suggestions that competition could be improved by the management of water storage being spread over more generator participants. These suggestions miss the point. Introducing more suppliers into a market improves the market only if the new entrants bring more supply. But here we are faced with a fixed quantity of water storage that cannot be increased by having more participants. The outcome from having more participants and the same storage resource is likely to be that the storage is less well managed, and not that price competition will change. Electricity users would not be better-off.
- 46 Market theory for this situation says that when competition is not strong between existing players, the threat of new entrants provides constraint against excessive pricing by the existing players. But here, unless the new entrant is a pumped-storage system, a new entrant with large-scale new storage is not possible. The potential new entrant is intermittent generation. But intermittent generation will be being added anyway, as fossil fuels depart from the wider economy and the demand for electricity grows. New Intermittent generation would be in competition with the existing intermittent generation, not the hydro generators.
- 47 New intermittent generators, untroubled by responsibility to signal the future value of stored water, would surely bid a lower price into the market when hydro-generation is the price-setter and would be selected to operate. Their output would then replace the equivalent amount of hydro-generation.

While this probably would not directly lower the prices bid by the hydro-generators, it would reduce their revenue.

- 48 Despite the current feasibility work, being done outside the electricity industry, on the idea of a substantial but very expensive pumped storage installation at Lake Onslow, pumped storage does not currently appear to be a likely addition to the hydro-storage presently available.
- 49 The market rules against taking undesirable advantage of being in a price-setting position are left as the primary device providing an upper bound on market prices. Are the market rules up to the job, and will they have widespread acceptance and sustain confidence?
- 50 The inclusion in the Market Development Advisory Group's simulations of some analysis of the changing pattern of revenue streams could have been usefully informative.

How Much Storage?

- 51 The system model hypothesised for the Market Development Advisory Group's simulation analysis postulates a system with enough intermittent generation, with some open-cycle gas turbine generators added, to keep hydro-storage above the hydro risk zone except in a few years when inflows are near the lowest so far ever recorded. The system model does not account for transmission constraints except on the inter-island link and assumes that aluminium smelting operations at Tiwai Point have ceased.
- 52 Since the work on the model was started, the desire of the owner of the aluminium smelter to keep it operating indefinitely has been made public.
- 53 The conclusion available from the simulation model, that existing hydro-storage may be adequate in the renewables-based system, has not stopped the feasibility study on the Lake Onslow proposal, the expected benefit of which is a major increase in hydro-storage in the South Island. That increase in hydro-storage would mean that investment in new intermittent generation would happen at a slower rate as demand increases and it would mean that the large spillage in the simulations would not occur.
- 54 The question of the desirability of the investment to construct the Lake Onslow system could be strongly influenced by whether the aluminium smelter continues to operate, notwithstanding the fact that the generating station that was built as a dedicated resource to supply the smelter is still supplying the smelter, albeit with the wholesale market now interposed, and the fact that it is able keep doing so.
- 55 A key advantage to the wholesale market would come with more water storage. As already noted, the increased storage would decrease the rate at which the building of intermittent generation was required, and substantial spillage would be eliminated. As a result, the Spot Price would be set more frequently by water values, as it is now, and generators would be contributing to fixed costs more evenly over the daily and seasonal demand patterns. Prices would not have to go as high to recover the fixed costs. The consequence would be that the inherent daily and seasonal patterns of the variability of the Spot Prices would be more obvious. The Market Development Advisory Group appears to be deeply preoccupied with Spot Price "volatility", but if natural and predictable daily and seasonal variations in the Spot Price were seen more clearly, they would be seen less as creating "risk" against which insurance is needed, called "hedging" or, lackadaisically, "contracting".
- 56 Of course, even if the thinking of the Market Development Advisory Group remains based on its simulation model with its large investment in intermittent generation and the resulting large quantity of spillage, the Group could incorporate some distinction between predictable, inevitable daily and seasonal Spot Price variations, and infrequent, larger variations due to market disturbances. The "volatility" scare would have more perspective.
- 57 The questions raised here about storage are much broader than price discovery in a market where all of the generation is renewable. Never-the-less, they arise from the transition to that market and are

fundamental to the wholesale market. Political interest will remain strong, but the many and multifarious aspects cannot be answered prudently without the broad, robust assessment of the questions that they raise. The Board of the Electricity Authority can seek to separate itself from the politics but it cannot be aloof from the debate. Electricity is so foundational in the debate that the Board, with its expertise, has leadership responsibilities.

- 58 A primary example of the critical issues will be the decisions about the ownership and control of the Lake Onslow scheme, if it eventuates. As a significant addition to hydro-storage, which is and will continue to be dominant in the electricity system, it must be managed in the wholesale market fully compatibly with the other hydro-storage. Its generation must be aligned, in relation to the cohesion of over-all storage management, to the current business interests. That is the domain of the Electricity Authority.
- 59 Storage outcomes that do not give sensible, long-term answers for the electricity system cannot be the best answers.

Sign-off

- 60 These comments on the Options Paper and the supporting documents are not intended to cover all of the discussion. The aim is to prompt incisiveness in the Market Development Advisory Group's next phase.
- 61 The wholesale market process still seems to be the desirable system for delivering benefits to its participants and for the community. But it will have challenges. The immediate challenge is to ensure sufficient supply to satisfy reliably the North Island peak demand, and the characteristics of the design of the market are not part of that challenge. Similarly, nothing apparent in the other foreseeable challenges suggests that they will not be solvable within existing market concepts.
- 62 The Electricity Authority needs to monitor continuously the working of the system as it fosters and accommodates the large upswing in new non-fossil generation needed over a few decades. The mechanisms that must sustain the availability of the existing fossil fuel generation until it is no longer necessary will also need to be monitored, with sensitivity to the commercial aspects. Sustaining community confidence will require appropriate reporting.
- 63 A particular focus for the monitoring by the Electricity Authority must be to understand the evolving medium-term and long-term commercial outcomes for the different types of generator businesses as the generation mix changes, and to anticipate any commercial stresses that could spoil the effectiveness of the wholesale market. A specific interest will be seeing a sufficient flow of investment into new non-fossil-fuel generation projects. Investors will be attracted by confidence that they can expect sustained returns despite the operators having to operate for significant periods at prices that do not produce adequate revenue and at other times not being selected to operate at all.
- 64 To be able to show leadership when the electricity system is in a sustained evolutionary phase, the Board of the Electricity Authority will need to guide the organisation away from its seeming narrow regulatory mindset of recent times. This will be a time for some governance focus. Detecting a possible existing, or the possibility of a future, technically less-than-perfect economic outcome may show smartness. But co-ordinating and smoothing the way for good developments will need wisdom more than smartness, and will be necessary as the electricity system accelerates its evolution to its future.