Submission on

Scarcity Pricing-Proposed Design

by

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Executive Summary

1. The Electric Power Optimization Centre (EPOC) is in favour of measures to improve outcomes in the New Zealand Wholesale Electricity Market. The measures proposed by the consultation paper "Scarcity Pricing – Proposed Design" (henceforth denoted CP) are an attempt to ensure security of supply of electric power and electric energy, by imposing price floors in conditions of scarcity.
2. Imposing prices during capacity or instantaneous reserve shortages using a demand curve with a VOLL section corresponds to standard electricity market theory for inelastic demand. This is a sensible interim measure in the absence of metered demand response.
3. Imposing a price floor in an energy shortage is an ad hoc measure in an effort to achieve two separate aims. EPOC contends that these aims should be dealt with by separate measures.
4. Providing disincentives for electricity market participants to call for a savings campaign is not the responsibility of electricity market designers. Instruments should be designed to improve overall welfare.
5. It is not clear that imposing a price floor in times of shortage will lead to efficient market outcomes, even if it provides fewer incentives for a participants to call for a savings campaign.

Introduction

EPOC welcomes the opportunity to make a submission on the Scarcity Pricing Consultation paper (CP). Our submission discusses the two proposals for scarcity pricing separately. We first look at price floors when there is a capacity shortage, then we examine the proposal to impose a price floor in an energy shortage.

Price floors for capacity shortfalls

EPOC is in general agreement with the principles underlying the recommendations in the CP (page 106-107) for imposing VOLL-type prices when there are shortfalls of capacity or instantaneous reserve. These are now part of the classical theory of peak-load pricing in electricity markets. The basic principle is simple and is as follows:

An a priori supply security standard is chosen that determines the number of times in each year that a shortage occurs.

A VOLL value is set so that the revenues earned during these periods are enough to cover the annual costs of a suitable plant of last resort (an OCGT peaking plant).

Unlike other jurisdictions (Australia, Singapore, Texas), the New Zealand wholesale market clearing mechanism does not have a VOLL (unless one counts the SPD penalty value of $100,000). It is interesting to speculate on what this would be. The annual cost of a peaker (page 111) is estimated to be $145,000/MW. The estimate (page 111) of 17 hours of instantaneous reserve shortfall, then gives a VOLL estimate of $8529.

So imposing a VOLL of $10000 in case of a capacity shortage corresponds well with the standard theory. Such a VOLL can be implemented in SPD very easily by adding a dummy thermal plant at each node with large capacity and offer price of $10000 (or equivalently a demand-side bid at the fixed price).

We see the imposition of a cap of $10000/MWh on prices to be charged whenever there is a reserve shortfall is a sensible market intervention.

Price floors for energy shortages

The proposed price floor in an energy shortage is performing a different function from the VOLL. There are two stated purposes:

1. To provide income to support investment in market instruments of last resort (demand participation or last resort generation).
2. To provide disincentives for purchasers/industrial loads/generators with short positions to call for a savings campaign.

The first reason is to contribute to the so-called “missing money”. If prices during energy shortages are not high enough then there is not enough income to cover the costs of generators of last resort.

The CP lists some examples of mechanisms from other jurisdictions (ERCOT, Singapore, Australia). This list is very selective, and none of the markets cited have significant hydro storage, which introduces a distinct set of problems for security of supply of energy (in contrast to security of supply of capacity). Comparing with mechanisms used in countries with significant hydro resources would be more relevant in this circumstance (e.g. the Nordic countries, Spain, Colombia). We are not aware that any of these markets impose price floors in shortages.

The proposed price floor described in the CP seems to us to be an ad hoc measure. If there is missing money, then why not impose a floor price throughout the year to guarantee all generators enough income? It may be argued that the price floor is an interim measure to be used until significant demand-side response mechanisms are in place. However, investment in electricity generation is long term and needs an enduring mechanism to support it. Our position is that market instruments should be introduced if

(1) they are welfare enhancing, and
(2) they will endure changes in the industry.

We believe that imposing a price floor in circumstances of an energy shortage is a poor approximation to the more enduring mechanism of demand response, and should not be implemented.

The effect of a price floor on industrial consumers

A savings campaign by residential customers with unelastic demand will reduce the overall demand for electricity and therefore spot prices.

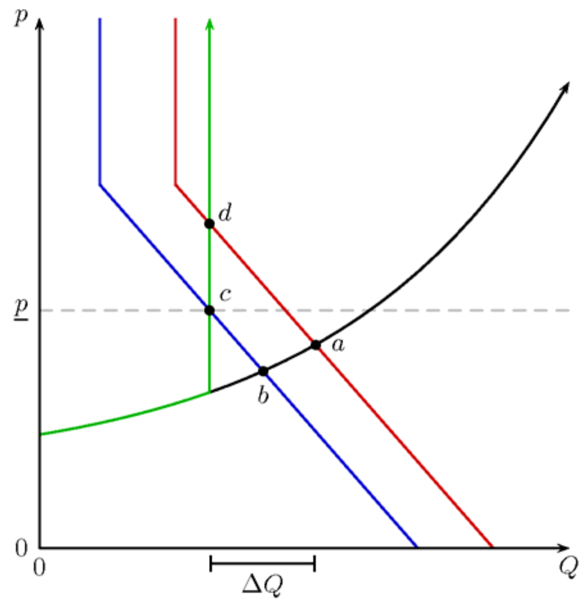

Figure 1: The effect of a savings campaign

Consider the diagram in Figure 1. The red and black curves represent the demand and supply curves (respectively) when there is no savings campaign. The point “a” on the diagram represents the point where the market would clear without any intervention. Observe that the aggregate demand consists of two portions, an inelastic part which is likely from the residential (and possibly commercial) consumers and an elastic part from the large industrial consumers.

When a savings campaign is called, the inelastic part of demand responds and the end result is that there is a shift (to the left) of the demand curve. The shifted demand curve is represented by the blue curve above. As the CP acknowledges, this reduction in demand causes lower prices.

The new market clearing point is the point labeled “b” which corresponds to a lower price than that corresponding to “a”. Notice that in this situation the consumption resulting from elastic demand has actually increased (even though total demand has decreased). The industrial customers, taking advantage of the lower price, actually consume more.

If we now impose a price floor at p, then the dispatch outcome moves to “c”. Industrial load has reduced also, and there is a greater reduction in load than that obtained from the savings campaign on its own.

Observe that this behaviour depends on the value of the floor. If the price floor is at or below the normal clearing price “a” then we can observe that when a savings campaign and a price floor are both in place, the portion of demand corresponding to elastic demand has again increased (under a public savings campaign and a price floor) although the total demand has decreased.

To achieve the same amount of reduction in the load as at “c”, it is also possible to impose a reduction in generation. As can be seen from Figure 1, the modified (green) offer stack can achieve the same reduction in demand as the savings campaign and price floor combined. If there is a savings campaign in place, then the market would clear at point “c” and if there were no savings campaign then the market would clear at “d”. It can be argued that market clearing at point d is preferable to point c as it respects the utility of various customers that they have signalled through their demand curves. In other words if the residential consumers were truly inelastic then they would not reduce load at any price, and the efficient outcome is a reduction in industrial load.

The best mechanism in our opinion is to enable the consumers to express their utility for power by using demand-side bidding curves that convey this. In the above, the implicit assumption is that the inelastic consumer will decrease their load at some finite price. In our opinion this elasticity can be articulated and should be articulated by consumers to enable efficient market clearing at times of energy shortage. This would avoid the allocative inefficiency that results from load reductions irrespective of price.

Calls for a savings campaign

The second reason for a price floor (to create a disincentive for agents to call for a savings campaign) is, in our view, not a good reason for market intervention. A savings campaign might increase welfare even though it is being called for by participants who stand to gain by it. With adequate compensation for those who save, a savings campaign provides a market instrument on the demand side that can provide benefits. Our view is that any market imperfections (such as the missing money problem) should be dealt with independently of the political question of removing individual agent’s incentives to call for savings campaigns.

Minimizing the risks of shortages

We conclude this submission with some general remarks about security of supply of energy in the NZEM.

The Electricity Authority has deemed a trigger level for starting a public conservation campaign to be when a measure of national storage hits a level that means that there is a 10% risk of shortage. The origin of this threshold value is not explained in CP. In terms of overall welfare it is not clear whether this is too conservative or not conservative enough.

We do not wish to debate the issue of what an appropriate risk level is in this document, but we wish to remark that this measure is a form of *chance* constraint. In other words it requires an action to keep the probability of a bad event below a certain level. This is not actually 10% as the conservation campaign is enacted when this risk level is encountered, and so the actual risk of shortage will be less. Indeed over the past 15 years we have energy savings campaigns in 2001, 2003, and 2008, but no actual rolling blackouts.

What is the purpose of an energy savings campaign? It endeavours to reduce load to minimize the probability of a shortage. The marginal value of water should therefore be expressed in terms of this or a similar objective. However the marginal values of water computed by SPECTRA and SDDP are imputed values from shortage costs, i.e. values of lost load. The objective function giving these water values is to minimize expected thermal fuel and shortage cost.

It follows that the graph is Figure 41 on page 139 of CP is slightly misleading. The marginal water value is computed from minimizing expected future thermal fuel cost and expected future shortage cost, which is a different objective from avoiding shortages with high probability (irrespective of cost).

This raises the possibility of a more sophisticated market monitoring scheme than a 10% minzone calculation. In this scheme, a hydro-thermal scheduling model (like SPECTRA or SDDP) could compute marginal water values at the start of each week to form a continuously varying floor price to be imposed on the market week by week. When water is plentiful this floor would be zero, and it would continuously climb in situations where water shortages were becoming increasingly likely.

One problem with such a method is that stochastic dynamic programming methods are typically risk neutral, i.e. they maximize expected welfare, and so every few years there needs to be some shortage costs incurred to deliver the optimal solution. This is rational in the context of minimizing expected cost, but does not align with avoiding shortages with high probability (which is typically set to be much higher by regulators and governments than is optimal for the system in a risk-neutral world).

The second problem is that such a method if taken to its logical conclusion would essentially dispense with the wholesale spot market. This is the approach followed by some countries, e.g. Brazil and Chile. This of course places a much greater onus on industry acceptance of water value models, as these are used to predict price.

In a market system such models still have a value. If the industry and regulators could agree on an appropriate measure of risk for the system then hydro-thermal models can be adapted to accommodate this[1]. This would enable a more rigorous standard of shortage risk to be imposed and monitored over the course of a dry year, even if these were not used to determine prices as in a centrally planned system.

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[1] See Philpott, A.B. and de Matos, V.L., Dynamic sampling algorithms for multi-stage stochastic programs with risk aversion, www.epoc.org.nz.