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Sophie Dunstone
Committee Secretary
Senate Select Committee on Electricity Prices
PO Box 6100
Parliament House
Canberra ACT 2600

14 September 2012

Dear Ms Dunstone,

Submission to the Senate Select Committee on Energy Prices

EnerNOC is grateful for this opportunity to contribute to the Senate's examination of these important issues.

EnerNOC is an aggregator of demand response operating in many different electricity markets in various parts of the USA, Canada, the UK, Australia, and New Zealand. We have over 8,300 MW of demand response available to dispatch in these markets, sourced from nearly 13,000 commercial and industrial sites. We employ 30 staff in Perth, Melbourne, and Sydney. This submission focuses on the NEM, as the Western Australian market is making good progress in addressing these issues.

The key points of our submission are as follows:

- Poorly managed growth in peak demand is a major cause of rapidly increasing electricity prices in the NEM, as it drives both energy price spikes and over-investment in network infrastructure.
- This poor management is caused by flaws in both the regulatory regime for networks and the design of the wholesale market: both strongly favour supply-side investment over demand-side solutions. Healthy and efficient competitive markets need dynamic interaction between supply and demand. Today in the NEM we have only highly inelastic demand because customers are not conditioned to be elastic. Most buy their electricity on flat tariffs because they do not want to worry about price or because they are risk averse.
- The failure to address these issues in the decade since they were identified in the 2002 Parer Report has resulted in around $16 billion of unnecessary infrastructure expenditure, for which consumers are now paying.
- The AEMC's recommendation, in its Draft Report on the Power of Choice review, to introduce demand-side bidding, whereby consumers can sell demand response into the wholesale market, is an essential step towards correcting gross inefficiencies in an electricity market dominated by the supply side, and is an enabling step for greater use of demand response to reduce network costs.
- Time-of-use pricing, although useful, is not a panacea: price signals which are strong enough to have a meaningful impact on peak demand tend to be highly unpalatable to consumers.

- The AEMC's recommendations on network regulation do not go far enough: they fail to set any targets, and propose only gentle "carrots", when it is clear that firm "sticks" are also needed to ensure behaviour change.
- To reach a low cost and efficient balance of supply-side and demand-side activity, it will be necessary to move away from the NEM's "energy only" design.

We recommend the following three actions to help reverse the upward pressure on electricity prices from peak demand:

1. Implement the draft recommendations from the Power of Choice review allowing demand response access to the wholesale market.
2. Strengthen the regulation of network businesses – both in general, and by setting explicit targets for the level of demand response activity, backed up by a system of penalties and rewards to bring about a rapid change in the approach to investment decisions by network businesses.
3. Introduce a capacity market, so as to simplify market participation, reduce energy price spikes and the opportunities for the abuse of market power, and ensure a level playing field between different types of capacity provider.

The remainder of this submission explains these issues in more detail, to show how we reached these conclusions. It includes as an appendix a brief primer on electricity market design, which we hope might be helpful. We are also submitting a report prepared by Carbon Market Economics examining the cost impacts of peak demand growth: costs that could be avoided through an efficient level of demand response.

We would be happy to assist the Select Committee in any way we can.

Yours sincerely,

Dr Paul Troughton
Manager of Regulatory Affairs
EnerNOC Pty Ltd

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1 Extreme peaks in demand are the key issue

The entire electrical system – generation, transmission, and distribution – must be sized to cope with extreme peaks in demand.

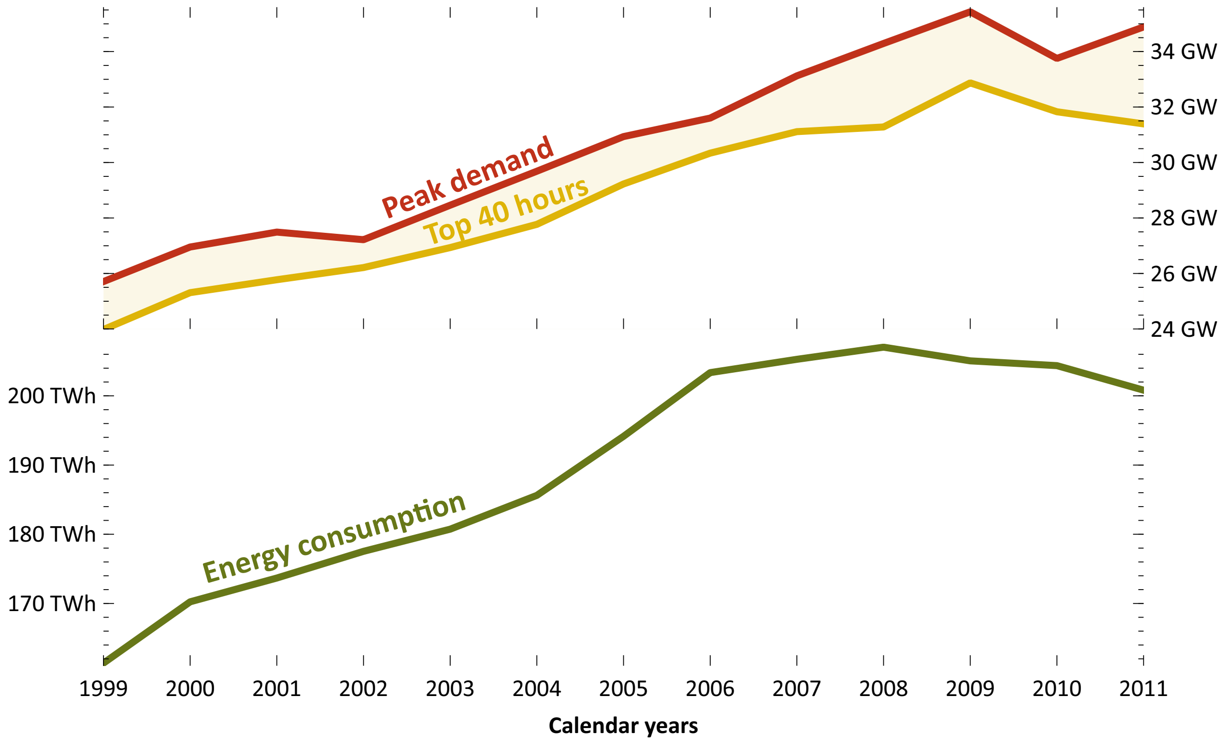

Figure 1: Peak demand and energy consumption in the NEM. Data: AEMO.

It is the extreme peaks, which appear for only a few hours a year, or maybe not at all in some years, that drive costs in the industry. Building infrastructure to address these extreme peaks, which will be used very rarely, is clearly wasteful.

Analysis of NEM infrastructure spending by Carbon Market Economics[1] shows that:

- Growth in peak demand is a key driver of costs in the electricity industry, estimated at $5.3 million per MW of peak demand growth.
- If 3,000 MW of peak demand growth had been avoided, this would have saved $15.8 billion, resulting in bills around 9% lower than they are now.

Unless substantive reforms are undertaken, peak demand issues in the NEM are likely to get worse, as most of the trends which are leading to reduced energy use – improved appliance standards, increasing distributed generation, and consumer focus on efficiency due to rising prices – have relatively little impact on peak demand.

Since the infrastructure costs resulting from increasing peak demand are recovered from customers mostly in the form of kWh energy tariffs, reducing energy consumption without also reducing peak demand will cause prices to rise further.

1 Mountain B., *Reducing electricity costs through Demand Response in the National Electricity Market,* Carbon Market Economics, August 2012. (included with this submission)

2 Strategies for addressing peak demand

There are three broad approaches to managing peak demand:

1. **Predict and provide.** Distribution and transmission businesses look at past trends, and forecast growth in peak demand. This growth is treated as an unchangeable fact, like a natural phenomenon, and infrastructure is built to ensure that the forecast peak demand can be satisfied.

2. **Dynamic pricing.** Utilities can raise prices at times of peak demand, so as to deter consumers from consuming at that time. This is a similar in concept to the familiar peak/off-peak tariffs, but more extreme, with much higher peak prices, but for shorter periods.

3. **Demand response.** This approach involves finding electricity consumers who are willing and able to reduce their demand during times of extreme peaks, and paying them to do so. It is the selective application of a strong price signal.

The “predict and provide” approach is dominant in the NEM, which is what has led to such high costs. The other two approaches both seek to reduce peak demand so that less infrastructure investment is needed.

The dynamic pricing approach is widely praised as economically elegant, and performs well in some trials, but has not been very successful in practice. The problem appears to be that customers are reluctant to expose themselves to such volatile prices that they may be unable to afford to run their air conditioning when they want it most.

When faced with the risk of very high prices, a very large proportion of customers is likely to opt out of dynamic pricing in favour of flatter price arrangements which protect against volatile prices. Of course, this undermines the objective of dynamic pricing. Mandating that dynamic prices be passed through to customers avoids this issue, but is likely to be a wildly unpopular policy, and could cause serious issues for vulnerable customers.

Demand response is a proven model, extensively and successfully used in other markets. It can provide all of the advantages of dynamic pricing with none of the associated customer acceptance issues.

3 What is demand response?

As a demand response aggregator, we seek out electricity users who are able to reduce their consumption at times when the electricity system is under stress or prices are high, and contract with them to do so.

Customers typically respond by selectively stopping particular pieces of equipment, to meet the agreed level of demand reduction while minimising disruption, rather than shutting everything down, as would happen in a power failure or a mandatory load-shedding event.

The collective impact of many customers aggregated into a portfolio of resources able to reduce demand in a time of need helps slow or avoid the need to build new generators and network infrastructure to service brief extreme peaks in demand.

Typically, the money saved by all customers from not having to bear the cost of such infrastructure upgrades is at least three times the cost of running the programme,[2] so the benefits far outweigh the costs.

EnerNOC, like many of its competitors, focuses on commercial and industrial energy users. A similar approach can be taken with residential customers. This is often suggested as an obvious first step in tackling rising peak demand, on the basis that residential air conditioning is largely "to blame" for recent rises in peak demand. However, there is no reason for the class of customer that is "causing" the peak demand to have to be the one that addresses it. A megawatt of industrial load reduction during a critical peak has the same effect as a megawatt of residential load reduction. It is also far more cost-effective to achieve. In addition, residential demand response programmes require a smart-meter roll-out, and tend to have high costs and relatively small benefits,[3] so it seems foolish to invest in such programmes when lower-cost commercial and industrial demand response potential remains untapped.

4 Demand response brings huge benefits

Demand response is used at scale in several large markets, and has brought significant benefits. For example, in a single hot week, demand response in PJM saved consumers $650 million through reduced energy costs.[4]

Also in PJM, two long-planned transmission projects, PATH and MAPP, have been cancelled, avoiding over $3.5 billion in capital expenditure, in large part due to the increasing levels of demand response.[5] This demand response was not targeted at deferral or avoidance of these projects, as the resources were only participating in the wholesale capacity market; the reduction in peakiness which obviated the transmission projects was a free side effect of large-scale wholesale demand response.

Demand response aggregators typically provide participants with near-real-time energy monitoring equipment and services. These, along with the analysis of energy consumption necessary to prepare for providing demand response, tend to increase awareness of electricity consumption, leading to efficiency improvements being found. Some aggregators also provide energy efficiency services, resulting in further benefits.

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2 This estimate is based on the prices paid for demand response capacity in the Western Australian Wholesale Electricity Market (WEM), compared to the avoidable costs in the NEM as estimated in the attached Carbon Market Economics report. We use WEM prices because there have been no attempts to procure demand response in the NEM on a large scale on an ongoing basis. This ratio is broadly consistent with EnerNOC's experience in other markets.

3 The high costs come not only from the large numbers of customers required to amass a useful quantity of load reduction, but also from the high value that residential consumers place on their electricity usage: on extremely hot days, consumers value their air conditioning highly – that it why they bought it. It would be perverse to expect them to reduce their usage of air conditioning on the hottest days.

4 PJM press release, *Early August Demand Response Produces $650 Million Savings in PJM*, August 2006.

5 Letter from PJM to Transmission Expansion Advisory Committee, 28 August 2012.

5 The Power of Choice review is getting many things right

The AEMC's Power of Choice review is an important first step towards efficiently addressing peak demand.

On the wholesale market, the Draft Report:

- Recognises that demand response is a substitute for generation, and that it is inequitable to prevent demand response from competing with generation.
- Recognises that competition to procure demand response is vital, and there can be conflicts of interest, so retailers should not be the only parties able to commit their customers' load in the wholesale market.
- Proposes a workable mechanism by which demand response can be unbundled from retail supply and participate in the wholesale market.

On network infrastructure, the Draft Report:

- Recognises that network businesses currently have little or no motivation to do anything other than build as much infrastructure as possible.
- Recognises that the regulatory regime must ensure that it is in network businesses' financial interest to use an efficient amount of demand response.
- Recognises that demand response is an activity which requires long-term participation, and so it is necessary to fix the aspects of the current five-year regulatory cycle which cause network businesses to use it only as a stop-gap measure.
- Recommends some incentive schemes which should encourage network businesses to use more demand response than they do now.

The recommendations in the Power of Choice Draft Report should be implemented as a matter of urgency. It is likely that some incumbent retailers, generators, and networks will lobby strongly against many of them. Since the AEMC prefers to work by consensus, and these large industry participants have the loudest voices, the Draft Report's recommendations are vulnerable to being watered down or ignored, as has happened with previous reviews.

6 What else needs to be done for the wholesale market?

In the Power of Choice review, the AEMC deemed changes to the design of the wholesale market to be "out of scope", and so did not consider them. This is unfortunate, because the current market design seriously inhibits the use of demand response, and will limit the benefits realised from the proposed reforms.

The NEM has an "energy only" design.[6] Since resources are paid only for the energy they produce, it is crucial to ensure that they are dispatched to produce energy fairly and efficiently. Timing is very important.

6 See the appendix for a primer on electricity market designs.

Some demand response can be very fast acting. EnerNOC has customers in New Zealand and Alberta providing sub-second responses, faster than any generator. However these are a small minority of the loads that can provide demand response, and they tend to be the rather expensive ones. The bulk of potential demand response providers require longer notice – e.g. 30 minutes, or as much as 2 hours – to curtail their consumption without causing damage or excessive disruption.

There are two related problems here:

1. The design of the NEM unnecessarily conflates the rewards for providing capacity with those for being fast acting. To earn the maximum reward from the spot market, scheduled resources have to respond within five minutes of receiving a dispatch instruction. Being any slower than this can significantly reduce payments to the resource.

2. Even fast-acting resources are harmed by a perverse feature of the NEM design: the trading price – the amount that resources will be paid for the energy they deliver – is not determined until the 25th minute of the 30-minute interval to which it applies. This pricing uncertainty creates risk for all participants, but impacts most strongly on the demand side.

Most generators are unable to start in less than five minutes. However, this is not a serious problem for them because their marginal costs to produce energy are relatively low. Hence they are able to "self commit", by looking at demand and price forecasts, choosing when they believe it will be profitable to start generating, and adjusting their bids so that the market operator will be sure to dispatch them at that time.[7]

Demand response facilities can have marginal operating costs more than a hundred times higher than those of generators. They are the cheapest form of capacity to have available, but it is important that they are only dispatched when they are actually needed, as to do otherwise is very wasteful. They cannot afford to bid themselves in speculatively at lower prices in an attempt to work around lead times or pricing uncertainty.

The issues of response timing and pricing uncertainty have tended to be dismissed as insignificant, and hence not worth fixing. This is because they are not a big deal for conventional generators, who have historically made up nearly 100% of the market. They are, however, a significant barrier to efficient demand-side participation, and must now be corrected.

Unless this issue is fixed, only customers whose loads are capable of very fast response will be able to participate effectively in the wholesale market. Extending the acceptable response times to between 30 minutes and 2 hours will lower costs and expand the pool of eligible customers by an order of magnitude.

All of these resources are equally capable of providing capacity during extreme peaks. Preventing participation by longer lead-time resources will lead to levels of demand response participation far below optimum, and hence higher costs than necessary.

7 This is why many generators routinely bid substantial amounts of capacity at negative prices and extremely high prices: they are choosing when and how much to generate, rather than relying on the market operator's dispatch process. This practice contributes significantly to price volatility.

It may be possible to amend the NEM's scheduling, pricing, and dispatch procedures to allow participation by high marginal cost, long lead-time resources. However, EnerNOC believes that the most straightforward way to solve this problem, and to unlock many further cost reductions, would be to move away from the current "energy only" design by introducing a capacity market.

As well as solving the timing problem, capacity markets have the additional benefit of reducing the industry's reliance on financial derivative contracts. This both avoids the associated credit risks and costs – a matter of increasing concern in the NEM – and lowers the barriers to entry by new participants, as financial services licensing would no longer be an issue. This should lead to lower costs, increased competition, and greater transparency.

Additionally, adoption of a capacity market would have the immediate and salutary effect of reducing energy prices and their volatility. This is because generators and demand response providers would no longer be forced to recover all of their fixed costs through energy revenues, many of which must be realised during periods of enormously high energy prices. As well as reducing costs and investment risks, this will greatly simplify the prevention of abuses of market power by generators.[8]

Empirically, it is evident that capacity markets are more effective at eliciting efficient levels of demand response than "energy only" markets. Figure 2 shows the penetration of demand response in markets with established demand response mechanisms. No pure "energy only" markets are shown, as we are not aware of any with a significant level of demand response participation.

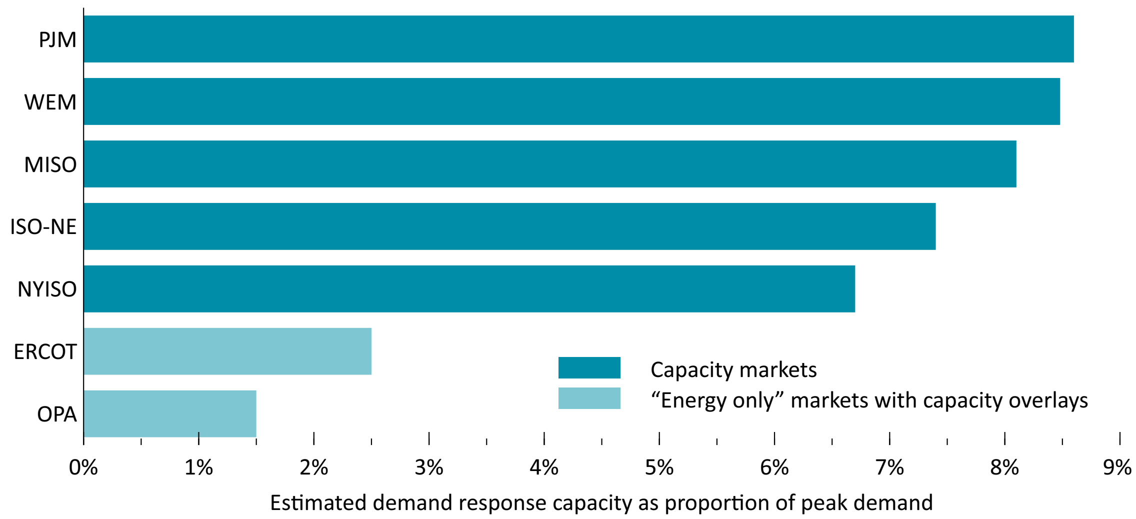

Figure 2: Dispatchable demand response capacity as a proportion of actual or forecast peak demand, in markets with established demand response mechanisms.[9]

The "capacity overlays" mentioned in the figure are separate schemes under which super-peaking resources such as demand response can address the reserve margin

8 See, for example, Mountain B., *Market power and generation from renewables: the case of wind in the South Australian electricity market*, Carbon Market Economics, June 2012.

9 EnerNOC analysis. Different years, ranging from 2011 to 2014/15, are used for different markets, due to limitations in data availability.

requirements while being paid on a capacity basis, rather than relying on the energy market for payment. This levels the playing field, allowing a more efficient mix of resources to be procured, resulting in higher reliability at lower cost than could be achieved by the "energy only" market alone.

We believe that the introduction of demand-side bidding, as recommended by the AEMC, will raise demand response participation in the NEM significantly above its current negligible level, which will benefit customers by reducing costs.

However, we expect that the level of participation, and hence the cost benefits, will remain lower than in these other markets unless a capacity-based mechanism, or, better, a full capacity market, is introduced.

7 What else needs to be done for networks?

Although the AEMC has correctly identified many of the issues with network regulation, the recommendations in the Power of Choice Draft Report are unlikely to be sufficient to fix them. Specifically, they do not propose to have any targets, or any "sticks", relying instead on a few (rather administratively expensive) "carrots".

To bring about the significant change in behaviour that is required to reach an efficient level of network-driven demand response, it is necessary for the regulator to have an opinion about the level of demand response that would be efficient, and to ensure that network businesses are strongly motivated to work towards reaching that level in a reasonable timeframe.

This is not how the regulator currently operates: instead, it claims to have no opinions about how a network business should be run. This is "hands off" regulation taken to a damaging extreme. In practice, it amounts to a *de facto* opinion by regulators that the efficient level of demand response is "almost none". This is costing consumers dearly.

This is not how regulation is done in other jurisdictions. e.g.:

- In the UK, the original model for the style of regulation used in the NEM, OFGEM now sets definite goals, and establishes strong incentive schemes to reward utilities that achieve them and penalise those that do not. These incentives have a material effect on the utilities' profitability, such that they cannot ignore them.
- Fourteen US states have legislation or regulations for peak demand reduction schemes, typically setting explicit targets for either (a) reductions in the absolute level of peak demand below a historical baseline, or (b) the proportion of forecast peak demand growth dealt with through peak demand reduction initiatives.

The mechanism we propose is as follows:

- The regulator should set targets for each network business, specifying the minimum proportion of forecast peak demand growth that should be addressed through demand-side measures, instead of by building new infrastructure.

- These targets should be deliberately lower than optimal. For example, a target could be developed through a modelling process to estimate the optimal level of demand response given the network's forecast load-duration curve, network augmentation costs, and demand response costs. Having found the optimal level, the target could then be set at a fraction of it, say 25%. The exact level is not critical: it merely needs to be high enough to require real action by the network business while low enough to avoid any risk of inefficient over-expenditure on demand response purely to satisfy the target.

- If a more aggressive approach is desired, then a target based on total peak demand (rather than growth) could be phased in – this approach has been taken by several US states.

- Network businesses should be strongly penalised if they fail to meet these low targets, such that it would significantly harm their profitability. This will provide a strong incentive that will kick-start behaviour change without the need for excessively large and expensive "carrots".

- "Carrots" are also needed, to align network businesses' risk-adjusted profit seeking behaviour with the long-term interests of consumers. The positive incentive can be considerably smaller than the penalty – it needs to be enough for it to be in each network business's self-interest to carry out an optimal level of demand response. Specifically, they must be able to make more profit, in absolute terms, from using an efficient level of demand response than from the alternative of capital investment in additional network infrastructure.

- Offering network businesses the potential to increase their profits may seem an odd way to reduce electricity prices. However, demand response is generally so cost-effective compared to traditional infrastructure investments that total costs can be reduced significantly even while incentivising the network businesses with higher profits. This is not a zero-sum game.

- The current regulatory framework treats "opex" very differently from "capex". Network businesses can earn a return on capex, but are only incentivised to minimise opex. Since most demand response expenditure is opex, whereas building network infrastructure is capex, this distortion must be removed, or the incentive scheme must overcome it.

- The incentive scheme must incentivise network businesses to do demand response efficiently. Otherwise there is a risk that they may inefficiently over-spend so as to maximise their rewards from the incentive scheme. This can be done by setting a maximum allowable cost for demand response programmes, based on the benefit of deferring network augmentations. This can be calculated either based on actual studies of the particular network augmentation that is being deferred, or, where that is not practicable, such as for broad-based schemes, deemed average values. Having established this upper bound, network businesses can be incentivised to seek efficient demand response solutions by allowing them to retain a proportion of the cost savings resulting from implementing solutions which cost less than this amount.

Appendix: Overview of electricity market designs

The importance of the capacity mix

Many different technologies can be used to meet demand in an electricity market. It is helpful to classify them by their cost structures:[10]

- Baseload resources have high capacity costs (the annualised capital cost, plus fixed operating costs, in $/MW), but make up for it by having very low energy costs (the short run marginal cost, in $/MWh). Typical examples include brown and black coal thermal plant, and combined cycle gas turbines.
- Peaking resources have lower $/MW capacity costs, but higher $/MWh energy costs. Typical examples include open-cycle gas turbines and reciprocating engines.
- Demand response can be considered as a “super-peaking” resource. Its $/MW capacity costs are lower than those of any generator, whereas its $/MWh energy costs are typically higher than those of any generator.

You could in principle run a whole power system using only baseload resources or only peaking resources. However, this would be extremely inefficient. An entirely baseload-powered system would have huge fixed costs, whereas an entirely peaking-powered system would have unnecessarily high energy costs.

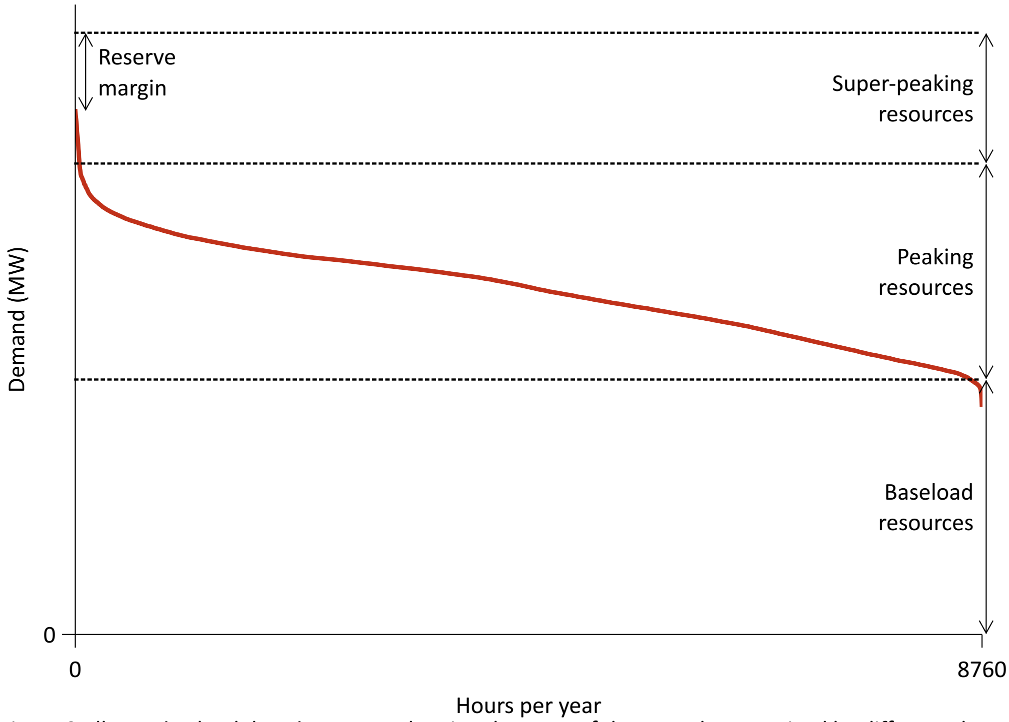

Figure 3: Illustrative load duration curve, showing the parts of the curve best serviced by different classes of resource. Reserve margin is the extra capacity needed to meet the reliability standards after allowing for generator outages and forecasting uncertainty.[11]

10 For simplicity, we are ignoring intermittent generation in this discussion, and focusing only on resources which can be dispatched whenever needed to meet demand.

11 Diagram adapted from Pfeifenberger J., Spees K. & Schumacher A., *A Comparison of PJM's RPM with Alternative Energy and Capacity Market Designs*, The Brattle Group, September 2009, which provides a more comprehensive survey of electricity market design options than we present here. For clarity, we have amalgamated their intermediate resources into the peaking resources.

The optimal mix of resources depends on the load-duration curve, as shown in Figure 3. Demand which is present all year round is best served by baseload resources, as they provide the lowest cost energy. Other demand is better served by resources with lower capacity costs, despite their higher energy costs: the savings from not having to build so many expensive assets which will be little used outweigh the higher energy costs when the capacity is needed.

The same principle applies when dealing with the top end of the load-duration curve and the reserve margin. While it can all be satisfied using peaking resources, without any demand response – this is roughly what happens in the NEM today – this is unnecessarily expensive. The extreme peaks in demand, which only occur a few hours per year, and the reserve margin, which is not called upon at all in many years, are most efficiently satisfied by the lowest cost form of super-peaking capacity, i.e. demand response.

If the load-duration curve is known, then it is straightforward to work out the optimal mix of resources to satisfy it at lowest cost. However, in practice, there is much uncertainty about future load-duration curves and the trends driving them. Resources take time to build, so decisions about what to build must be taken years in advance. As a result, some of these decisions prove to be sub-optimal in the light of actual demand. One of the purposes of competitive electricity markets is to transfer many of the risks associated with investment decisions away from a central planning body, to investors.

Electricity market designs

Electricity markets are unlike any other commodity markets, because they need to balance supply and demand on a minute-to-minute basis.

Whenever a 2 kW oven is switched on, either a generator must increase its output by 2 kW, or another load must reduce its consumption by 2 kW. Capacity represents the ability of a resource to deliver that 2 kW whenever called upon to do so.

An electricity market must not only match energy supply and demand on a minute-to-minute basis, but also ensure that the capacity to do so exists during all potential peak demand hours.

Markets for both capacity and energy

A capacity market makes the capacity requirement explicit: the market operator determines how much capacity is needed to meet the forecast level of demand, plus a reserve margin, and then holds an auction to procure this much capacity.[12] The market operator thus makes a judgement about the total capacity requirement – how much is needed to keep the lights on – but not about the shape of the load-duration curve or

12 In modern capacity market designs, instead of having a fixed reserve margin requirement derived from reliability requirements, and hence a single number for how much capacity is needed, a downward-sloping demand curve is used to provide a trade-off between price and reserve margin. Having more capacity available improves reliability, which has some value to customers. This approach allows additional low-cost capacity to be procured to the extent that the reliability benefits to customers outweigh the procurement costs.

the optimal mix of resources to satisfy it. These more difficult but less sensitive issues are left to the market.

The mechanism typically works on a multi-year cycle, so that there is time for new capacity which clears the auction to be built before it is needed. A well-functioning capacity market minimises electricity costs in the long term by providing the correct investment incentives to ensure that capacity is supplied in the cheapest way.

An energy market works alongside the capacity market to determine which resources are dispatched when, to minimise electricity costs in the short term.

Demand response is able to participate in both the capacity and energy markets. However typically almost all demand response resources participate in the capacity market, because demand response is in essence a pure capacity product. Participation in the energy market is usually seen as an add-on to capacity market participation, only practicable for a small subset of customers.

Prices in both the capacity and energy markets can be quite tightly controlled: the capacity price need never greatly exceed the annualised cost of building new peaking resources, and the energy price need never exceed the short run marginal cost of the most expensive resource in the system.

"Energy only" markets

The NEM does not have a capacity market, so the energy market has to do double duty: not only determining which resources are dispatched from minute to minute, but also providing long-term signals for investment in capacity.

Many economists find the design rather elegant in principle. However, in practice it has many difficulties. In particular, it:

- Requires the potential for extremely high and volatile energy prices, and these must actually occur from time to time.
- Makes it necessary to allow generators to exercise market power, as a reward for providing needed capacity. It is this opportunity that provides the investment incentive.
- Requires market participants to trade in financial derivative products to manage their exposure to highly volatile prices.

In the "energy only" model, the market operator does not determine how much capacity is required to keep the lights on. Rather, we rely on investors deciding to build generation capacity speculatively, based on their expectations of future energy price behaviour. This is facilitated by a trade in futures and other derivatives.

Investors in peaking resources in such markets are exposed to a great deal of risk, as a small deviation from the expected load-duration curve can have a dramatic impact on the number of hours for which their resources are dispatched, and hence their revenues. This high level of risk makes capital raising more expensive than under other market models.

Other “energy only” markets are less “pure” than the NEM, as they have introduced capacity-based overlay mechanisms for demand response, or are considering abandoning the design by introducing a capacity market. For example:

- **UK.** The Government has announced its intention to move to a capacity market, the detailed design of which is now underway. The introduction of a capacity market is expected to facilitate the integration of higher levels of intermittent renewable resources, while also reducing household bills by 4% from their current trajectory.
- **Texas.** ERCOT’s original design was largely inspired by that of the NEM. However, concerns about resource adequacy have led to the introduction, and recent significant expansion, of the Emergency Response Service, a capacity-based mechanism for demand response. There is currently active debate about whether a move to a full capacity market would be justified, and preferable to allowing energy prices to increase to rival those in the NEM.
- **Ontario.** OPA has introduced a capacity-based demand response programme to manage periods of low reserve margin.

The notable exception among “energy only” markets is New Zealand: the approach appears to be working quite well there. This is probably because, whereas the NEM and the other markets discussed above are capacity constrained, New Zealand, being hydro-dominated, has plenty of generating capacity. The issues in New Zealand centre on energy constraints in drought years; the “energy only” design is well suited to address these.