# DEMAND MANAGEMENT PLANNER

# acknowledgements


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Cover diagram from AEMO: Demand Terms in EMMS Data Model October 2019

## The National Electricity Objective (NEO)

The National Electricity Objective as stated in the National Electricity Law (NEL) is:

"to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:

- price, quality, safety and reliability and security of supply of electricity
- the reliability, safety and security of the national electricity system."

Figure 1: The national electricity market is complex and by necessity, electricity is an essential service, it is highly regulated through a system of laws and rules. Parts of the network are provided by monopoly businesses that make regulation even more important to ensure efficiency. To understand the role of the network governing bodies see "References and Tools." It has long been a frustration to many that the NEO[1] makes no reference to the environment, a missed opportunity.

1 The National Electricity Objective (NEO)

# contents

# introduction

Electricity is a vital and essential service to buildings and the people in them. It is the energy source that powers lights, air conditioning, computing, and makes hot water for washing, or for coffee. Electricity is the energy source that keeps people alive in hospitals and maintains refrigeration for critical medicines.

Electricity is often among the largest operational costs of a building and it is easy to forget that we buy it in a marketplace, not once every couple of years when a retail electricity contract is negotiated and unit prices are agreed, but every half hour or even every 15 minutes. The period of highest demand can ratchet up a price that will be paid for 12 months or more. Flattening the electricity demand curve in peak periods can deliver big savings while also contributing to keeping the grid resilient and helping to keep the lights on for everyone in those periods of highest energy demand and electricity system stress.

Electricity is generated, sold, and delivered through a marketplace where supply and demand must be perfectly balanced every minute of every day. Price signals are applied under rules set by the market operator that are designed to create the incentives that keep the grid operating effectively and efficiently meeting the national electricity objective. When consumers understand how they use electricity and the price signals that apply they can choose how to manage demand to manage their energy bill.

The market operator must accommodate the transformations currently underway in the energy economy with increasing reliance on renewable energy: distributed generation from solar roof tops to remote windfarms. Solar electricity is changing the daily periods where generation capacity is at maximum capacity while data systems and integration of data in real time allow smarter management by consumers. There is further innovation with battery storage and the related transition to electricity to power vehicles underway. These changes need to be accommodated so that the community-wide goal of a safe, reliable, secure and efficient network is achieved, and consumers have an important role to play.

# glossary

| Term | Definition |
|---|---|
| AEMC | Australian energy market commission |
| AEMO | Australian energy market operator |
| AER | Australian energy regulator |
| BMS | Building management system |
| Demand Management (DM) | Managing electrical loads (i.e. demand) to control (limit) or shift demand |
| Demand Response (DR) | Controlling electricity demand in direct response to a signal |
| Demand Response Aggregator (DRA) | Organisation that can accumulate demand response customers and bid into the wholesale electricity market in a similar way to generators |
| Demand side | Consumers of electricity (in contrast to Generators) |
| Distribution network | Low voltage electricity network (poles and wires) that deliver electricity to electricity customers |
| ESCO | Energy Services Company |
| FCAS | Frequency Control Ancillary Services |
| Generator | Producer of electricity: renewable, non-renewable, on site and off site |
| kVA | Kilo Volt Amps, a measure of demand or electrical load, which must be carried by the transmission and distribution network. Often demand and capacity charges are based on kVA demand. Also known as apparent power |
| kW | Kilo Watt, a measure of demand or electrical load. Demand and capacity charges may in some instances be based on kW demand (rather than kVA). Also known as real power. |
| kWh | Kilo Watt Hours, a measure of energy consumed. For example, a constant electrical load (or demand) of 100 kW for one hour will use 100kWh of energy |
| M&V | Measurement and verification, the process of measuring the outcome of a demand or energy management project |
| Network charges | All items on an electricity bill relating to the transmission and distribution of electricity |
| NMI | Network Meter Identifier, a unique number that identifies a meter that measures energy consumed from the electricity grid |
| Power Factor | Real power (kW) divided by apparent power (kVA) |
| Power Factor Correction (PFC) | An electrical device that is used to make the power factor close to unity (1) |
| RERT | Reliability and Emergency Reserve Trader |
| Retailer | Business that buys electricity in a wholesale market and sells to electricity customers |
| Transmission network | High voltage electricity system between generators and distribution networks |

# about this planner

The BBP Demand Management Planner (the Planner) provides a framework for assessing the potential of a building to participate in, and benefit from, a demand management program that engages in the balance of electricity supply with demand.

Each step is provided with a description accompanied with illustrative material and examples to provide users insight to the information required to be an active participant in the electricity market. Undertaking a demand management program is not a trivial exercise. The electricity system is complex and sometimes information is hard to find but the aim of this planner is to provide useful links and tips to streamline engagement.

As the Planner is an initiative of the City of Sydney Better Buildings Partnership, it is specific in providing guidance to the electricity supply scenarios experienced in the CBD of Sydney. For instance, the distribution network in the Sydney CBD is managed by Ausgrid, therefore Ausgrid tariffs apply to all customers in the Sydney CBD and are used in the examples used for illustration. The Planner is also supplemented by case studies offered by Sydney building owners detailing their experiences in implementing a demand management project. Check the BBP website for their latest resources and information.

If you are planning a demand management project outside of the Sydney CBD, you can follow the same steps but will need to research the transmission and distribution providers and the tariffs relevant to your case. Caution is required, the ways in which peak demand is measured and charges applied can be quite different in other network areas.

There are likely to be occasions during planning for a demand side management project that you will be uncertain in using some information or feel that there is a lack of information. You can increase your chances of implementing a successful project by engaging with **specialist energy advisors**, your **electricity retailer** or with a **Demand Side Aggregator**.

# demand management checklist

| | | Complete |
|---|---|---|
| **Step 1** | Select building: Choose the building, find a recent electricity bill and the meter/s number<br>• Know your NMI | ☐ |
| **Step 2** | Define the purpose of the demand management project<br>• Financial<br>• Social<br>• Environmental | ☐ |
| **Step 3** | Understand how the buildings uses electricity<br>• Analyse meter data | ☐ |
| **Step 4** | Identify opportunities for managing demand<br>• Review the asset register for:<br>  • Energy efficiency opportunities<br>  • Load curtailment/shedding<br>  • Generation/storage<br>• Check electrical single line diagrams and switchboard configurations to identify controllable loads | ☐ |
| **Step 5** | Undertake a benefit analysis<br>• Set targets for benefits | ☐ |
| **Step 6** | Implementation planned and tested<br>• Stakeholders engaged<br>• Risks and opportunities managed | ☐ |
| **Step 7** | Measure performance<br>• M&V Plan agreed with project stakeholders | ☐ |
| **Step 8** | Seek feedback and improve performance<br>• Set up a demand management dashboard for each building as part of your energy management system | ☐ |
| **Step 9** | Keep an eye on the future<br>• Assign responsibility and schedule routine demand management reviews | ☐ |

# step 1: select building

A demand management project may come about due to an internal trigger, such as a review of energy costs, or may be instigated externally, maybe an energy service company or a Demand Response Aggregator has been in contact to recruit your building into their pool.

Whatever the trigger the steps that follow remain the same. The same data set is needed to inform any project and to determine what actions can be taken to manage electricity demand.

Review a recent electricity bill. It will include:

- the tariffs being charged for the various components of the energy itself and the transmissions costs
- name of your electricity retailer
- NMI number

Now is a good time to check who is the electricity distribution network provider and the transmission network provider for your area. These are the organisations responsible for getting electricity delivered to the building and have direct interest in managing demand on the grid. In the Sydney CBD they are:

- Distribution network = Ausgrid, www.ausgrid.com.au
- Transmission network = Transgrid, www.transgrid.com.au

Visit each of these websites and search for demand management activities to see if they are offering incentives for demand management.

TIP

**You should have ready access to your electricity bills through a retailer portal or via your own energy management portal. If not, it's time to upgrade!**

# electricity account - pricing details

Ausgrid uses the term capacity instead of demand

| Charges | Usage | | Unit Price | | Loss Factor | Total Price (excl GST) | |
|---|---|---|---|---|---|---|---|
| **Retail Charges** | | | | | | | |
| NSW Peak | 5,000 | kWh | 5.000 | c/kWh | 1.05723 | $ | 264.31 |
| NSW Off Peak | 10,000 | kWh | 3.000 | c/kWh | 1.05723 | $ | 317.17 |
| NSW Shoulder | 12,000 | kWh | 6.000 | c/kWh | 1.05723 | $ | 761.21 |
| **Environmental Charges** | | | | | | | |
| NESC | 27,000 | kWh | 0.15 | c/kWh | 1.0479 | $ | 42.44 |
| LRECs | 27,000 | kWh | 0.5 | c/kWh | 1.0479 | $ | 141.47 |
| SRECs | 27,000 | kWh | 0.25 | c/kWh | 1.0479 | $ | 70.73 |
| GreenPower | | kWh | | c/kWh | | | |
| **Network Charges** | | | | | | | |
| EA305 - Peak | 8000 | kWh | 6.195 | c/kWh | | $ | 495.60 |
| EA305 - Shoulder | 9000 | kWh | 2.2747 | c/kWh | | $ | 204.72 |
| EA305 - Off Peak | 10000 | kWh | 1.1181 | c/kWh | | $ | 111.81 |
| EA305 - Capacity | 80 | kVA | 32.811 | c/kVA/Day | | $ | 787.46 |
| EA305 - Supply Charge | 30 | Days | 1652.3676 | c/day | | $ | 495.71 |
| **Market Operator Charges** | | | | | | | |
| AEMO Ancillary Fee | 27,000 | kWh | 0.068 | c/kWh | 1.0479 | $ | 19.24 |
| AEMO Market Fee | 27,000 | kWh | 0.0374 | c/kWh | 1.0479 | $ | 10.58 |
| **Metering Charges** | | | 1500 | $/mtr/annum | | | 125 |
| **TOTAL for NMI XXXXYYYYZZZZ** | | | | | | **$** | **3,847.45** |

Figure 2: Sample electricity bill with all values for illustration only showing the various charges applied to a monthly bill. Use your bill to understand these charges as some buildings can have capacity charges comprise 30% or more of the monthly energy bill.

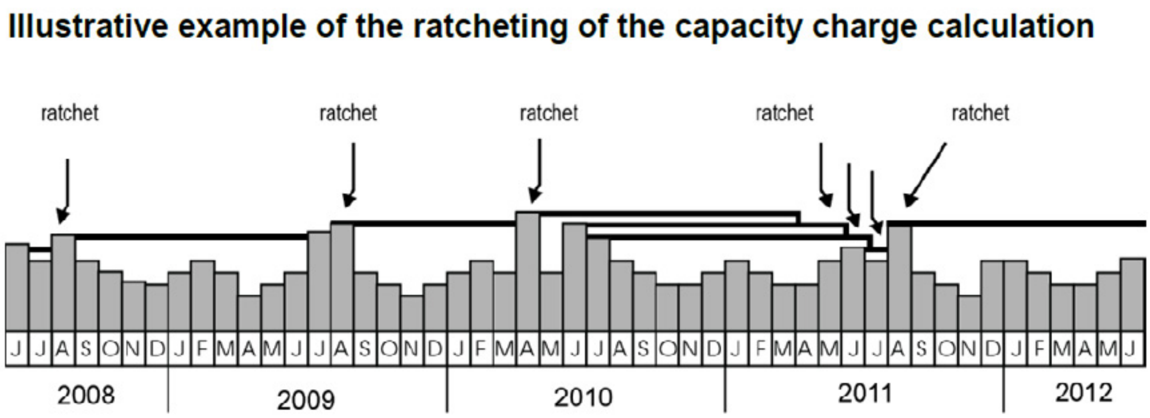



Figure 3 The bold line shows how capacity charge ratchets up or down on a 12-month window. The peak demand a building achieves sets the rate for what you will be charged for 12 months and can only ratchet down again after that anniversary. 2

# step 2: define the purpose of the demand management project

Electricity customers can manage how buildings use grid electricity to achieve a variety of outcomes either individually or in combination.

- Financial savings arise from:
    - **Electricity consumption savings**: For example, changing stairwell lights to high efficiency saves energy all year round and reduce demand everyday
    - **Electricity distribution network savings**: Reducing peak demand and enjoying the reduction in peak demand tariff charges
    - **Electricity transmission network savings** or project benefits
    - **Electricity market or spot price trading**: Actively reducing demand when the electricity market price or spot price is high through load curtailment, switching equipment off or down, or by bringing generators or energy storage online.
- Environmental savings by:
    - Reducing consumption and related greenhouse gas emissions
    - Reducing consumption and avoiding investment in materials in upstream generation and distribution. Even in a 100% renewable energy world there is no point building a field of solar panels just because someone leaves the aircon running.
- Social benefits include:
    - Enhancing the resilience of the electricity system, particularly in times of system stress or 'keeping the lights on'
    - Creating demand for services and jobs that deliver smart grid strategies and technology
    - Creating demand for innovation in data systems, management systems and skills.

The point is, there a range of benefits to managing demand and it pays to be clear about your objectives.

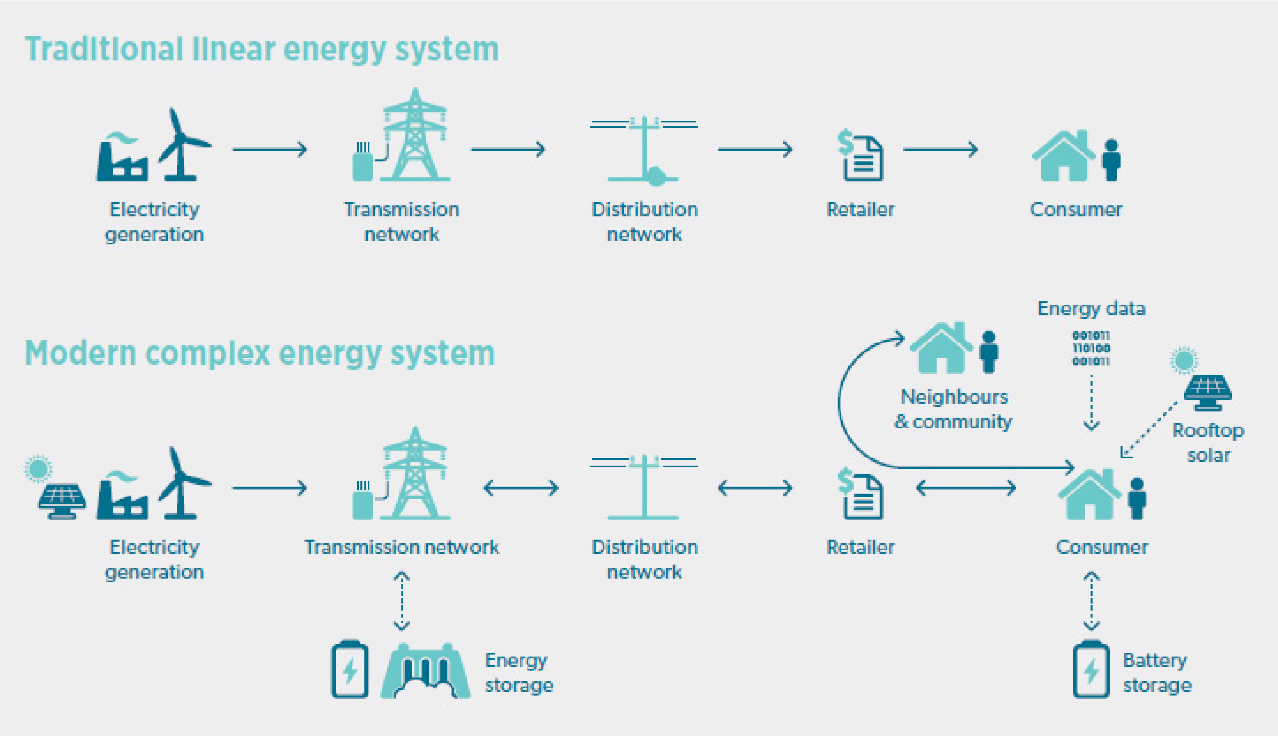



Figure 4: At almost every step in the chain of electricity delivery there are opportunities to balance supply and demand. This diagram from the NSW Electricity Strategy[3] illustrates how the electricity grid is changing from a one way supply grid to a two way distributed generation grid, enabling renewable energy and smarter technology to assist in balancing supply and demand at every point in the grid, at every point in time.

3 NSW Electricity Strategy

# step 3: understand how your building uses electricity

Access the last 1- 2 years of time-of-use metered consumption information through your energy management system (if you cannot do that, you will struggle! Get onto it… or ask your retailer or energy management service provider to provide access to the electricity meter interval data). You should be able to generate a number of views, like those to the left, that will help inform the approach you choose to take to demand management.

### Determining the demand management strategies:

**Energy efficiency upgrades**: Are often the simplest type of demand management. Changing to a more efficient appliance or upgrading stairwell lights, fans, chillers not only contributes to a reduction in peak demand but also reduces consumption throughout the year with cumulative financial savings and emission reductions. Power Factor Correction (PFC) is a particular type of efficiency project that improves the way the building uses electricity, helping to reduce demand at the peak where peak is measured in kVA. **Tip**: If you have energy efficiency projects in the pipeline it can change what an optimal PFC project requires, so where you can, do the energy efficiency first.

**Load curtailment or load shedding:** Determine if there is equipment that can be turned off or down during the peak period. In summer peak, pre-cooling buildings and then raising afternoon setpoints can mitigate the afternoon peak. In some buildings, areas may be isolated and HVAC disabled to mitigate peak. Key to this strategy is understanding the thermal inertia of the building, how quickly it responds to any change in HVAC output as well as how quickly it responds to high temperatures outside.

If possible, source zone temperature verses outside air temperature data for last summer's hottest days, and supplement this with information from days when the HVAC system suffered compromised service e.g. a chiller was offline. It is a good opportunity to define what acceptable zone temperatures are on the hottest days, beyond design capacity, and if tenants are going to be sensitive to comfort conditions, have a conversation with them about comfort control during extreme conditions. The BBP Leasing Standard contains material that enables these conversations.

This is also a perfect time to review the BBP Demand Management case studies to see what others have tried that could inform your own demand management project.

**Standby generation:** Many buildings are fitted with standby generators that switch on for emergency supply when the grid goes down. Running generators while the grid remains energised requires either that the system is "islanded" from the grid or that synchronising controls are fitted and approval is gained from the network company (Ausgrid in the Sydney CBD case). Often these generators have not been operated under summer peak conditions so it may be worth implementing careful testing if they are under consideration for a demand management program.

The operating procedures need to be carefully tested to ensure that the generator can be energised to operation and the load transferred back to grid in an orderly fashion. An error in controls can easily see load peak as the building returns to grid power with an accompanying loss of savings.

**Energy storage**: Some buildings have capacity to store thermal energy in chilled water tanks and, increasingly, batteries will play a part in energy storage. Discharging storage during peak demand periods will mitigate the grid peak.

Use the building **asset register** as the perfect starting point to consider which equipment might be used to allow these strategies might to be deployed in your building.

Load curtailment, standby generation and energy storage can all be used in **demand response,** for cases where agreement is reached to implement these strategies, in response to a market condition.

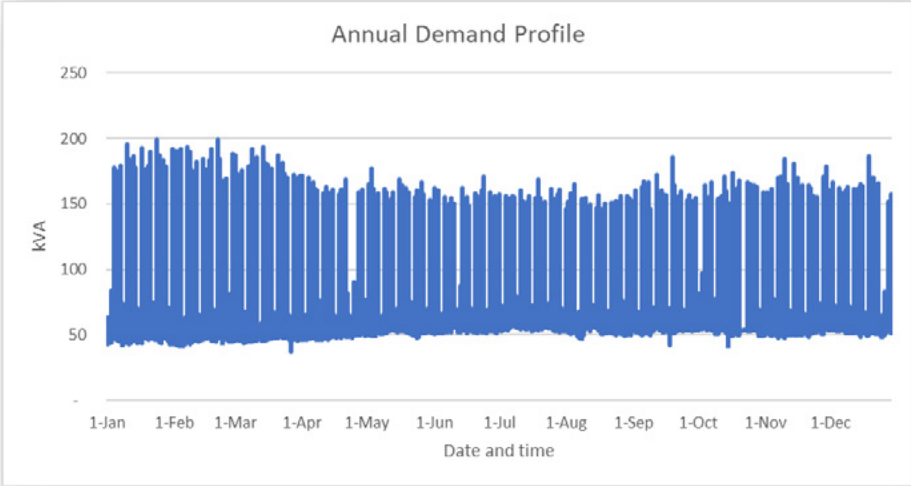



Figure 5 Annual profile of electricity consumption shows a seasonal correlation with higher consumption in the summer period driven by increased air conditioning use.

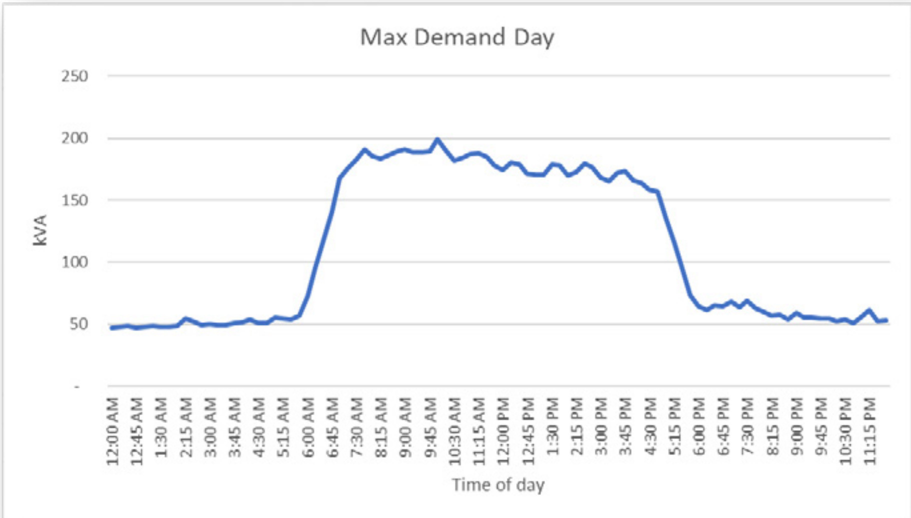



Figure 6 The daily profile of peak maximum demand shows the peak was achieved mid-morning with high consumption throughout the day. Correlating this information with temperature information would confirm the conditions that drove this building response.

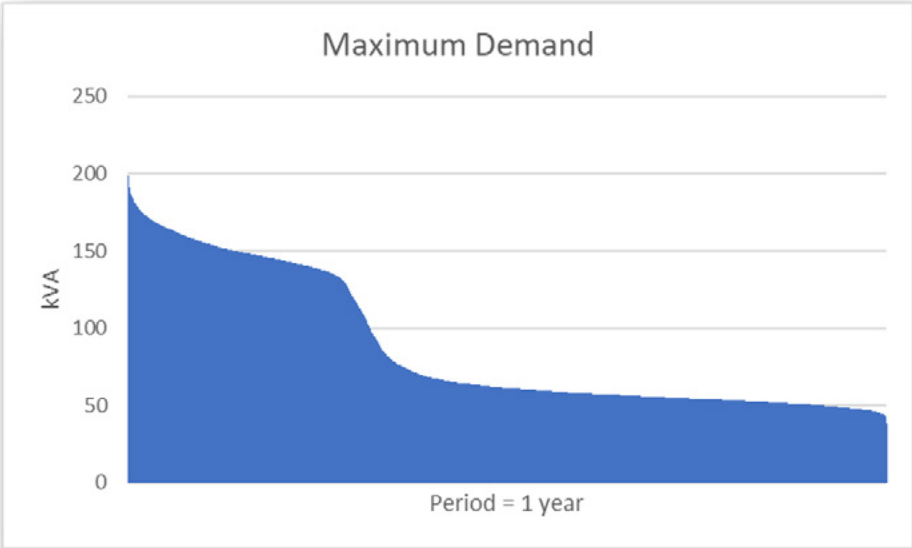



Figure 7 A load duration curve shows how little a proportion of the year that demand reaches a high peak.

In this case demand exceeds the 90th percentile for less than 0.75% of the year. If demand in this period could be curtailed, the demand component of the electricity bill could be cut by 10% for the whole year.

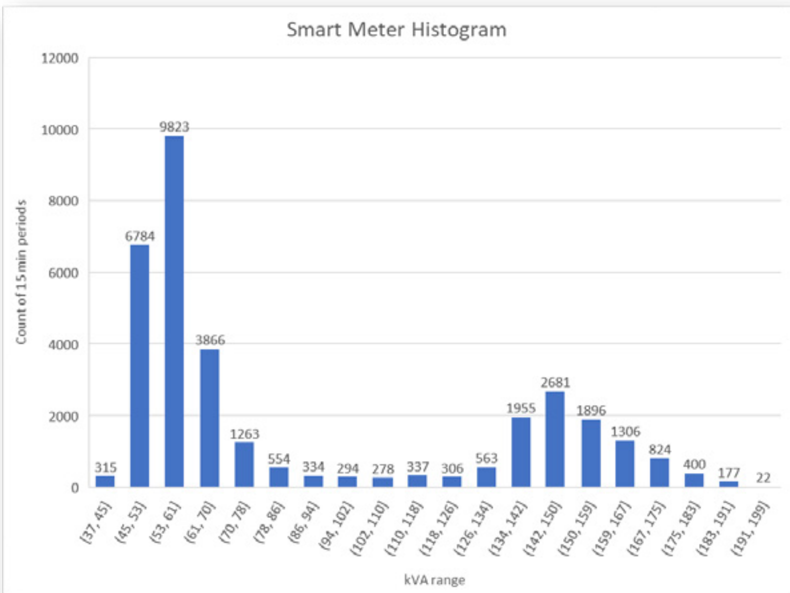



Figure 8 A histogram of the annual demand emphasises the small amount of time the building draws the peak demand (to the right of this chart).

# step 4: identify opportunities for managing demand

If your objective is simply to contribute to grid resilience and a social benefit, this step can be skipped. Otherwise, to understand the financial benefits available, it is necessary to match the demand management opportunities provided by the equipment in the building with the available demand management incentives.

**Distribution demand tariff or Capacity charge:** As shown on the following page, Ausgrid applies a capacity charge on a 12-month ratchet; the capacity charge that applies on each monthly bill is calculated using the highest demand in the times shown in the preceding 12-month period. For more information on tariffs see the price guide. Check back on your electricity bill for the line that is charged on a kVA or kW rate.

CAUTION

**For buildings outside the Ausgrid area, you will need to download and research tariffs that are applied by the relevant distribution network.**

All demand management strategies can contribute to capacity charge savings.

**Distribution network demand management project**: From time to time Ausgrid may engage with customers to manage demand in specific areas of the network as an alternative to investing in more network infrastructure. Check the Ausgrid website

**Transmission network demand management project:** From time to time, Transgrid may engage with customers to reduce demand and avoid, or delay, transmission infrastructure expenditure. Check the Transgrid website.

**Spot market electricity price:** Electricity can be purchased on the spot market where the price reflects the supply and demand for the half hour settlement period. This spot price is volatile; the average NSW price for all of 2019 was $85 while the average price for January 2020 was $152/MWh with spikes in price up to $14,700/MWh. You may be able to work with your retailer or a Demand Response Service Provider to be paid to provide relief from these spikes using demand management.

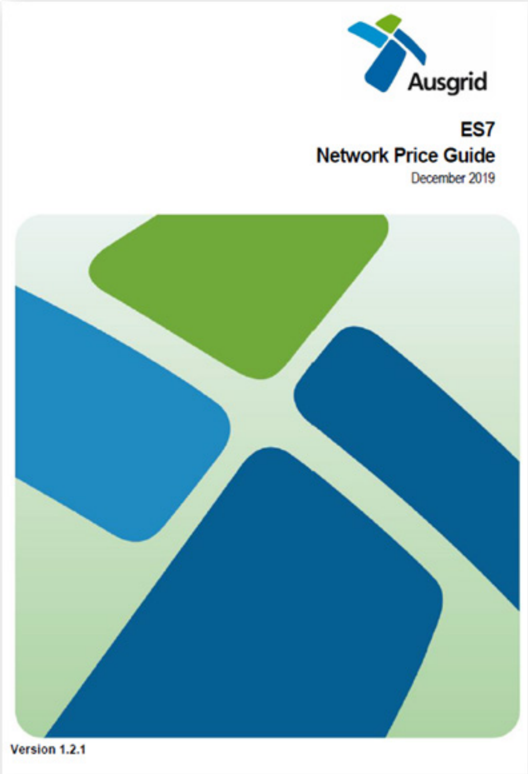



**Table 3.6. Capacity charge: windows for medium to large Low Voltage, High Voltage and Sub-transmission business customers**

| Capacity window | Time period definition |
|---|---|
| All year round | • From 2 pm to 8 pm on working weekdays. |

*Medium to large Low Voltage business customer is a non-residential customer with more than 40 MWh usage pa.

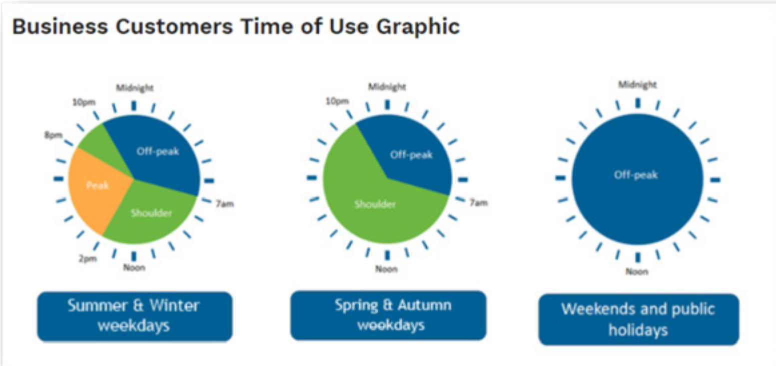



Figure 9: As a monopoly provider of distribution services, Ausgrid is required to publish the network price guide each year which includes time of use for network charges for customers in Ausgrid's distribution area. N.B. The time of use periods for energy consumption may differ from these periods and need to be confirmed with your electricity retailer.

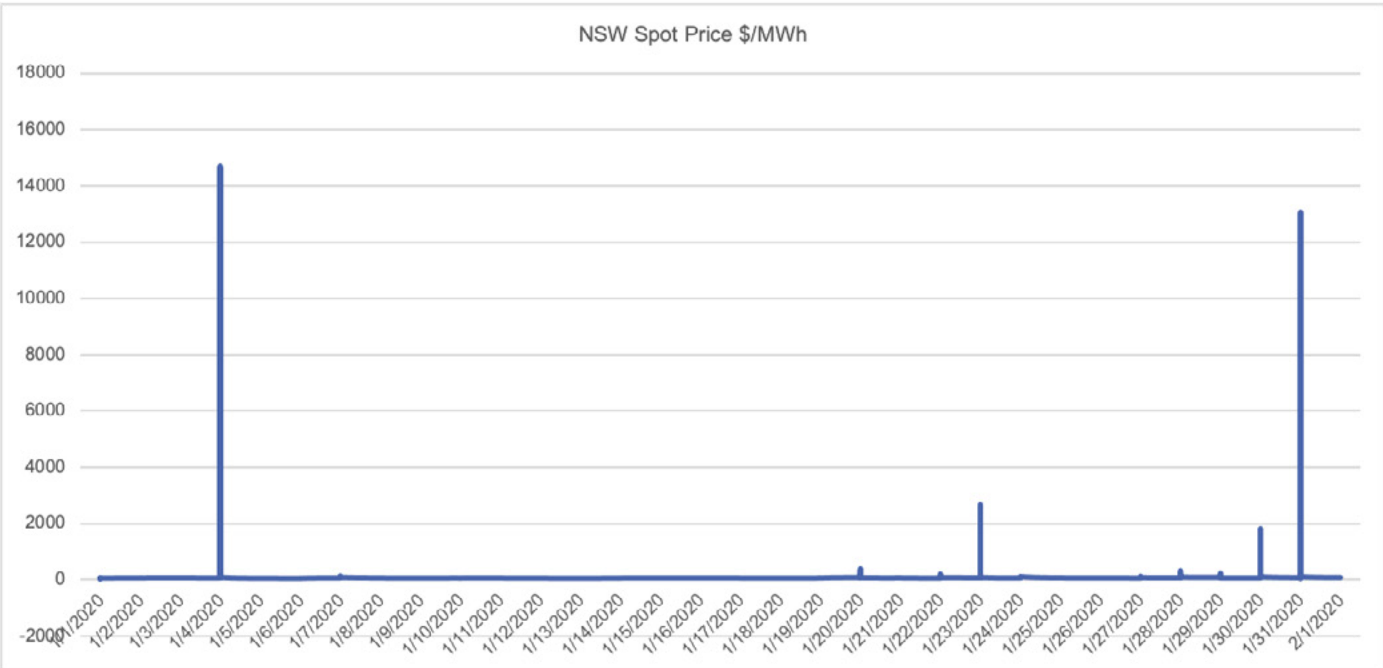



Figure 10: The NSW spot market price for January 2020. Trading in this market requires a deep understanding of network supply and demand.[4]

4 Ausgrid Time of Use Pricing

# step 5: undertake benefit analysis

Accurately forecasting the financial benefits of demand management requires careful analysis. This analysis should consider how the building uses energy, and the tariffs that apply at the time of day and year where electricity consumption and demand will be reduced.

Sample calculations are shown below for illustration only using the same electricity rates shown on the sample bill in Figure 2: Sample electricity bill with all values for illustration only showing the various charges applied to a monthly bill. Use your bill to understand these charges as some buildings can have capacity charges comprise 30% or more of the monthly energy bill.. Great care is required in undertaking savings calculations as each element of the electricity bill needs to be applied correctly. For instance, don't assume that retail energy price peak hours align with network price peak hours. You will need to check with your retailer.

Clearly, an energy efficiency project that can provide savings all year round, as well as creating a peak demand capacity charge benefit, and energy savings certificates, generates the highest savings in this scenario. This will often be the case for efficiency projects where multiple benefits can be aggregated.

Efficiency projects often result in improved system performance, for example better lighting, as well as increasing NABERS Energy ratings (where applicable) while also providing an emissions reduction and environmental benefit through the decreased use of electricity.

The projects in the example analysis provide the same social benefit, a reduction in peak demand of 50kVA just for the purpose of comparison but if it happens that you have a grid synchronised, or islanded 500kW generator available, the benefits of responding to spot price alone could accrue at $4,000/hour of operation or more.

**Every project needs to be evaluated carefully. Remember, as with other financial products past performance is no guarantee of future results, and if it sounds too good to be true it probably is.**

| Demand management savings examples | | | | Lighting Efficiency (50kVA, 24/7) | Load shed escalator (50 kVA 1 hour) | HVAC Load shift (50kVA 1 hour) | Battery or Generator resposonse (50kVA 1 hour) | Spot market response (50kVA 1 hour) |
|---|---|---|---|---|---|---|---|---|
| Charges | Usage | Unit Price | Loss Factor | Annual Saving | Annual Saving | Annual Saving | Annual Saving | Annual Saving |
| **Retail Charges** | | | | | | | | |
| NSW Peak | 150,000 kWh | 5.000 c/kWh | 1.05723 | $ 7,929 | $ 3 | | | |
| NSW Off Peak | 150,000 kWh | 3.000 c/kWh | 1.05723 | $ 4,758 | | | | |
| NSW Shoulder | 138,000 kWh | 6.000 c/kWh | 1.05723 | $ 8,754 | | | | |
| **Environmental Charges** | | | | | | | | |
| NESC | 438,000 kWh | 0.15 c/kWh | 1.0479 | $ 688 | $ 0 | | | |
| LRECs | 438,000 kWh | 0.5 c/kWh | 1.0479 | $ 2,295 | $ 0 | | | |
| SRECs | 438,000 kWh | 0.25 c/kWh | 1.0479 | $ 1,147 | $ 0 | | | |
| GreenPower | 438,000 kWh | 2.5 c/kWh | 1.0479 | $ 11,475 | $ 1 | | | |
| **Network Charges** | | | | | | | | |
| EA305 - Peak | 39420 kWh | 6.195 c/kWh | | $ 2,442 | $ 3 | | | |
| EA305 - Shoulder | 157680 kWh | 2.2747 c/kWh | | $ 3,587 | | | | |
| EA305 - Off Peak | 240900 kWh | 1.1181 c/kWh | | $ 2,694 | | | | |
| EA305 - Capacity | 50 kVA | 32.811 c/kVA/Day | | $ 5,988 | $ 5,988 | $ 5,988 | | |
| **Market Operator Charges** | | | | | | | | |
| AEMO Ancillary Fee | 438,000 kWh | 0.068 c/kWh | 1.0479 | $ 312 | $ 0 | | | |
| AEMO Market Fee | 438,000 kWh | 0.0374 c/kWh | 1.0479 | $ 172 | $ 0 | | | |
| **Energy savings certificates (ESC's)** | 438,000 kWh | 2.4 c/kWh | | $ 10,512 | | | | |
| **Demand response benefit** | eg: $ 1,000/MW, called on 4 times in a year | | | | | | $ 200 | |
| **Spot market response benefit** | eg: $8,000/MWh, called on 6 times in a year | | | | | | | $ 2,400 |
| | | | **Total** | **$ 62,752** | **$ 5,996** | **$ 5,988** | **$ 200** | **$ 2,400** |

Figure 11 These numbers are for illustration only, please check the tariffs and rates applicable to your building.

# step 6: implementation plan

For the benefits of demand management to be long lasting, the change needs to be captured in the systems of management for the building. This can mean involving quite a wide number of people, some of them in Figure 11 These numbers are for illustration only, please check the tariffs and rates applicable to your building..

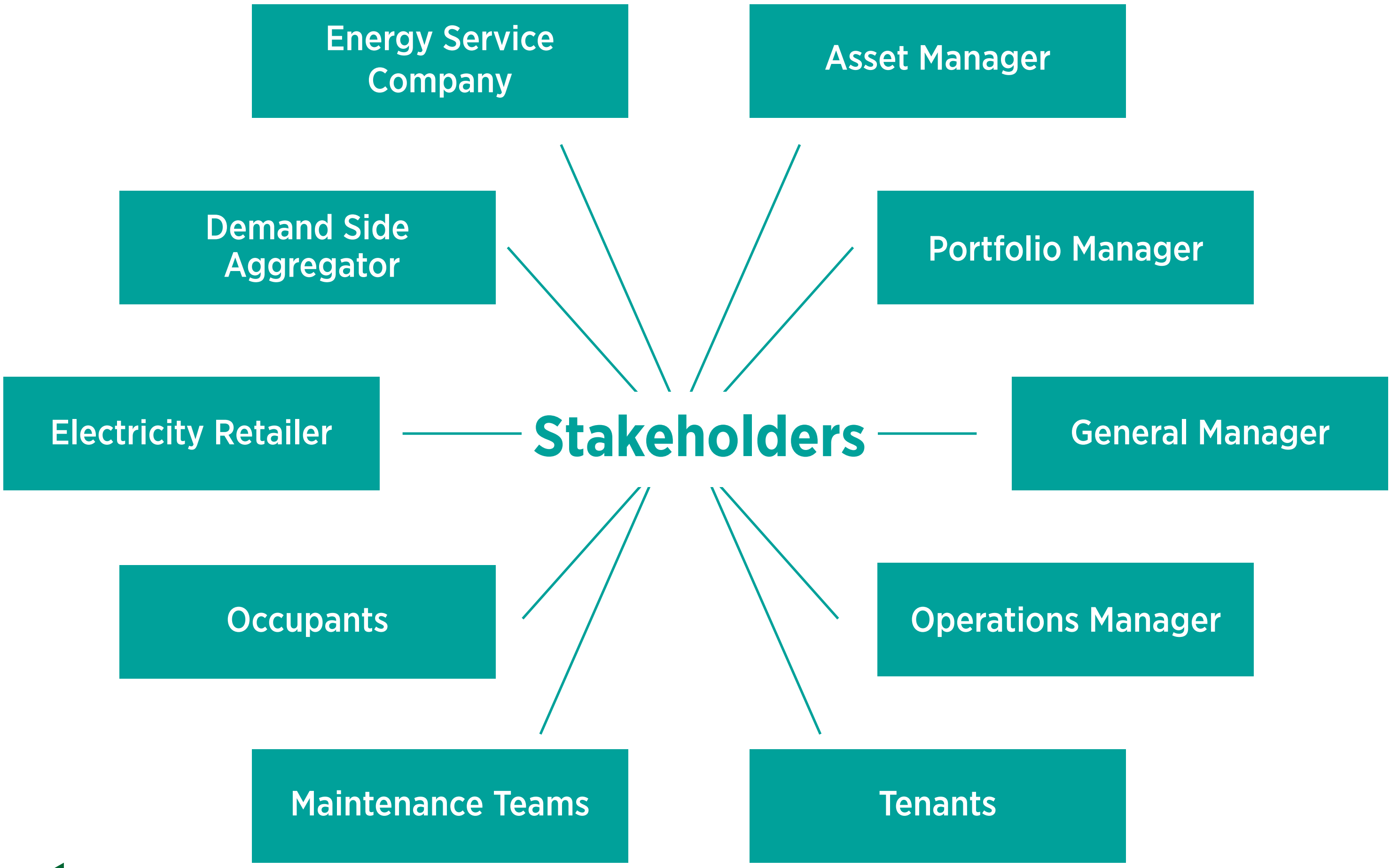
**The change management program should include:**

- Clear communication of the goal
- Definition of responsibilities, skills, and training
- Documentation of the process and procedures
- Timeline for deployment
- Communication requirements
- Definition of key performance indicators and systems of measurement (automate do not complicate; your energy management system or BMS is your friend)
- Setting for peak demand alarm points and responsibility for responses

Ideally energy is already managed under an ISO management system so this is an opportunity to build new standard operating procedures and to provide ongoing training of key personnel including maintenance/service contractors.

When HVAC is included as a demand management measure, call out the demand management goal as a KPI in the DA19 Guide to HVAC Maintenance definition of objectives. This step allows the HVAC maintenance team to play their part in understanding and managing equipment and controls to achieve the preferred outcome. This means they, and the controls contractors, need to be brought into the communication loop and provided access to the performance information.

The implementation plan should also consider risks associated with the demand management project as load curtailment can result in loss of utility or performance and generators coming online can trip grid connections if not configured properly. It is important to identify these risks, design mitigating controls and test these controls under controlled conditions well before peak periods are likely.




Ideally, lease schedules encourage collaboration between property managers and tenants in relation to HVAC temperature control, especially under extreme weather conditions. Refer to the BBP Leasing Standard

Figure 12: Effective change management requires careful identification of the stakeholders that need to act or co-operate for project success. Demand management projects require a technical team to manage the changes to equipment controls and often a management team that can inform and negotiate acceptable conditions with building users.

# step 7: measure performance

There are a variety of ways to measure and verify (M&V) the impact of a demand management project and the best method depends on the demand management strategies used. The daily electricity demand profile of a building is subject to variables, such as weather and occupancy, that can complicate the measurement process.

The NSW Government publication, "Measurement and Verification Operational Guide – Best practice M&V processes" provides guidance on measuring the outcomes of energy savings measures, usually consumption rather than demand, and there is information about specialist M&V experts that can assist from the Energy Efficiency Council.

In the simplest form savings in energy demand and energy consumption, can be measured using the before and after formula:

## Demand savings = (Baseline demand – Actual demand) +/- Adjustments

M&V at a project level is often simpler than the alternative of whole of building measurement.

Project level measurement is best for:

- Energy efficiency projects like lighting upgrades, metering, or one off load measurement
- Generator/Energy storage enabled

Building level measurement is best suited to:

- HVAC efficiency projects
- Power factor correction: https://www.ess.nsw.gov.au/Home/About-ESS/Energy-savings-calculation-methods/Power-Factor-Correction-Energy-Savings-Formula

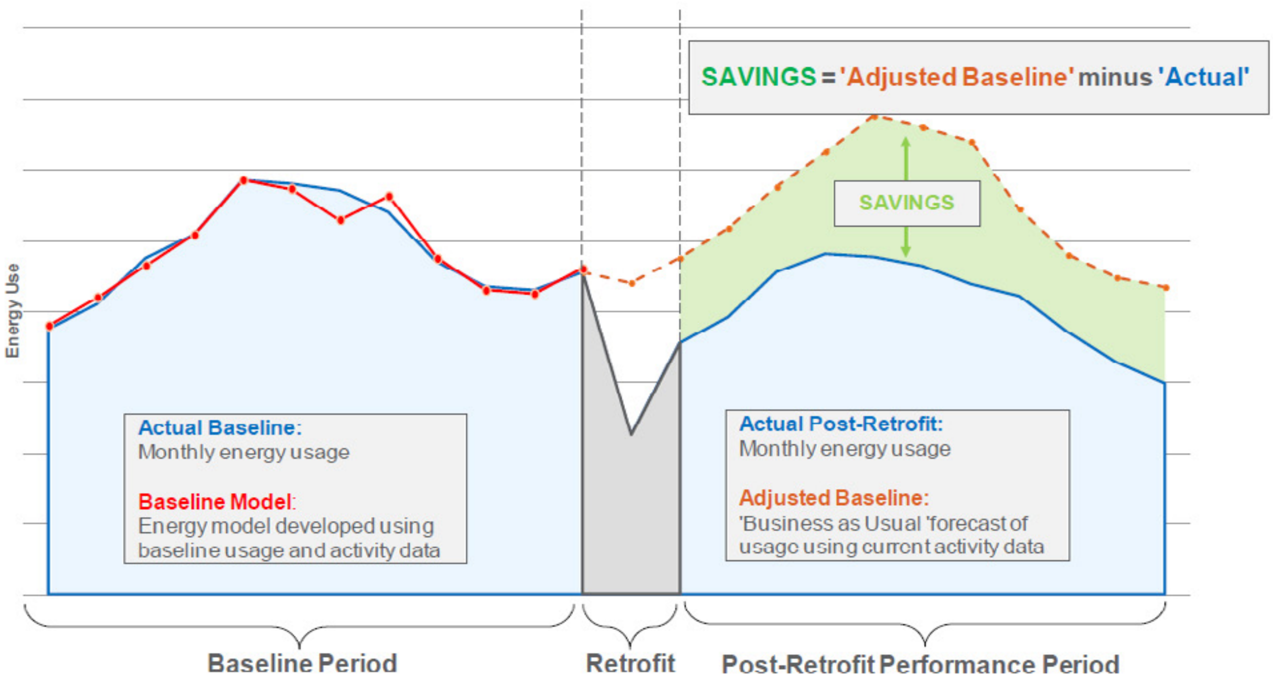



Figure 13: Measuring demand savings is sometimes likened to measuring what did not happen. It requires a clear understanding of the baseline condition and the variables that drive demand after an energy conservation measure (ECM) is enabled.

# step 8: seek feedback and improve performance

As with any other managed characteristic, a carefully selected group of lead and lag indicators can be used to ensure that demand management processes remain effective.

Setting up a demand management dashboard in your energy management system is one way of assembling related information in one view.

**Lead indicators include:**

- Targets that are included in the operations/facility managers performance objectives
- Energy management portal that provides automated reporting on peak demand analysis
- Energy management portal that is set with demand alarms warning of impending overruns
- Maintenance contracts that include peak demand targets, where technicians are trained (or, training is scheduled) and that actively use data from the metering system
- Peak demand as a KPI in service contracts which is reviewed during routine performance meetings with relevant service teams
- Energy management portal that includes information on:
    - Demand performance (e.g. meter data)
    - Demand drivers (e.g. weather)
    - Building performance in peak conditions (e.g zone temps)
    - Tarif information

**Lag indicators include:**

- Peak demand achieved in the 12 months verses target
- Peak demand charges/savings

Work with your energy management system or building management system provider to assemble the demand management relevant information onto one or two dashboard pages and document them as part of the energy management system to be included as part of team training.

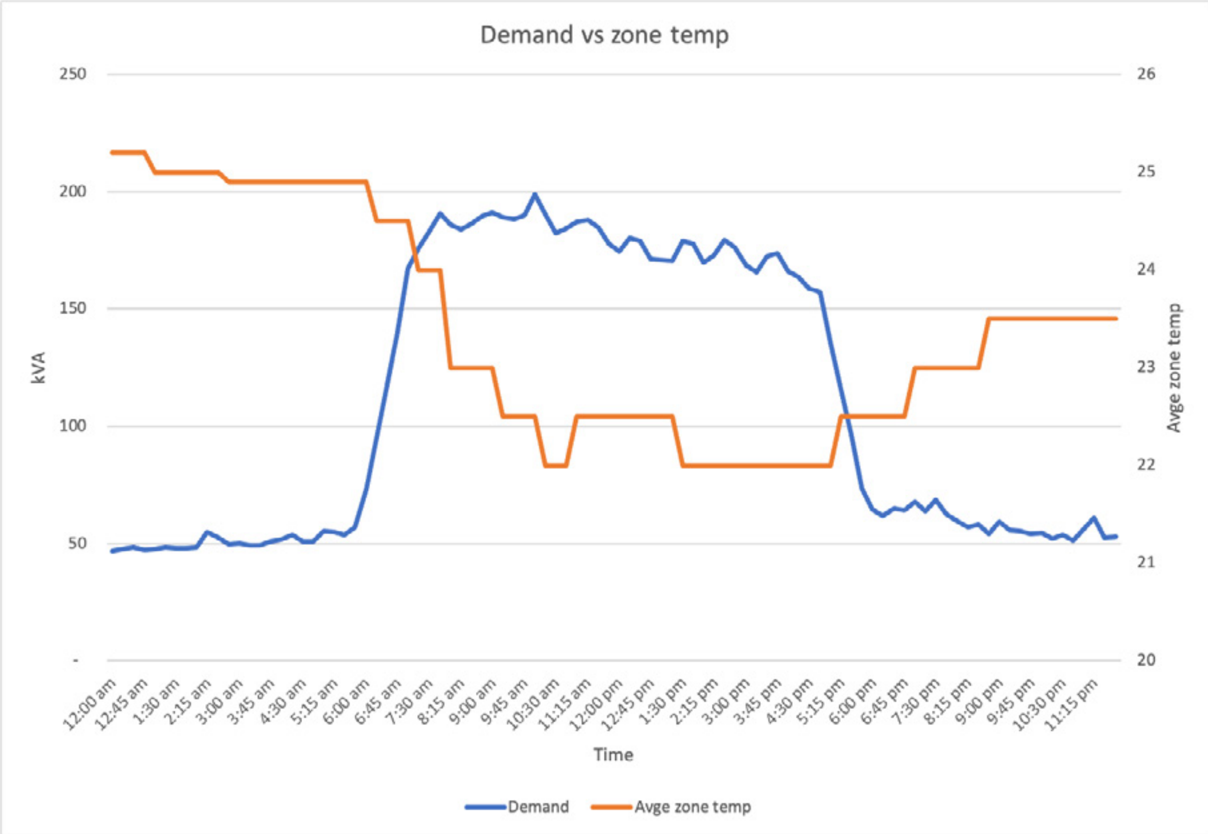



Figure 14: A demand management program that relies on curtailing or moving HVAC loads needs to include a good understanding of how the building will operate under the peak demand condition.

During summer peak the outdoor ambient temperature can often exceed the design condition, meaning zone temperatures are already at risk of being exceeded depending on the loading of the building. Understanding the degree of thermal inertia available in the building and working with tenants on allowable temperature limits are key to determining the extent of HVAC curtailment.

# step 9: keep an eye on the future

There is no doubt that there will be ongoing focus on the development of a smart electricity grid as it is vital to our cities and communities. Building managers should be prepared by understanding how buildings use energy and be nimble to ensure that the technology, market and behaviour changes can be accommodated at the building level for the best economic, social and environmental outcomes.

Technology and data communication will facilitate the automation of responses to the grid condition and new markets will open as the regulator moves to optimise grid performance. New, near horizon, opportunities include:

- NSW Energy Savings Certificates – Peak Demand: NSW Government has committed to the development of new peak demand incentives.
- Frequency Control Ancillary Services (FCAS): As demand increases in the grid the frequency of the alternating current (AC) supply tends to change affecting the quality of electricity supply. There is an existing market in frequency response, although it requires response times measured in seconds or minutes and special metering to capture the benefit. More information is available from the AEMO website
- Reliability and Emergency Reserve Trader (RERT): A mechanism where the energy market operator can contract for emergency reserve generation.  More information from the AEMO website
- Wholesale Demand Response: The Australian Energy Market Commission published a new rule in June 2020 that allows new demand response service providers to bid capacity into the supply market in a similar way to any large generator.

The New Buildings Initiative have developed a set of metrics that indicate how a building is designed or configured to respond to grid conditions.

| GridOptimal Metric | What it Measures |
|---|---|
| Grid Peak Contribution | Degree to which building demand contributes to load on the grid during system peak hours |
| Onsite Renewable Utilization Efficiency | Building's consumption of renewable energy generated onsite (not exporting to grid) over a year |
| Grid Carbon Alignment | Degree to which the building demand contributes to upstream (grid) carbon emissions over a year |
| Energy Efficiency vs. Baseline | Percent better than code (annual total energy use) |
| Short-Term Demand Flexibility | Building's ability to reduce demand (shed) for 1 hour |
| Long-Term Demand Flexibility | Building's ability to reduce demand (shed) for 4 hours |
| Dispatchable Flexibility | Building's ability to automatically reduce demand (shed) for 15 minutes, controlled by utility/ third party |
| Resiliency | Building ability to island from grid and/or provide energy for critical loads for 4-24 hours; motor soft start capability to help grid restart after outage |

Figure 15 The GridOptimal Metrics details these measures that could be used in a NABERS style program to recognise those buildings that are active participants in grid optimisation.

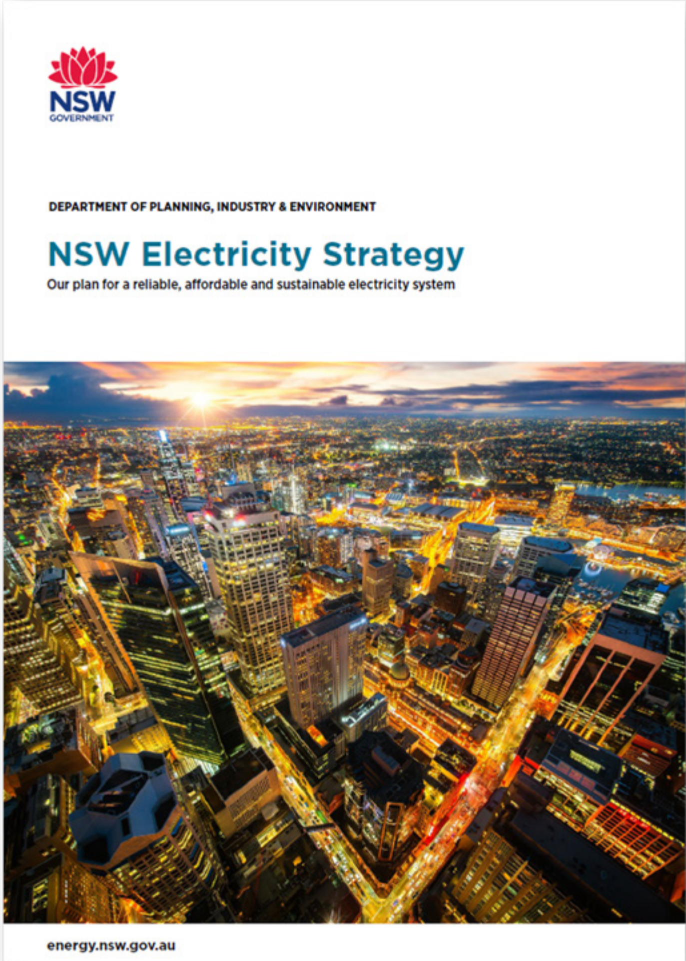



Figure 16: The NSW Electricity Strategy, released in November 2019, recognises the changes required to support the economic and efficient operation of the grid as technology and the operating environment continues to change. It identifies firmed renewable energy as the lowest cost form of new generation and that the grid must respond to ensure successful integration of this distributed generation.

> The first component of the Safeguard will involve expanding the existing Energy Savings Scheme to 2050, with targets increasing gradually up to 13 per cent by 2030 and participants able to receive certificates for an expanded set of activities which reduce demand on electricity and gas networks, including substituting gas for biomass.
>
> The second component of the Safeguard will involve establishing a new certificate scheme for the deployment of peak demand reduction technologies, such as batteries, smart pool pumps and electric vehicle chargers that enable electricity demand to be shifted away from peak periods.

Figure 17: The NSW Electricity Strategy promises new schemes to incentivise deployment of technologies that reduce peak demand.

# references and tools

- Energy Efficiency Council  https://www.eec.org.au/
    - Provide demand management training and advocacy resources
- Transgrid https://www.transgrid.com.au/
    - Keep up to date with transmission demand management projects
- Ausgrid https://www.ausgrid.com.au/Industry/Demand-Management
    - Keep up to date with distribution demand management projects
- NSW Electricity Strategy https://energy.nsw.gov.au/government-and-regulation/electricity-strategy
- BBP Demand Management Case Studies https://www.betterbuildingspartnership.com.au/
- The National Electricity Market is governed under the National Electricity Law and the National Electricity Rules, they confer power to:
    - Australian Energy Market Operator who administers rules and oversees the market
    - Australian Energy Market Commission who make the rules
    - Australian Energy Market Regulator who enforces the rules
    - Energy Security Board who coordinates a reform blueprint with the COAG Energy Council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