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THINK DEEPER

Technical paper

ORCHESTRATED ENERGY

How asset owners can become active energy market participants



Acknowledgement of Country

We acknowledge the Traditional Custodians as the first engineers and designers of the lands on which we live, gather and work.

We pay our respect to Elders past and present.

Artwork: Created by Timothy Buckley, a proud Mununjali man, this artwork titled 'Thrive' was commissioned by ADP Consulting, as a representation of our reconciliation journey.

In brief

As Australia's energy market changes, building owners can become active market participants. But how?

With the right energy flexibility strategy and procurement model, owners can cut energy costs by up to one third, unlock new revenue streams and achieve battery paybacks in under 4 years.

The opportunity comes from treating buildings as active participants in the energy market, not passive consumers of electricity.

But success is not guaranteed. Not all buildings are equally advantaged. There are different networks, tariff structures, climates, operating hours, incentives and procurement models to consider.

This paper explains why:

- A single peak demand event can affect energy costs for months and sometimes an entire year
- Just 20-50 short market events each year can generate more than 25% of total flexibility value
- The same battery in the same building can double or triple its financial benefit depending on the energy procurement strategy the asset owner signs up to
- A retail centre may achieve a battery payback in under 5 years, while a typical office building may take more than 10.

Capturing the biggest benefits requires more than installing a battery. Building owners must understand how to combine energy procurement, operational flexibility, storage and market participation to create value.

ADP Consulting's research finds retail centres, airports and data centres are particularly well positioned to benefit.

This paper, a companion to the upcoming NABERS energy flexibility study, sets out the fundamentals asset owners need to know to make energy flexibility work in practice.





Introduction

ADP Consulting produced this paper in collaboration with the NABERS team.

NABERS will shortly release the findings of its feasibility study into energy flexibility, listing new financial incentives, policy settings, sustainability frameworks and market mechanisms which are beginning to reward flexible energy use.

NABERS' paper distils insights from interviews with stakeholders from across the property, energy and government sectors, offering an overview of energy flexibility barriers and opportunities, and laying the foundation for wider industry consultation for a national pathway forward.

This paper is designed as a companion to NABERS' work as a practical guide for asset owners, facilities management teams and engineers looking to obtain value from a more flexible grid.

How this paper was developed

This paper has been 12 months in development. Its findings are based on:

1. Completed real-world analysis of building energy usage and energy market data for a leading Australian asset owner.
2. Insights from extensive interviews with key industry stakeholders, with findings based on real commercial retail rates, margins, tariffs and bills.
3. A collaborative knowledge sharing partnership with NABERS, which provided valuable feedback and insights.

Previous work

In 2024, ADP Consulting released a white paper, [Megawatts and Megatrends](#), which explored the topic of energy flexibility and encouraged asset owners to actively participate in the energy market.

This new paper complements *Megawatts and Megatrends*, but can also be read as a standalone document.



The energy market is complex, therefore a glossary of terms and acronyms is provided at the end of this paper.

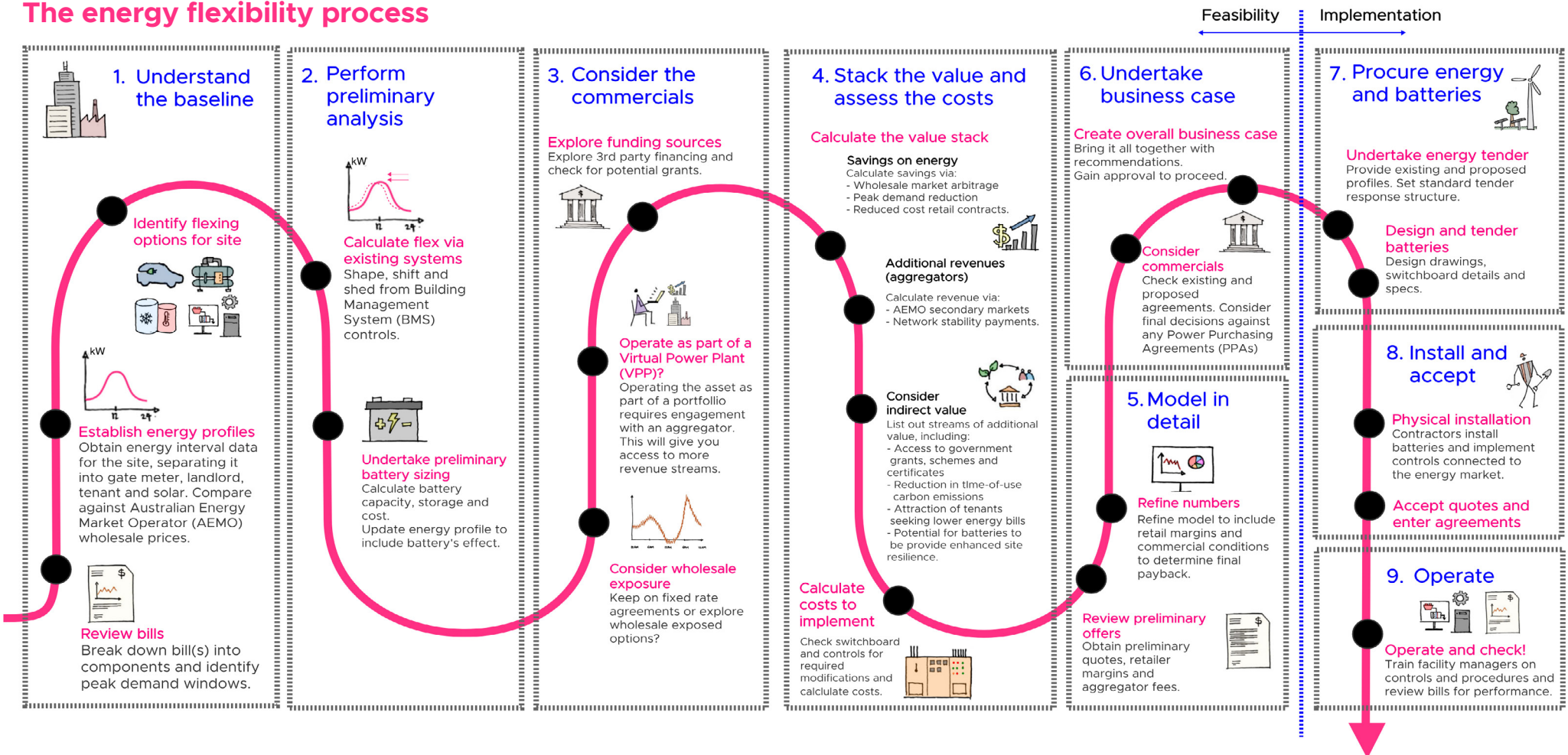
Rethinking the industry approach to energy usage

With the right buildings and right procurement, energy flexibility can cut energy costs by one-third and deliver battery paybacks in less than 4 years.

Building owners can make substantial energy cost savings and develop new revenue streams by turning their assets into energy market participants. To do so though, they need to:

- Investigate the energy flex potential of their assets
- Understand the commercial frameworks they operate in
- Systematically explore mechanisms available to reward them.

The energy flexibility process



Understanding your energy bills is the key

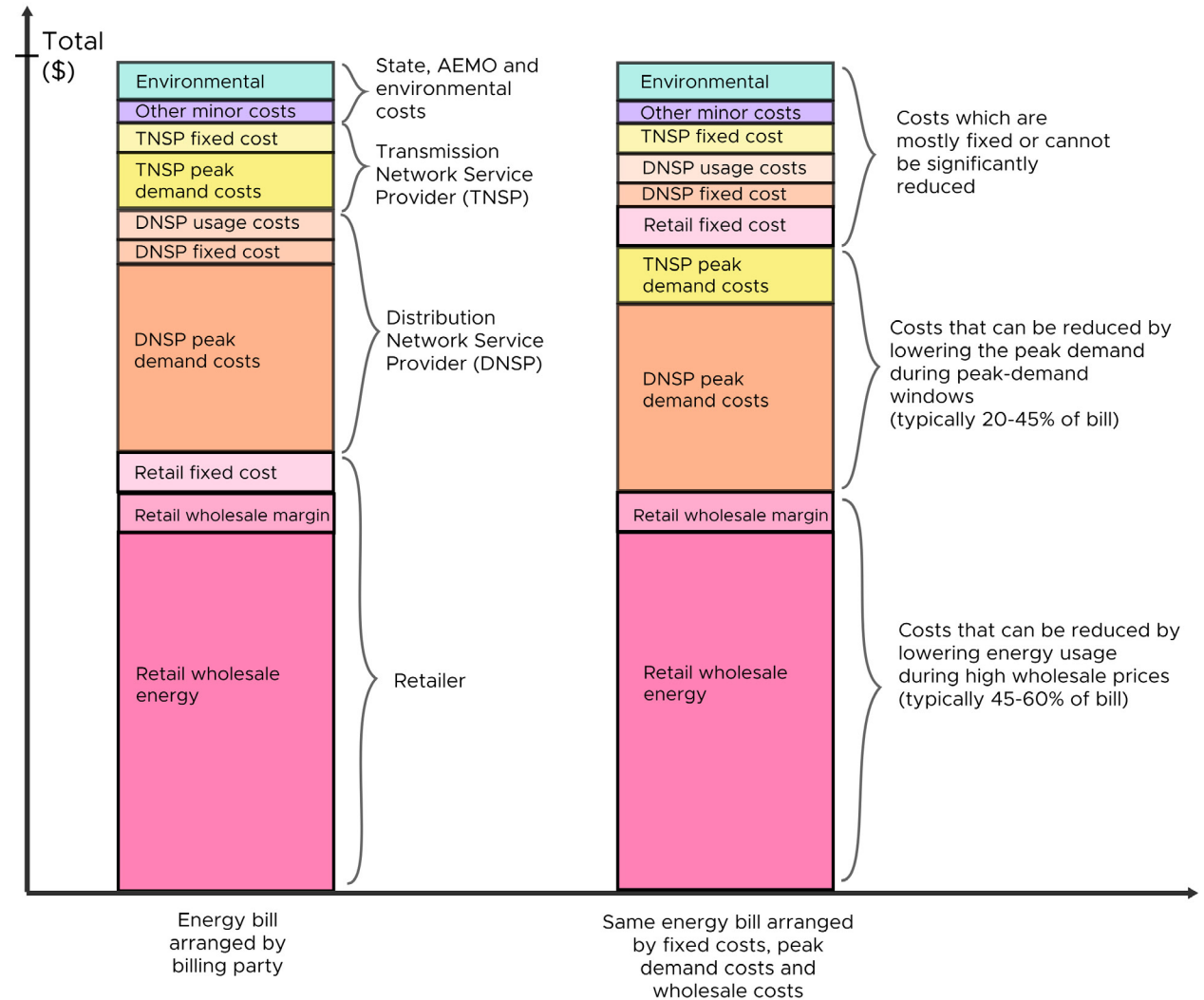
Bills contain insights into what value can be gained through “flex”. They show where and who the energy costs go to. When combined with knowledge of the peak demand windows, they reveal the key flexing strategies.

A typical energy bill in Australia is made up of several costs from various parts of the energy supply chain.

Cost structures and proportions depend on the state, network, retailer and contract arrangement.

The basic set up is shown opposite.

The key components to consider are peak demand costs and wholesale energy costs. These are the biggest components of most energy bills, and are most effectively reduced through flexing.



Insight: Don't assume the data doesn't exist

Most commercial buildings already have access to the data required for energy flexibility, including 5-minute interval consumption data and detailed energy bill breakdowns from their retailer or distributor.

The mechanisms behind the bills

Alongside the information in the energy bill, the building's energy profile is also a factor.

The "energy profile" is the building's energy usage of the site's gate meter plotted for every 5 minutes over an entire year (in line with AEMO's 5-minute settlement time).¹

Wholesale energy costs are calculated by multiplying energy usage in any 5-minute period with the wholesale cost at the time.² The Volume Weighted Average Price (VWAP) (\$/kWh) is the total wholesale energy cost over a period divided by the total energy usage. The retailer margin is added on top.

Understanding the VWAP is essential for informed discussions of retail energy contracts.

Peak demand costs are calculated by working out the largest peak during the network's peak demand window. This is usually multiplied by a factor specific to the network. Networks have different peak demand windows and peak demand multipliers.

Peak demand windows and costs vary. There is no such thing as a universal energy flexibility strategy because every network tariff works differently.

Two similar buildings located in different states demonstrate the differences in peak demand calculation methods:

Queensland building:

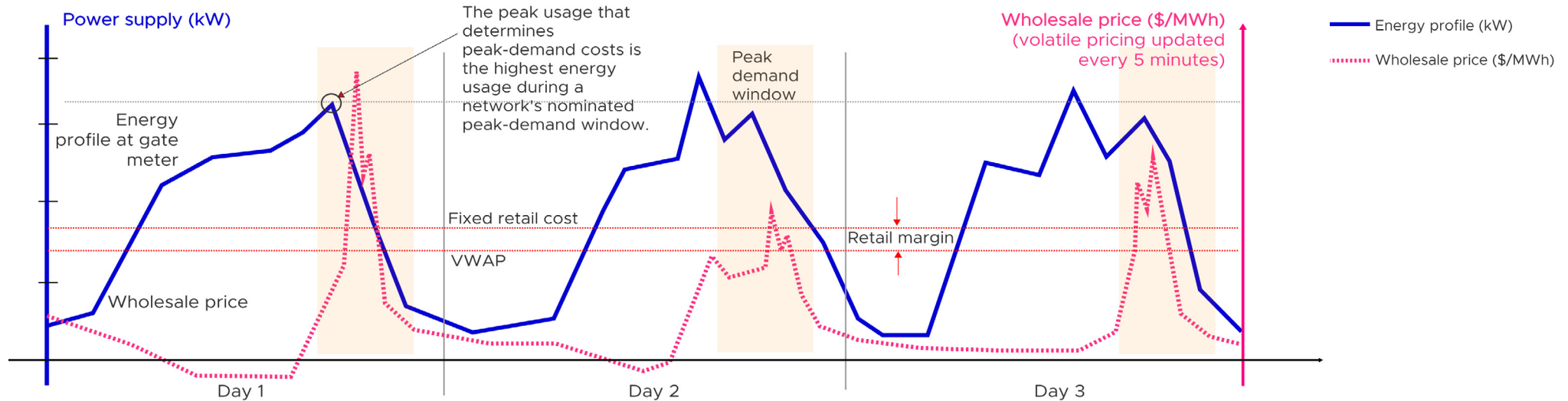
- Demand charges only apply during 5pm-8pm weekdays
- Only during summer months
- Peak demand is reset every month.³

New South Wales building:

- Demand charges apply during 3pm-9pm weekdays
- Peak demand is tracked on a rolling 12-month basis
- One single demand event can affect charges for a year.⁴

These differences affect everything from battery sizing and load-shifting opportunities to the overall viability of an energy flexibility strategy.

Visualising your energy profile



Insight: Cost reduction value split

Our analysis has found that energy flexibility can deliver value from multiple sources:

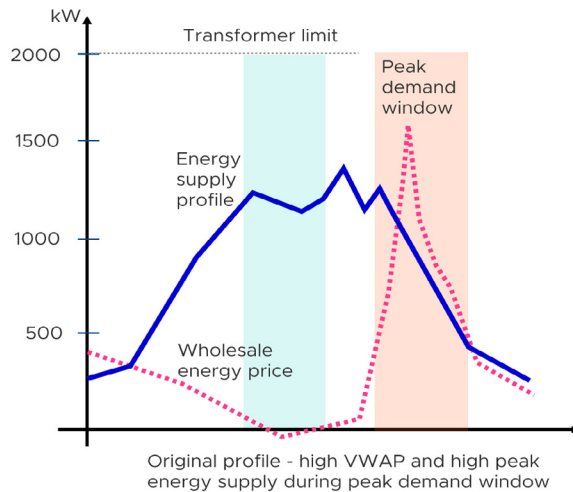
- Peak demand charge reductions accounts for 30-45% of value created
- Wholesale energy savings and ancillary markets revenues accounts for 55-70% of value. This analysis, while not definitive, highlights why building owners should consider both key value streams in any feasibility.

Shape, shift and shed

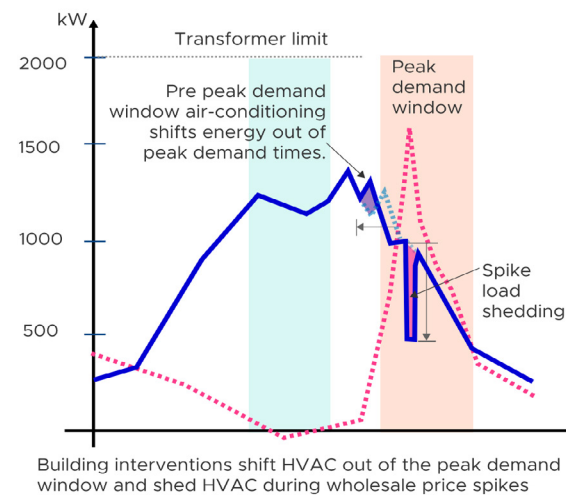
Flexing is all about changing your building's energy profile. Do it right and you can lower peak demand charges and energy supply rates, and depending on commercial arrangement, unlock new revenue streams.

Energy profiles need to be considered across the whole year, but the basic concepts can be understood for a typical day, as shown in the diagrams below.

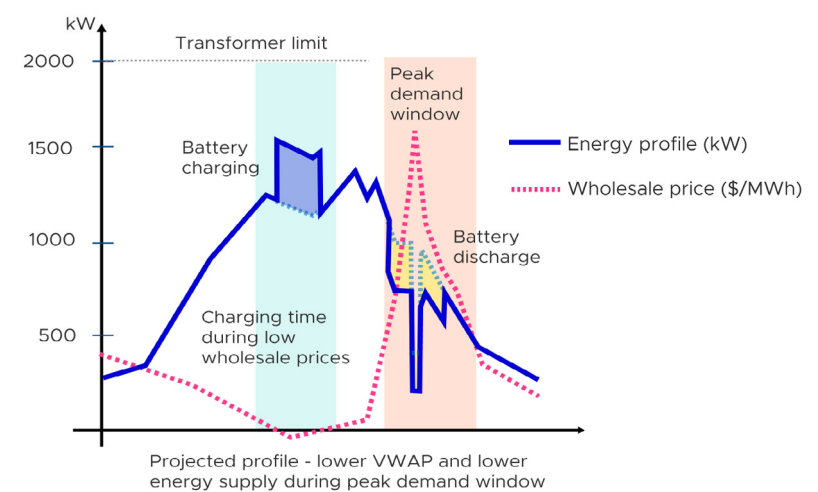
Original profile



Profile after building interventions



Profile after building interventions and battery



Two key categories central to reshaping an energy profile are:

1. **Interventions** (changes enacted through BMS controls to building services, systems or occupant behaviour)
2. **Battery storage** (using stored energy to shift, reduce or optimise electricity demand).

Separating these two categories allows the impact and payback of each to be assessed independently. This is important because battery storage is typically the single largest investment in any building flex strategy.

Typical building flexibility interventions

A. HVAC load shedding

Temporarily reducing heating, ventilation and air conditioning (HVAC) loads for short periods (typically 5–15 minutes) during extreme price events (usually over \$1,000 per MWh).

B. HVAC load shifting

Pre-conditioning spaces when electricity prices are low, allowing energy use to be reduced during peak demand periods without affecting occupant comfort.

C. Using thermal storage and inertia

Temporarily reducing energy use in systems such as chilled water plants, thermal storage systems and cool rooms, which can maintain acceptable temperatures for a period of time without active cooling.

D. Managed EV charging

Slowing or rescheduling electric vehicle charging during periods of high electricity prices, or applying pricing signals that encourage charging at other times.

Some loads just cannot be shifted. These include essential services like lighting, security systems, communications infrastructure and tenant power.

Insight: HVAC shifting and shedding has an impact

HVAC is the largest source of flexibility. During peak times, up to 80% of base building energy usage can come from HVAC systems. This large chunk can be moved out of peak demand windows or shed during extreme prices.

Risk, reward and retail contracts

Retail contracts can take many forms. Some are negotiated over portfolios; others are individual to buildings.

The best path forward weighs wholesale exposure, third party control and risk against opportunity and upside.

Traditionally, fixed cost contracts have offered more price certainty and fewer risks. This may be appropriate when costs are passed through to tenants. But for building owners seeking overall value, a higher exposure to the wholesale market can deliver dividends.

Fixed price and wholesale exposed retail contracts are fairly well understood by building owners. The role of the aggregator less so.

Aggregators are specialist third parties that can combine flexible energy assets and buildings into a VPP. These assets can include batteries, HVAC systems, electric vehicle chargers and other controllable loads.

By aggregating many assets together, VPPs can participate in wholesale energy and grid services markets that are typically inaccessible to individual building owners.

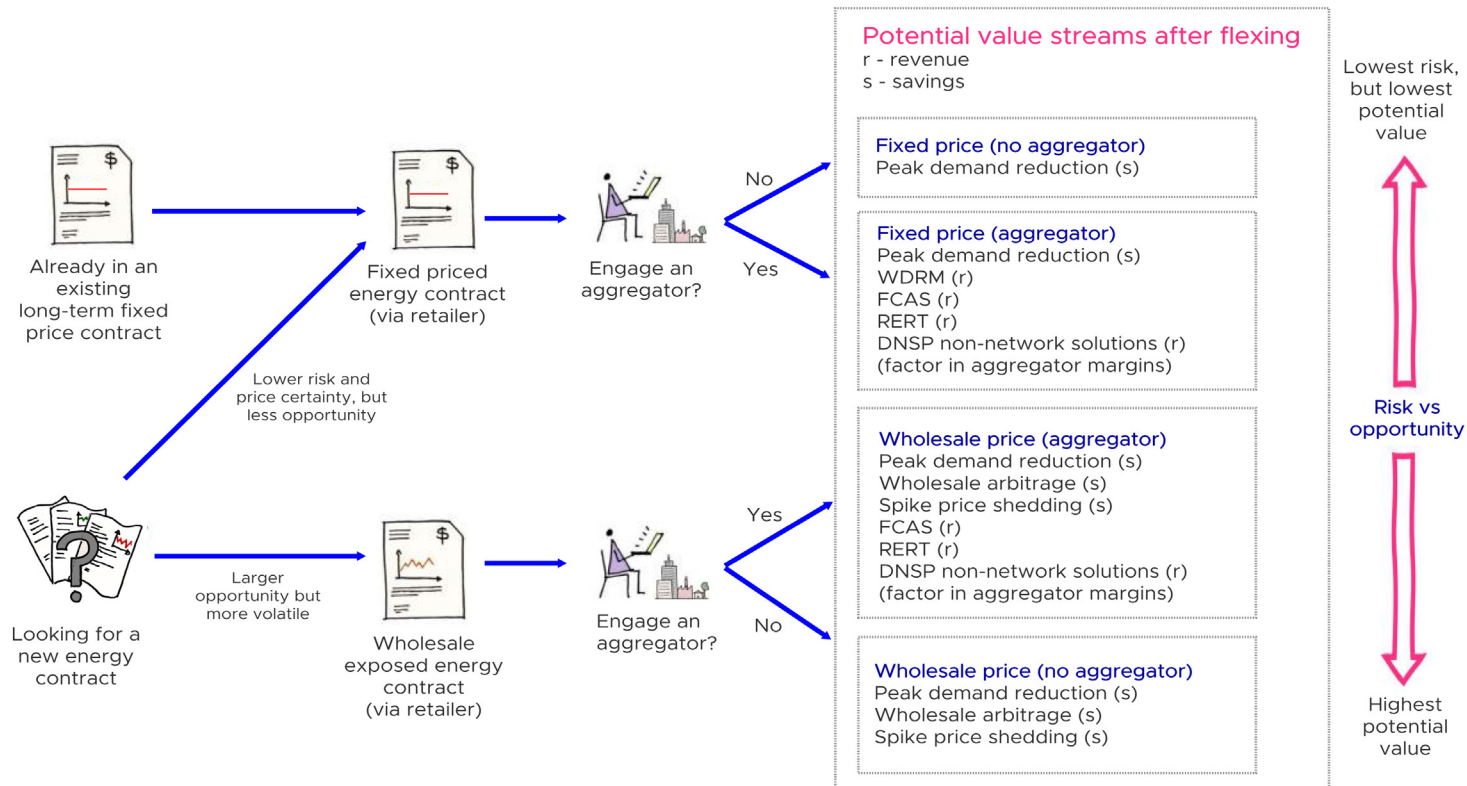
This can create additional revenue streams beyond the direct benefits of reducing peak demand or shifting energy consumption.

Potential revenue sources include:

- Wholesale Demand Response Mechanism (WDRM)⁵
- Frequency Controlled Ancillary Services (FCAS)
- Reliability and Emergency Reserve Trader (RERT).⁶

In return for providing market access, software platforms and operational expertise, aggregators typically retain a share of the value generated, commonly in the range of 15-35% of total benefits.

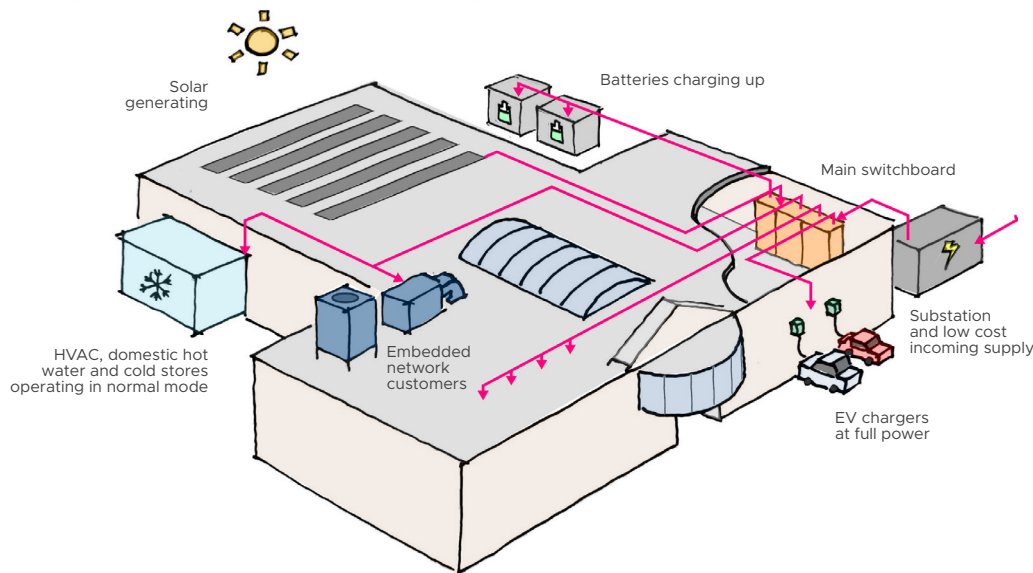
The value streams from aggregators is often hard to predict because a portion of their value proposition relies on the more bespoke and more often evolving AEMO secondary markets.



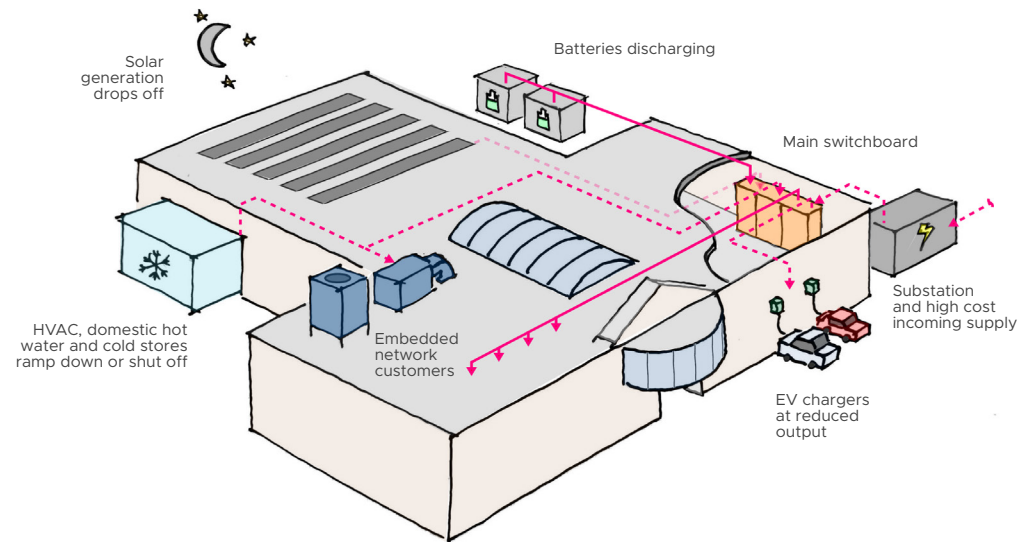
Shopping centre playbook

System	Recommended actions during high energy costs
Batteries	<p>Charge: During times of either over-solar generation or at times of low wholesale energy costs.</p> <p>Discharge Priority 1: Peak demand reduction (if peak demand on that day is at risk).</p> <p>Discharge Priority 2A: Response to high paying ancillary markets (e.g. FCAS, RERT, WSDR).</p> <p>Discharge Priority 2B: Response to wholesale energy spikes: discharge battery when wholesale prices are above \$500/MWh.</p> <p>Discharge Priority 3: Typical daily discharge: store when prices are cheap and discharge during peak energy window.</p>
HVAC systems	<p>During daily peak period: Expand temperature setpoints or “cruise” at ~50% operation (subject to lease conditions or pre-conditioning).</p> <p>During short >\$1000/MWh spike: consider cutting 100% of HVAC and relying on thermal inertia.</p>
Domestic hot water	Stop generation, rely on storage.
Cold storage	Stop generation, rely on system inertia.
Vehicle chargers	Reduce charging speed, depending on application and commercial charging arrangements. In the very near future, Vehicle to Grid (V2G) technology will allow building owners to use customer cars as batteries.
Controls and signals	<p>Controls can be via BMS or dedicated battery controllers. Aggregators and retailers can provide control systems based on AEMO market prices and predictions. Some top-tier mechanical contractors have started offering BMS patches to allow automatic control based off AEMO markets or external aggregator control.</p> <p>Note: Aggregators participating in secondary markets such as RERT, WSDR or FCAS may require enhanced control and signalling requirements.</p>

Daytime and low wholesale prices



Early evening and high wholesale prices



Case study: NSW shopping centre

ADP Consulting helped an NSW shopping centre owner investigate multiple energy procurement routes as part of an ongoing energy flexing strategy.

Our analysis showed the asset owner could potentially reduce energy costs by a third and the \$240,000 investment in batteries could be paid back in under 4 years.

Overview

- DNSP: Ausgrid
- 380kW peak demand
- \$200,000 annual electricity spend
- 200kW / 400kWh battery assessed (~\$240,000 installed)

Background and strategy

ADP Consulting analysed the centre's energy bills, load profile and tariff structure. Peak demand charges accounted for 45% of costs and wholesale energy a further 43%, making both strong targets for optimisation.

The key challenge was managing demand across Ausgrid's 3pm-9pm peak demand window. Three pathways were assessed: a conventional retail model; an aggregator-led VPP model; and full wholesale market exposure.

1. Existing fixed retail contract and battery

Lowest risk / simplest model

Battery used primarily for peak demand reduction, with limited HVAC load shifting.

Net annual benefit: ~17,000/year

Indicative payback: Less than 13 years, although most benefits flow to the retailer, who may in the future offer a more attractive fixed rate retail price.

2. Aggregator / VPP model

Moderate risk / outsourced optimisation

An aggregator controls the battery and instructs on flexible HVAC load as part of a broader VPP. Existing retail contract is maintained.

Potential value streams include:

- Demand response participation (WSDR)
- FCAS/RERT revenues and potential DNSP payments
- Peak demand reduction
- (Less aggregator fees of 20%)

Net annual benefit: ~\$46,000/year

Indicative payback: Around 5 years

3. Fully exposed behind-the-meter wholesale strategy

Highest complexity and exposure / strongest returns

The shopping centre directly participates in wholesale market.

Cost reductions include:

- Battery arbitrage
- HVAC load shifting and shedding
- Peak demand management

Net annual benefit after efficiencies: ~\$62,000/year

Indicative payback: Less than 4 years

Outcome

While full wholesale exposure offered the highest return, it was considered high-risk for the organisation at this stage.

An aggregator-led VPP model was selected, providing a strong balance of savings, revenue generation and risk management. If successful, the client intends to explore full wholesale market participation in the near future.

Right-sizing the battery

Battery sizing, costs and payback can vary depending on the building, tariff structure and commercial arrangements.

With potential paybacks ranging from less than 4 years to more than 10, it is important to understand the factors that influence battery performance and value.

Selecting the appropriate battery size requires knowledge of:

- Summer and winter load profiles
- Peak demand windows and tariff structures
- Commercial agreements and market participation
- Capability and limitations of electrical systems.

Final battery sizing should always be based on detailed optimisation modelling and sense checked against physical constraints on site and available products. The following section provides a high-level process for estimating an appropriate battery size.

Battery sizing is typically expressed as kW/kWh and requires the calculation of two key units:

kW rating: The battery's inverter capacity rating, which determines how fast it can charge or discharge

kWh rating: The battery's energy storage capacity (the inverter rating multiplied by hours of storage).

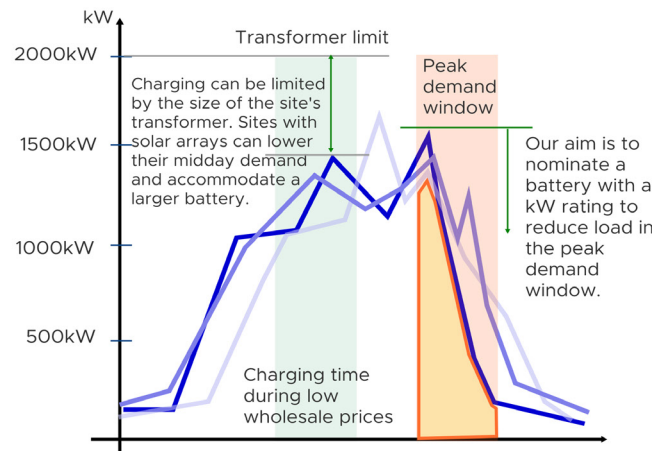
Factors that may drive a larger KW/kWh rating

- The size of the peak demand spikes that need to be reduced during the peak demand window. Larger demand peaks generally require larger batteries.
- The duration of the peak demand window. Longer peak periods require batteries with greater storage capacity.
- The opportunity for energy price arbitrage, as greater differences between low and high electricity prices increase the value of storing and shifting energy.
- Wholesale market exposure, as larger batteries limit risks.
- Government grants, funding or certificate schemes available, as these can change payback rates significantly.
- Solar availability on site, which can provide free charging and reduce transformer capacity constraints.

Factors that could limit the size of the battery

- The substation's transformer capacity
- The size and duration of winter load profiles
- The age and available capacity of spare breakers on the main switchboard. (See the following page for details).

Thinking about battery sizes by plotting peak days in summer



Insight: Separating building interventions from battery analysis

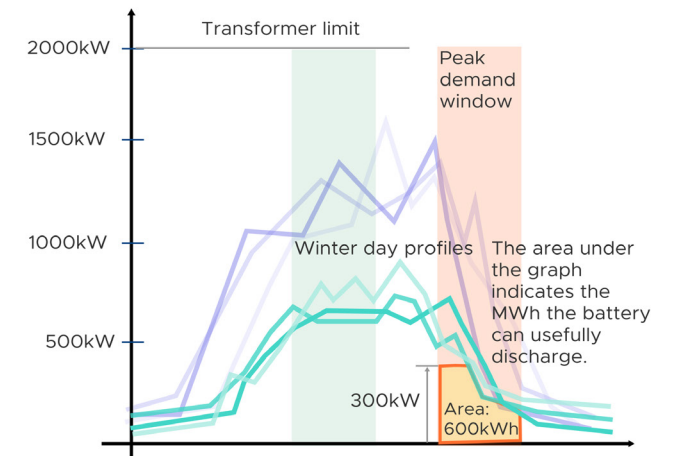
Battery economics should be analysed after calculating the benefits of building interventions, like HVAC optimisation and other BMS controls. Separating these helps avoid overstating the benefits of batteries and provides a more isolated assessment of battery payback.

Insight: Checking winter profiles helps spot oversizing

Battery paybacks are often around 5 years. Oversizing them can significantly extend that payback period.

Batteries used heavily during summer peaks may sit largely underused during winter. Reviewing winter demand profiles helps identify whether a battery's capacity is likely to be used consistently throughout the year.

Thinking about battery sizes by plotting days in winter



It's not just the battery

A desktop study of a battery can only do so much. Understanding the electrical on site and the commercial products available are just as important. The difference can be a payback of less than 5 years to over 10.

Vastly different paybacks

Asset type, load profile and commercial arrangement are critical to a battery's payback. For instance:

- A retail shopping centre operating from 9am to 9pm may recoup battery investment in under 5 years as part of a VPP or on a wholesale-exposed energy contract
- A commercial office building operating from 8.30am to 5.30pm on weekdays will likely have a 10-year payback or more.

Understanding electrical system architecture

Before sizing a battery, considerations include:

- Whether the site operates an embedded network, as this can allow greater battery arbitrage
- The metering architecture to determine the split between base-building and tenant loads
- Which loads, including HVAC and EV charging, can realistically be shifted or controlled
- Available capacity within the site's electrical infrastructure.

Battery installation costs

Battery prices continue to fall as more products come on to the market.⁷ But they do vary from site to site.

To install a commercial battery system, costs typically range from \$300 to \$800 per kWh installed. Lower costs typically correspond with larger installations (above 1MW) and simpler installations (where there are no switchboard modifications).

The big killers for battery installation costs

Batteries can quickly become expensive and non-viable. Three big items that can cause costs to rocket above \$1000/MWh include:

1. Main switchboard upgrades outside of CAPEX cycles, particularly ones that trigger a switch room redesign⁸
2. Roof locations requiring structural modifications
3. Internal locations requiring fire engineering and enhanced fire services to mitigate any danger.

Switchboards with "spares"

Modern switchboards (post-2015) with spare capacity can enable relatively straightforward battery installations of under \$500/MWh. Older switchboards may have physical limitations or compliance issues that require upgrades.

A switchboard manufactured before 2000 has a high likelihood of triggering a full upgrade, significantly influencing project economics. In these cases, timing the battery install with a main switchboard replacement may be the best option.



This 630Amp MSB spare was utilised for a 350kW battery.

Insight: V2G future

As electric vehicle adoption increases, V2G technology will allow parked vehicles to act as distributed batteries, providing energy and flexibility services to buildings. To facilitate this opportunity, new commercial models will need to be created.

This will include:

- Vehicles with bi-directional charging capability
- Appropriate regulatory frameworks and commercial agreements
- Systems that enable buildings to manage charging and discharging safely.

In the near term, fleet vehicles are likely to be the most practical application, providing a pathway to broader V2G adoption.



Which buildings should flex?

Type and profile matter. Buildings with larger loads that are operational between 5pm and 9pm are typically the best candidates.

Why? Because they have loads during the most volatile time of the market (during the early evening).

Many commercial offices don't meet this requirement, typically shutting, or at least ramping down, their plant around 5.30pm.

Buildings like retail shopping centres, airports and data centres make good flex candidates.

The following attributes have been found to be advantageous for flex:

- Larger building loads (to make the administration of flex worth it)
- 7 days per week operation
- Loads over the peak 5-9pm period that can be flexed or supplied with stored battery power
- Access to solar on site (this can both charge batteries for free or lower the peak demand of the site, allowing charging at low wholesale rates without tripping the maximum demand for the site)
- Central HVAC systems with modern BMS controls
- Buildings with embedded networks, large solar and storage that can take full advantage of large on-site solar by selling it on to their customers at retail rates
- Operating in a zone designated by a distributor or transmitter which is eligible for stability payments.

Understand the individual buildings

To understand the potential and costs of energy flexibility, building owners must understand their asset's ability to flex, generate and/or store electricity. To do that, engineers should analyse the following:

- The electrical infrastructure present at the site to understand if the main switchboard and setup can accommodate any required works
- The site's metering setup, including whether there are sufficient meters or an embedded network present
- The existing load profile of the building
- Existing control and metering systems present
- Large energy uses within the building (e.g. thermal plant or IT racks), and identifying flexible load possibilities
- Existing or proposed solar and EV installations
- Tenant, customer or operational constraints that limit flexibility
- Whether batteries or other forms of energy storage are viable for implementation.

Insight: Watch out for tariff changes

Keep an eye on your current tariff bands, as you may shift or shape your way out of them.

At a certain profile shape and usage, you may affect the network tariff that your building is on, and then all the rules will change.

What stacks up the best

The following attributes typically show great benefit when exploring energy flexibility.

Advantageous attributes	Typical office	Typical retail	Typical hotel	Airport	Data centre	Cold stores	Industrial
Large loads available to shift	Low	Medium	Low	High	Very high	Yes	Yes, if electrical loads are high
Hours of operation	8am - 6pm	10am - 9pm	24hrs	24hrs	24hrs	24hrs	Varies
Solar installations	Small	Large	Small	Large	No	No	Sometimes
Embedded networks	Typically not	Potentially	N/A	Yes	No	No	No
Vehicle chargers	Few	Many	Few	Many	No	No	No
Domestic hot water load	Medium	Low	High	Medium	Low	No	No
Pool facilities	No	No	Yes	No	No	No	No
Good candidate	Not usually	Yes (if operating after 6pm)	Yes	Yes	Yes	Yes	Maybe

Attributes that make flex more beneficial	Reason
Large electrical loads	Scale allows higher rewards and more operational efficiencies
Hours of operation during early evening	Allows arbitrage opportunities over the most volatile period of the day
Large solar arrays	Provides opportunities for batteries to store for free
DNSP offering network stability incentives	Some DNSPs offer incentives to assist with network stability
Location has access to state-based incentives	Different states have different incentives, grants and certificates available
Embedded networks	Allows greater landlord loads and potentially larger arbitrage opportunities
Energy usage profile has short high peaks	Potential to smooth energy profile, reducing demand charges over a billing period

Who benefits?

Flexing building loads with the grid benefits the whole energy ecosystem

- **AEMO:** Balances supply and demand across the National Energy Market (NEM), flattens out energy market spikes and improves electricity quality.
- **Generators:** Enable more solar and wind to be connected to the grid, reducing curtailment during peak renewable generation.

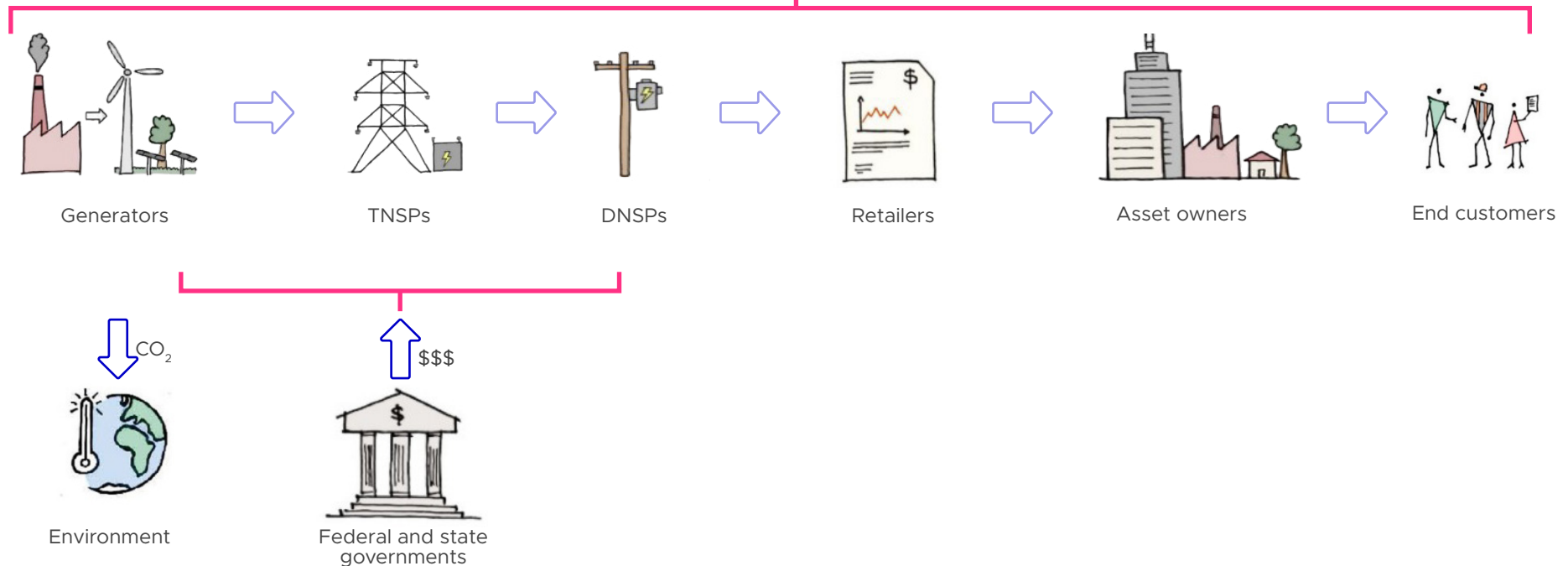
- **TNSPs:** Reduce strain on the high-voltage network by smoothing demand, helping to avoid large-scale outages and defer major infrastructure upgrades.
- **DNSPs:** Manage local network constraints by shaping demand at a community level, reducing maintenance requirements and delaying the need for network upgrades.
- **Retailers:** Protects exposed retailers from energy price spikes, which improves margins.
- **End customers:** Reduces bills, as PPAs and retailers charge less for energy, and associated network and environmental costs fall.
- **Federal and state governments:** Reduces the need for public investment in new infrastructure.

- **Environment:** Reduces greenhouse gas emissions by increasing the use of renewable energy and reducing reliance on fossil fuel generation.







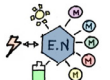




Flexing load adds significant value to third parties. On the following page, we identify mechanisms that allow asset owners to monetise the value they add to each member of the supply chain.



AEMO manages the National Energy Market (NEM)



The different mechanisms and pathways to be rewarded

Value lever	Stakeholder	Action	Value creation
Wholesale arbitrage	 Wholesale market (via AEMO)	Buy and store energy when prices are low, then use or sell when prices are high.	Captures price volatility in the market. Works best with storage and flexible loads.
Secondary market services (such as FCAS & RERT)	 Wholesale market (via AEMO)	Provide fast response (increase or decrease load) to help stabilise grid frequency.	Generates revenue from rapid response capability, independent of energy consumption.
PPA optimisation	 Generators and PPA providers	Align energy use with renewable generation profiles (e.g. daytime solar).	Reduces firming costs and enables cheaper or more favourable PPA terms.
TNSPs	 TNSPs	Reduce or shift load when requested to relieve network constraints.	Can generate payments for avoiding network stress or deferring infrastructure upgrades.
DNSPs	 DNSPs	Provide local demand response or manage exports in constrained areas.	Value is highly location-specific, but may include direct payments or avoided network charges.
Retail contract optimisation	 Energy retailers	Shape load profile to reduce risk for retailers (e.g. avoid peaks, increase flexibility).	Enables lower fixed rates or partial exposure to wholesale pricing.
Behind the meter optimisation	 Asset owners, tenants	Use onsite solar and storage to generate, store and supply energy within the building.	Captures margin between generation costs and retail pricing. Often strong returns, with regulatory consideration for embedded networks.
Tenant value and leasing	 Tenants and end users	Reduce and stabilise energy costs passed through via outgoings.	Lower costs, improve tenant satisfaction and can support leasing outcomes and asset value.
Carbon and Environment, Social and Governance (ESG) performance	 Asset owners, investors, tenants	Shift consumption towards lower-emissions periods and increase renewable use.	Reduces Scope 2 and Scope 3 emissions, supporting ESG targets and reducing reliance on offsets.
Government initiatives	 Government agencies, including the Australian Renewable Energy Agency (ARENA) and the Clean Energy Finance Corporation (CEFC)	Access grants, funding and certificate schemes.	Can offset upfront costs, though eligibility and access vary.
Aggregator-led participation	 Aggregators (third-party market operators)	Outsource participation in wholesale markets, including arbitrage, FCAS and demand response (e.g. WDRM).	Unlocks market revenue without managing complexity directly, subject to eligibility and performance.

Carbon, curtailment and coal minimisation

Today's carbon accounting misses the value of flexing. In the future, buildings that flex will realise a carbon benefit.

Most Australian building emissions are currently calculated using annual average emissions factors. In practice, this means a kilowatt-hour consumed at midday is treated the same as a kilowatt-hour consumed during the evening peak, despite their very different emissions profiles.

Under current carbon accounting, 100 MWh consumed during a solar-rich afternoon is treated the same as 100 MWh consumed during the fossil-fuelled evening peak.

This effect varies by building type. Offices, which consume more energy during daylight hours, naturally align more closely with renewable generation than hotels with evening demand.

ADP Consulting's analysis found that applying time-of-use carbon factors would reduce reported emissions for a typical office building by around 4% compared with a typical shopping centre, and by 10% compared with a typical hotel.

Energy flexing and time-of-use carbon

Energy flexing shifts electricity consumption towards periods of low carbon and away from high carbon. But energy flexing doesn't change carbon emissions if carbon calculations don't consider time-of-use.

Australia plans to move to time-of-use carbon reporting by 2031, with current renewable energy certificates to be replaced with Renewable Energy Guarantee of Origin (REGO) certificates with granular tracking for time-stamped, below baseline and stored renewable energy.

The new system will bring geographical complexities.

For example, Queensland and New South Wales currently present some of the greatest opportunities for carbon reductions from flexing, with high solar penetration combined with continued reliance on fossil-fuel generation during evening peak periods.

Batteries are more than a building asset

Battery storage does more than reduce a building's electricity costs.

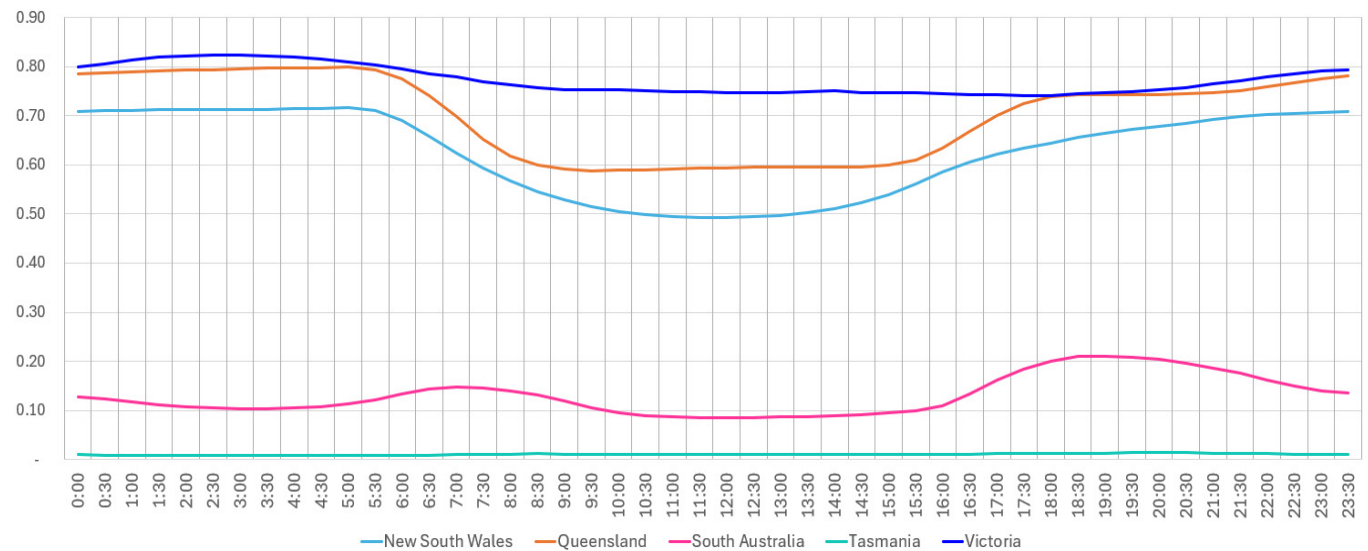
By storing excess solar generation and discharging during peak demand periods, batteries help reduce renewable energy curtailment and provide the flexibility needed to support a cleaner and more reliable electricity system.

Every megawatt of battery capacity installed in commercial buildings is capacity that does not need to be built elsewhere on the grid.

For this reason, commercial batteries are not only building assets, but critical energy transition infrastructure.

Carbon intensity over a year kg(CO2e)/kWh

Note: Graph ignores interconnectors, non-exported rooftop generation and network losses.





Store low, discharge high

When renewable generation is high, the proportion of renewables on the grid increases and carbon intensity falls. When renewable production is low, the system must rely on stored energy or fossil fuel generation to meet demand.

The wholesale electricity market, operated by AEMO, reflects this balance in real time (or, more precisely, every 5 minutes). Prices fall when renewable energy is abundant and rise when supply tightens, incentivising alternative generation or lower consumption. Energy bills are a combination of wholesale energy costs, distribution, transmission, metering and retail margin costs.

Typical grid day conditions

Under normal operating conditions, the grid delivers:

- Lower-carbon, lower-cost electricity during the day
- Higher-carbon, higher-cost electricity in the evening and overnight, with regular early evening peaks encouraging dispatchable generators to switch on.

Unusual grid events

At various points each year, the grid experiences atypical events caused by factors such as:

- Equipment failures
- Extreme weather or natural disasters
- Generator outages
- Unusual demand or supply conditions.

These events can trigger sudden changes in:

- Supply and generation availability
- Frequency, harmonics or power quality.

The consequences may include blackouts, equipment damage, and broader system impacts. Wholesale electricity prices and fast response ancillary markets (e.g. FCAS) often spike during these periods, rewarding assets and responses that can stabilise the grid.

To maintain system reliability, AEMO and network operators (TNSPs and DNSPs) must respond rapidly. They do so through investment in costly preventative infrastructure or by using market mechanisms to increase supply or reduce demand. Examples include:

- Wholesale energy market which balances supply with demand, increasing prices when demand is high, and lowering prices when demand drops
- Network support payments from TNSPs and DNSPs to maintain local network stability (sometimes called “non network solutions”).

Insight: Reviewing quotes, terms and conditions is a must

Retailers and aggregators often provide contracts and terms in a varying range of rates, margins, incentives and fixed costs.

It's critical to go into these meetings understanding what these are, what's good value and where incentives should be aligned.

This also allows for clearer comparison of multiple offers and a clearer knowledge of future savings or revenue.

Early evening volatility

There's a secret to maximising returns on energy assets: capitalise on rare sharp price spikes on the wholesale energy market.

Even though large spikes often only last 5-15 minutes, and occur historically 20-50 times a year, over 25% of a building's yearly value can be captured from these moments.

The most basic way to financially benefit from energy flex or battery storage is to store energy when it's cheap, and then use it within your building later when the wholesale market is more expensive. This is known as arbitrage.

Typical day

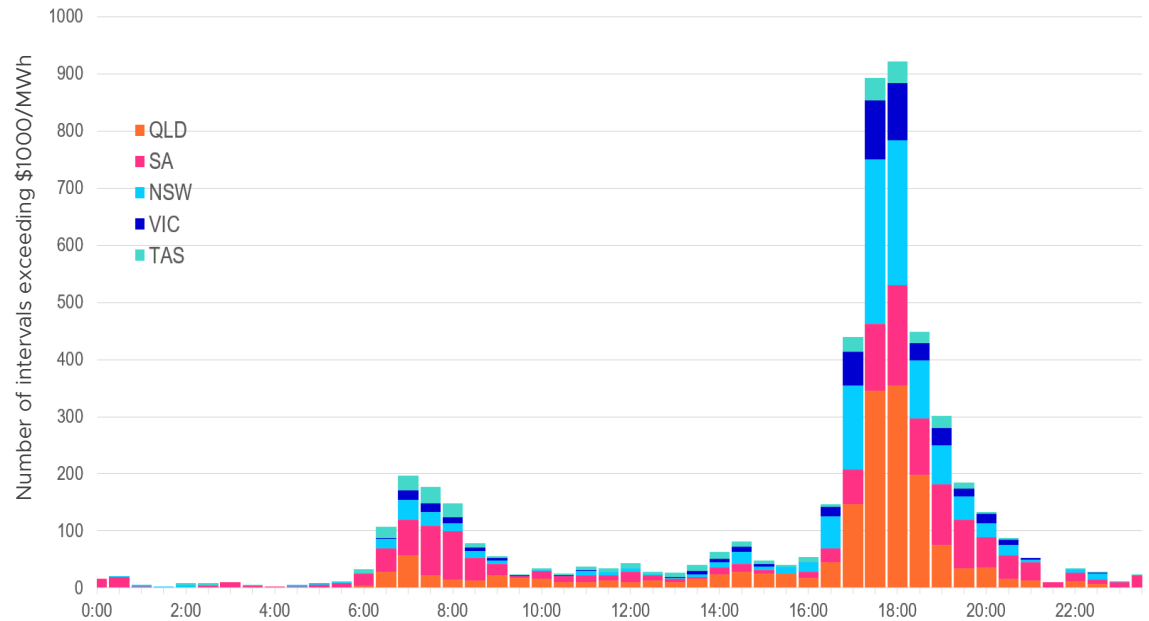
On a typical day, the wholesale energy market ranges from negative \$50/MWh to about \$200/MWh peaking as the sun goes down.

Grid 'event' day

Around 20 times a year, depending on the year and the state, the wholesale energy price rises above \$1,000/MWh, and escalates up to \$20,300/MWh. Roughly half of these grid "spikes" occur between 5pm and 8pm. Shifting loads or using stored energy during these brief periods can result in substantial energy savings.

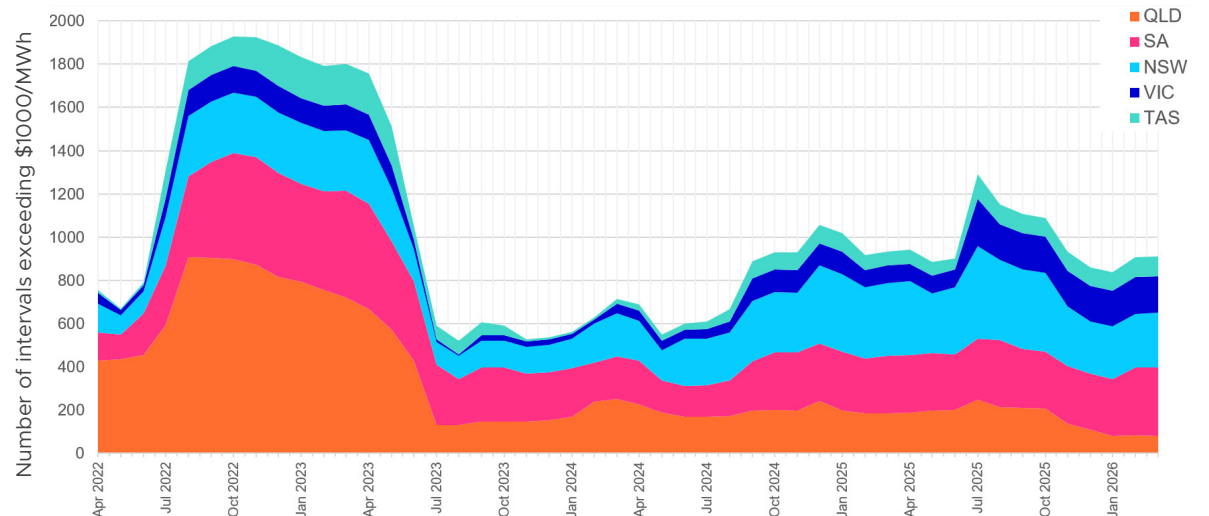
Wholesale price spikes generally occur between 6am and 9am and between 5pm and 9pm

Count of 5 min intervals > \$1000, 2021 to Apr 2025



The wholesale market has been somewhat consistent over the last three years, but this is not a guarantee of consistency in the future

Count of 5 min intervals > \$1000, Apr 2022 to Apr 2025



Making it work at scale

VPPs aggregate distributed batteries and flexible loads so they can operate collectively as a single, grid-scale asset.

VPPs provide a practical pathway for portfolios to participate in energy and network markets without each asset needing to engage directly.

Wholesale Demand Response Mechanism

One of the most relevant mechanisms for large private assets is the WDRM.

Under the WDRM, aggregated loads are paid to reduce consumption during high-price or supply-constrained periods. These reductions are treated as a virtual generator in the wholesale market, allowing building owners to monetise demand flexibility without exposure to full wholesale price risk.

Note: Many buildings may not be eligible, depending on baseline performance and measurement requirements.

Aggregators

Due to the technical, regulatory and market complexity, participation is usually managed by specialist aggregators. Aggregators handle forecasting, dispatch, compliance and settlement. They remotely control assets via inverter platforms, control systems or BMS interfaces. This simplifies market access and risk management for building owners, while enabling portfolios of buildings to respond coherently to price signals and grid events.

Grants, funding and monetising certificates

Accessing grants and monetising certificates is central to the business case for solar, battery storage and energy flexibility projects in Australia.

A mix of federal bodies, market operators and state regulators underpin these schemes, each playing a distinct role across funding, certification and compliance.

Savings from grants and certificates can range from 5-50%, making a material impact on viability. However, eligibility can be complex, and many schemes are not available to private organisations. Early investigation is essential before including these benefits in a business case.

Savings via grants and certificates for projects can range from 5-50%, drastically changing any business case.

Funding and grants

Funding for larger, more impactful and more innovative projects is available – particularly through AEMO (via trials or schemes), ARENA and CEFC.

Certificates (generation and monetisation)

Australia has a range of federal and state-based certificate schemes that can improve project economics.

These include:

- **Large-scale Generation Certificates (LGCs)** – generated by accredited large-scale renewable energy projects such as solar and wind farms.
- **Small-scale Technology Certificates (STCs)** – created through the installation of eligible small-scale renewable energy systems, including rooftop solar.
- **Australian Carbon Credit Units (ACCUs)** – generated through approved carbon abatement projects.
- **Energy Savings Certificates (ESCs)** in New South Wales and Victorian Energy Efficiency Certificates (VEECs) in Victoria – generated through eligible energy efficiency activities.

- **Peak Demand Reduction Scheme (PDRS)** in New South Wales provides further incentives for reducing peak demand during critical times.

These certificates can be sold to retailers and other market participants, creating an additional revenue stream or reducing project costs.

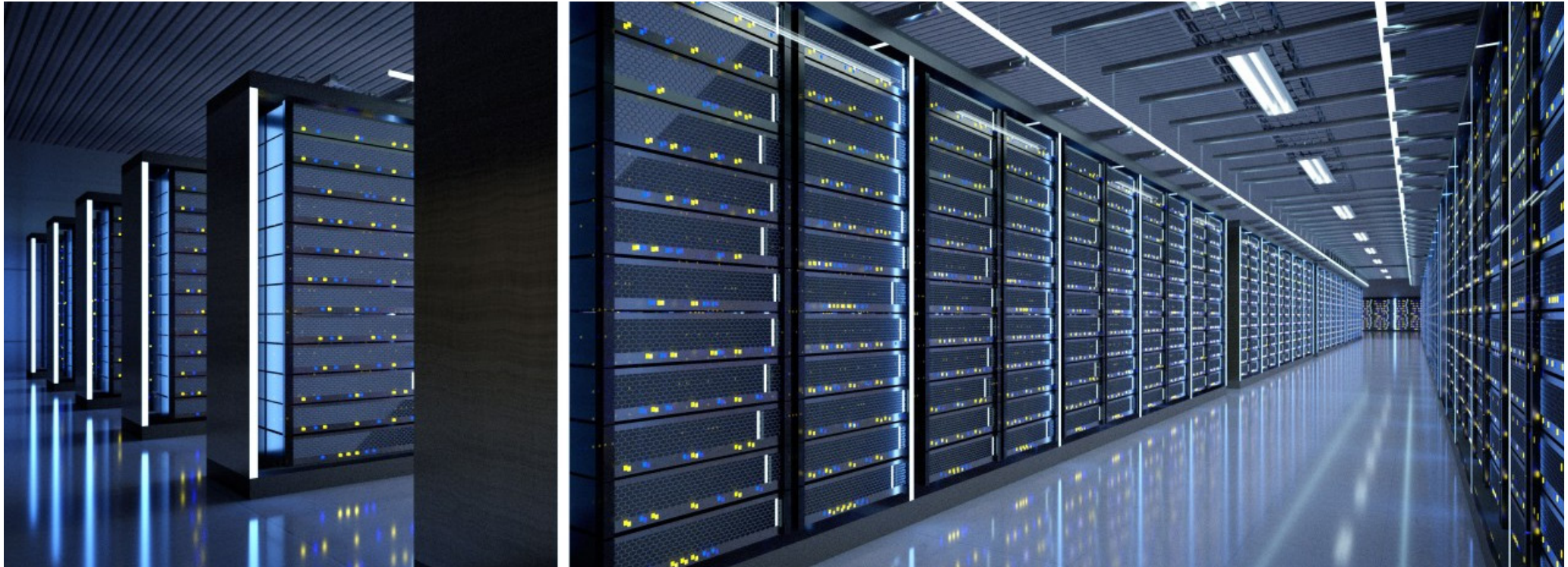
It is important to understand who owns the certificates generated by a project. In some cases, their value may be retained by the asset owner. In others, it may be transferred to a contractor, installer or third-party provider as part of a commercial agreement.

The certificate landscape is evolving. REGO certificates will replace LGCs by 2031, introducing a new framework for tracking and trading renewable electricity attributes. More on this on page 23.

Larger loads in specific regions of the grid

In parallel, distributors and transmitters increasingly offer payments for network stability, particularly in constrained zones where local demand reduction or fast-response support can defer expensive network upgrades. These arrangements (often referred to as “non-network solutions”) are typically location-specific and require reliable, dispatchable response.

Distributors and transmitters will pay building owners to avoid their own capital expenses or to avoid fines from network outages or drops in power quality.



Co-location of data centres and batteries

Data centres have big loads and 24/7 operation. That makes them great flexing candidates.

In March 2026, the federal government released its *Expectations of data centres and AI infrastructure developers*.⁹ This encourages developers to:

- Minimise energy demand and emissions by adopting industry-leading efficiency measures and technologies
- Improve the overall security and stability of the energy grid, including by enhancing demand flexibility and opportunities for peak-load management and appropriate sharing of consumption data.

Furthermore, transmitters and distributors are starting to request on-site batteries to minimise peak loads and respond during grid events.

Data centres are excellent candidates for co-location of batteries for the following reasons:

- They already have a site connection sized for a large battery
- They can reduce peak loading and risks for distributors and transmitters, potentially lowering cost and assisting connection
- They can form part of an ESG offering
- The site is already set up with advanced controls and metering, allowing for more sophisticated multi-day arbitrage
- They have a load profile that makes them ideal to benefit from daily arbitrage
- They are likely able to access government grants (such as from ARENA, AEMO or CEFC)
- Their load profiles are large enough to warrant control strategies beyond simple arbitrage to include reduced peak demand charges and network stability payments
- Standalone Uninterrupted Power Supply (UPS) can be replaced with co-located batteries
- They result in lower costs for end customers!

Further changes are on the way

Australia's energy market is in a state of flux, with market participation, technology improvements, scheduled works and regulatory reform happening simultaneously. Successful energy procurement and asset management will need to keep on top of one of Australia's most complex and fast-paced industries.

National level

- Ongoing decarbonisation will accelerate fossil fuel plant closures, leading to further grid stability challenges.
- Real-time carbon intensity is gaining regulatory attention and may, at some point, replace flat-emission reporting currently in the Australian Sustainability Reporting Standards (ASRS), as identified for implementation in 2030.
- New incentive and funding schemes are emerging, (although, historically, these schemes have favoured residential or large industrial customers).¹⁰
- Rating tools such as Green Star are expanding focus on time of use through leadership challenges and additional performance points.¹¹
- NABERS is currently consulting with industry about how to incorporate real-time carbon into the NABERS Renewable Energy Indicator.

- AEMO will tighten regulation on data centres and likely enforce levels of grid interactivity.
- FCAS markets, historically highly profitable for early movers, have become more competitive with increased participation and therefore large-scale batteries have reduced marginal returns.¹²
- Residential battery uptake is materially changing market behaviour and volatility.
- Electric vehicle charging is incorporating V2G and Vehicle-to-Load (V2L).

Local market level

- More retailers are offering partial or full wholesale market exposure to customers. As customers become more aware and sophisticated in their procurement choices and the conditions attached. The implication: risk and reward are increasingly shifting to asset owners.
- Grid reliability will increasingly rely on flexible demand, and distributors and transmitters will likely offer more network support and stability payments to maintain network stability or avoid costly upgrades. For example, some distributors are paying to take loads when local solar generation is high. CitiPower in Melbourne, for instance, is moving towards flexible tariffs.¹³
- Electrification (changing gas-heating to heat pumps) will drive new morning and evening demand peaks, in turn incentivising office owners to store energy during the day and use it when its most needed.
- Asset owners are becoming increasingly aware of energy prices and demand response.
- Batteries have fallen in price over the past 10 years, improving project viability.¹⁴

The need for real-time carbon reporting

Accurate carbon reporting requires time-resolved energy analysis, rather than the flat average carbon-intensity factors currently used to calculate Scope 1 and 2 emissions in the ASRS.

Australia's Renewable Energy Target (RET) scheme ends in 2030.¹⁵ From 2031, LGCs will be fully replaced by REGO certificates, offering granular tracking for time-stamped, below-baseline, and stored renewable energy.

This will have two big effects:

1. Reporting of carbon will become far more complex, with renewable sources able to operate during high wholesale prices and batteries receiving an enhanced premium.
2. Different assets will either increase or decrease their carbon emissions depending on their time of use. For example offices, which operate mainly during the day will have their carbon usage dropped significantly (~25% real-time carbon reduction) and nighttime buildings such as hotels will increase their carbon emissions.

Energy flexibility is creating new opportunities for building owners to reduce costs, generate revenue and improve resilience. The challenge is knowing where to start.

ADP Consulting can help.

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Glossary of terms

ACCU (Australian Carbon Credit Unit) A tradable unit representing one tonne of carbon dioxide equivalent (CO₂-e) avoided or removed.

AEMO (Australian Energy Market Operator) Operates Australia's electricity and gas markets and manages real-time grid balance.

Aggregator A third-party operator that combines multiple assets (e.g. buildings, batteries) to participate in energy markets.

ARENA (Australian Renewable Energy Agency) Provides funding and support for renewable energy and emerging technologies.

ASRS (Australian Sustainability Reporting Standards) Mandatory and voluntary standards set by the Australian Accounting Standards Board, for disclosing climate and sustainability-related risks.

BMS (Building Management System) A central control system for building services, including HVAC, lighting and energy.

CER (Clean Energy Regulator) Administers national schemes such as carbon credits and renewable energy certificates.

CEFC (Clean Energy Finance Corporation) A government-backed investor that finances clean energy and low-emissions projects.

Carbon intensity The amount of greenhouse gas emissions produced per unit of electricity consumed.

Dispatchable generation Power sources that can be turned on or off on demand (e.g. gas-fired generation).

DNSP (Distribution Network Service Provider) Operates local electricity networks that deliver power to homes and businesses.

Embedded network A private electricity network within a site (e.g. a shopping centre) where the owner can supply power to tenants.

Energy arbitrage Buying or storing energy when prices are low and using or selling it when prices are high.

ESC (Energy Savings Certificate) A tradable certificate created through energy efficiency projects in New South Wales.

ESG (Environmental, Social and Governance) A framework used to assess an organisation's environmental, social and governance performance.

FCAS (Frequency Control Ancillary Services) Markets that pay for fast-response actions to maintain grid frequency.

Firming The process of balancing intermittent renewable energy with storage or other generation to ensure reliability.

Flexible load The ability to adjust energy consumption in response to price signals or grid needs.

Grid frequency The operating frequency of the electricity system (50 Hz in Australia), which must remain stable.

HVAC (Heating, Ventilation and Air Conditioning) Systems that manage indoor climate. Often the largest energy load in a building and a primary opportunity for load shifting and demand response.

LGC (Large-scale Generation Certificate) A tradable certificate for electricity generated from large-scale renewable energy sources.

Load shifting Changing when energy is used to avoid peak periods or align with lower prices.

Maximum demand charges Charges based on the highest level of electricity demand during a billing period.

NEM (National Electricity Market) The interconnected electricity market across eastern and southern Australia.

Network support payments Payments made by network operators to reduce load or support grid stability in specific locations.

Non-dispatchable generation Generation that depends on natural conditions (e.g. solar and wind).

Non-network solutions Alternatives to building new network infrastructure, such as reducing or shifting demand.

NSP (Network Service Provider) A general term for companies that operate electricity networks, including transmission and distribution.

PPA (Power Purchase Agreement) A long-term contract to buy electricity, often linked to renewable energy generation.

REGO (Renewable Energy Guarantee of Origin) A certificate that records when and where renewable electricity is generated, stored or used, enabling more granular tracking of renewable energy attributes.

RERT (Reliability and Emergency Reserve Trader) A function conferred on AEMO to maintain power system reliability and system security using reserve contracts.

Retailer Buys electricity from the wholesale market and sells it to customers under retail contracts.

RET (Renewable Energy Target) Australia's renewable energy certificate scheme, which supports renewable electricity generation and ends in 2030.

Scope 1 emissions Direct greenhouse gas emissions from sources owned or controlled by an organisation (e.g. on-site fuel use).

Scope 2 emissions Indirect emissions from the generation of purchased electricity.

Scope 3 emissions Indirect emissions across the value chain (e.g. tenant energy use).

STC (Small-scale Technology Certificate) A certificate created for small-scale renewable systems such as rooftop solar.

Tariff The pricing structure for electricity, including energy charges and demand charges.

UPS (Uninterruptible Power Supply) A battery-backed power system that provides temporary electricity during outages or power quality disturbances.

TNSP (Transmission Network Service Provider) Operates high-voltage transmission networks that transport electricity over long distances.

V2G (Vehicle-to-Grid) Electric vehicles supplying energy to the grid.

V2L (Vehicle-to-Load) Electric vehicles supplying energy directly to a building or device.

VEEC (Victorian Energy Efficiency Certificate) A tradable certificate created through energy efficiency projects in Victoria.

VPP (Virtual Power Plant) A network of distributed energy resources that operate collectively as a single asset.

VWAP (Volume Weighted Average Price) The average wholesale electricity price over a period, weighted by the amount of energy consumed at each price point.

WDRM (Wholesale Demand Response Mechanism) A market mechanism that pays large energy users to reduce demand during high-price or constrained periods.

Wholesale energy market Where electricity is bought and sold in real time, with prices varying based on supply and demand.

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Special thanks to

Grid-interactivity is a complex topic that requires the energy sector, building sector and policy makers to come together.

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