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# Keeping the power on

Prepare today for potential brownouts and blackouts in times of power uncertainty.

NOVEMBER 2017

AN ENERGY POWER SYSTEMS AUSTRALIA WHITE PAPER

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Energy Power  
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**“The Australian Energy Market Operator (AEMO) forecasts a potential supply shortfall in Victoria and South Australia following the closure of the Hazelwood Power Station. This has raised concerns about the NEM’s ability to maintain a reliable electricity supply during the FY2018 summer. Prudent actions are required to manage this risk.”<sup>1</sup>**

**Independent Review into the Future Security of the National Electricity Market: Blueprint for the Future.**

DEPARTMENT OF THE ENVIRONMENT AND ENERGY, JUNE 2017

## Protecting and preparing your power from grid instability and weather

Never has there been a time when investing in generators, batteries or other emergency power sources been more hotly debated – and for good reason. Uncertainty around viability of new generation investment and coal plant closures is contributing to a generation mix increasingly reliant on intermittent renewable energy.

Following Federal Government Chief Scientist Alan Finkel’s review into the National Electricity Market (NEM)—which powers customers in Queensland, NSW, Victoria, South Australia and Tasmania—concerns about the power crisis have escalated; especially for summer.

Then, in firm acknowledgement of the crisis, the Government announced a program to pay households and businesses across NSW, Victoria and South Australia to turn down air conditioning, furnaces and cool rooms to stave off blackouts during peak demand. This is a sure sign of the energy crisis – skyrocketing power prices and grid instability exacerbated by our tedious relationship with Mother Nature.

As those three states look to measures to prevent summer blackouts, among many trial projects, large-scale industrial and commercial businesses will have hardware installed to automatically and remotely control and reduce energy.

**We’re at the forefront of the energy transition to support businesses—large and small**

At Energy Power Systems Australia (EPSA), we supply Cat® power generators for hire or purchase as new or used. They suit any business or application backed by cutting-edge technology. We also offer reliable HVAC equipment for temperature control – crucial for productivity, efficiency and safety in the workplace along with air compressors that cater to almost any pressure and air flow.

For customers unprepared due to a brownout, blackout or summer storm, we can supply emergency power generation for as long as required, and provide urgent equipment 24/7 to minimise downtime during unplanned outages.

Caterpillar® are also leading the global charge to integrate renewable power with smart energy storage and conventional diesel or gas-fuelled power generation. EPSA is the sole Australian distributor of the Cat® Microgrid system, which contains solar photovoltaic solar and energy storage for increased energy efficiency with no reliance on the grid.

**The grid is getting complicated and climate change is more erratic**

This makes predicting energy supply and demand to maintain balance and pricing more challenging. In this white paper, we examine the status quo in Australia, identify the headwinds, and reveal solutions for businesses to ensure reliability, stability and be prepared for what’s to come.

**Phil Canning**  
Managing Director

1. Dr A Finkel, K Moses, C Munro, T Effenev, Prof M O’Kane, [Independent Review into the Future Security of the National Electricity Market: Blueprint for the Future](#), Australian Government, Department of the Environment and Energy, June 2017, viewed 17 November 2017



## Australia has long been battered by extreme weather impacting power

Heatwaves pose the most significant threat to the power system at a bulk supply level. But other weather-related events can be just as damaging. Bushfires and smoke may damage infrastructure; transmission lines can trigger shutdowns to prevent damage and safety of personnel; cyclones can damage power stations, substations and transmission lines, resulting in a loss of generation or ability to transmit power; while floods can lead to damage to electricity infrastructure, resulting in repairs or rebuilds and disconnection in areas not directly affected. And drought causes problems too. It can reduce the generating capacity of both hydro and thermal generation.<sup>2</sup>



**“Delivering a secure and reliable electricity supply is the highest priority. Low emissions and affordable supply must be delivered through a power system that is secure and reliable. While delivering 100 per cent reliability would be prohibitively expensive, it is also clear that there is no public appetite for a reduction in delivered levels of reliability.”<sup>3</sup>**

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### The power system is undergoing significant transformation

According to AEMO<sup>4</sup>, key factors changing the dynamics of the power system include:

- » retirement of an ageing traditional power generation fleet
- » flattening grid demand growth
- » increasing prices in domestic gas due to international LNG markets
- » rapid growth of variable renewable energy resources
- » increased penetration of rooftop solar
- » advances in storage capability
- » ability to access and exploit increasingly large amounts of data.

### Older baseload units are not suitable in the medium to longer term

They need high production levels, stable revenues and are not suited to varying energy system needs and potential falling costs of competitive sources. 5,199 MW of National Electricity Market (NEM) baseload generation has already retired and replaced with:

- » 2,895 MW of gas-fired generation
- » 273 MW of hydro
- » 91 MW of liquid fuel
- » 2,965 MW of wind
- » 265 MW grid scale solar
- » 186 MW of other sources (i.e. biomass).<sup>5</sup>

### Greater understanding is required into renewable generation and power system security

The NEM was designed in the 1990s when large centralised generation (coal, gas and hydro) supplied almost all electricity but the last decade has brought about a decline in traditional coal and gas-fired generation and significant increases in variable renewable electricity, which require new security and technical services.<sup>6</sup>

- » Growth in rooftop solar photovoltaic units on the NEM increased exponentially in the past decade.<sup>7</sup>
- » Solar and wind generators can pump cheaper electricity into the system but is often at unpredictable times and quantities.
- » Australia is one of “the most attractive countries for renewable energy investment”<sup>8</sup> with record sums (\$7.5 billion+) committed to large-scale wind and solar, and rooftop installations over 2017, taking Australia to fifth in the world from 11th in October 2016.<sup>9</sup>
- » Battery and pumped hydro storage will be able to support a reliable and secure NEM, as and when they are deployed at scale.<sup>10</sup>

### Price pressures are motivating consumers to take greater control of energy consumption

The rate of rooftop solar photovoltaic and battery storage system installation is indicative of this trend. Growing unreliability is also influencing proactive planning by businesses as they seek solutions to address the consequences and costs of unplanned blackouts or power disruption.

2. Finkel, *ibid* 3. Finkel, *ibid* 4. A Zibelman, *Advice to the Commonwealth relating to Australia's National Energy Market*, Australian Energy Market Operator, 4 September 2017, viewed 17 November 2017 5. Zibelman, *ibid* 6. Finkel, *ibid* 7. From 14,064 units in 2008 to 1,691,840 units in 2017 (estimated output of 4,917 MW). Cited in Zibelman, *ibid* 8. Ernst & Young's Renewable Energy Attractiveness Index released in May 2017 cited in G Parkinson, *Australia leaps up global renewable energy investment rankings*, Renew Economy, 17 May 2017, viewed 2 November 2017 9. Parkinson, *ibid* 10. Finkel, *ibid*

## Energy pricing and extreme weather are major risk concerns for almost 1 in every 3 Australian businesses

### Top 5 risks for doing business in Australia over the next decade

Asset bubble 46%

Fiscal crisis 43.7%

Cyberattacks 34.5%

Energy price shock 32.2%

Extreme weather events 31%

The World Economic Forum's 2017 Global Risk Report asked respondents to select the five global risks they're most concerned about for doing business in their country within the next 10 years. The share is the percentage of respondents selecting the risk among the five of highest concern.<sup>11</sup>

In September 2017, AEMO released its 10-year outlook<sup>12</sup> for the NEM identifying that Australia's growing energy challenge looks set to peak in summer 2017-18 and 2018-19.

#### 1. Climatic vulnerability is unprecedented

The overall responsiveness of the electricity system is at risk from increased vulnerability to climatic events, such as extended periods of high temperatures, and the risk of loss of, or reduction in, output of major generation units. Grid disconnection is most likely on days of Code Red or high-risk conditions.

#### 2. Firming capability is essential in peak summer periods

Targeted actions are necessary to provide additional firming capability (i.e. generation on the grid, storage, demand resources behind the meter, flexible demand, or flexible network capability) to reduce risks of supply interruptions and maintain grid balance.

#### 3. Victoria and South Australia are at highest risk for summer 2017-18

The highest forecast Unserved Energy (USE) risk (energy that cannot be supplied to consumers resulting in involuntary load shedding) is for summer 2017-18, although the South Australian Energy Plan will help alleviate risks to consumer supply with development of additional diesel generation and battery storage. AEMO is also pursuing supply and demand response where customers are paid to decrease load during actual or forecast supply shortfalls in both states.

#### 4. Retirement of coal generation in NSW will increase risk of load shedding from 2022

The potential for USE will likely increase in NSW and Victoria after the Liddell Power Station closes in 2022. Retirement of other coal generation in NSW after 2022 could also significantly increase the risk of load shedding.

#### 5. A strategic reserve will continue to be required in summers beyond 2017-18

The amount will progressively reduce over the four summers to 2021-22 as peak demand continues to be moderated by additional rooftop photovoltaic, new large-scale renewable generation, and ongoing energy efficiency improvements. It will then increase again in NSW and Victoria after the Liddell Power Station closes.<sup>13</sup>

**"Rural businesses switch to diesel as electricity prices soar."<sup>14</sup>**

ABC NEWS, 9 MARCH 2017

11. World Economic Forum, [Global Risks of Highest Concern for Doing Business \(Australia\)](#) Global Risks Report 2017, viewed 31 October 2017 12. AEMO, [Electricity Statement of Opportunities for the National Energy Market](#), September 2017, viewed 9 November 2017 13. This may be extended to ensure energy system security based on current forecasts. 14. J Barbour, [Rural businesses switch to diesel as electricity prices soar](#), ABC News, 9 March 2017





**VICTORIA A black hole**

- » On 1 December 2016, a transmission failure in western Victoria shutdown the Heywood interconnector. With reduced supply available, load-shedding was needed to balance the network in both Victoria and South Australia – Alcoa's Portland aluminium smelter lost power for the first time in its 30-year history.<sup>15</sup>
- » In March 2017, the 1,600 MW Hazelwood power station closed in Victoria's La Trobe Valley. AEMO advised there is sufficient generation to meet maximum demand and forecast the closure will put Victoria's firm capacity reserves at -145 MW.<sup>16</sup>
- » The closure of Hazelwood – the ninth power plant to close in five years – removed a combined 5,400 MW of generation from the grid. There are three brown coal-fired generators remaining in the La Trobe Valley.<sup>17</sup>
- » Victoria has 1,377.8 MW of large-scale renewable energy capacity installed (excluding hydro).<sup>18</sup>
- » Wind farm planning restrictions between August 2011 and March 2015 saw only two small wind farms approved during that period.<sup>19</sup>

**SOUTH AUSTRALIA Blackouts and batteries**

- » South Australia is now powered by just a mix of wind, solar and gas after the closure of the power station at Port Augusta effectively removed coal power generation from the state's electricity production equation.
- » 40 per cent comes from wind and solar with possible construction of more wind farms.<sup>23</sup>
- » South Australian's 1.7 million residents were left without power following severe storms in September 2016 after three elements of critical infrastructure were destroyed contributing to the power system protecting itself by shutting down.
- » The state's renewables-heavy power mix was a factor in the September blackout according to AEMO.<sup>24</sup>
- » Load shedding enforced by AEMO to ensure enough power to cover peak demand during heatwaves in February 2017 caused blackouts affecting around 90,000 households and businesses – the third major incident since the statewide blackout.<sup>25</sup>
- » The State Government will spend more than \$500 million to build a new 250 MW gas-fired power plant.<sup>26</sup>
- » The 'world's biggest' lithium-ion battery is to be built in South Australia by Tesla and French company Neoen.

**NEW SOUTH WALES A bleak future**

- » The looming shutdown of Australia's third largest power station at Liddell in the Hunter Valley in 2022 will leave a huge 2,000 MW generating capacity shortfall – the Federal Government is in talks to extend Liddell's life until at least 2027.<sup>20</sup>
- » The Federal Government has a \$2 billion plan to expand the Snowy Mountains hydro scheme to increase the current 4,000 MW output of the scheme by 50 per cent in a bid to power up to 500,000 homes.<sup>21</sup>
- » In February 2017, parts of NSW reached 42°C causing load shedding – wind generation was below forecast, solar PV generation was declining in the late afternoon, some thermal generators were at reduced capacity due to high temperatures and two gas-fired generators weren't working.<sup>22</sup>

**TASMANIA Relying on rainfall**

- » Tasmania is the Australia's leader in renewable energy (95 per cent) largely acquired from baseload hydro power.<sup>27</sup>
- » In December 2015, Tasmania was suddenly cut-off from mainland energy supply when the Basslink interconnector suffered its first ever extended fault, leaving the state reliant on its vast hydropower network during its driest spring on record when hydropower storages dwindled to a record low.
- » In response, the Tasmanian Government established the Tasmanian Energy Security Taskforce whose interim report released in December 2016 assesses that 'there are no immediate threats to energy security in Tasmania' but calls for 'more conservative' energy security settings due to the unique characteristics of the state's energy system.<sup>28</sup>

## Businesses need power and partners that they can rely on

**Disaster response**

Immediate response to disasters and emergencies across Australia—no matter the location—is critical. EPSA has long supported businesses and people affected by natural disaster with 24/7 back-up power generation including during the 2015 Newcastle floods, Cyclone Yasi in Far North Queensland in 2011, the 2008 Victorian Black Saturday bushfires and Cyclone Winston in Fiji in 2016.

**24/7 support**

When power failure occurs, it's critical to have a partner who can work with authorities and businesses to provide temporary back-up power - and fast. To support Tasmania during its 2015 statewide power shortage, EPSA set up two temporary power stations of 35 Cat® generators in 28 days and deployed 40 specialised people across multiple disciplines. EPSA also supported South Australian businesses during its 2016 statewide blackout. All EPSA's Cat® generators started automatically and all emergency requests were supported.

**Standby power**

When it comes to reliability and uninterrupted power supply, it's vital to have a back-up genset from a partner renowned for quality and reliable products, service and support. EPSA has installed Cat® back-up generators for essential services organisations across Australia including aged care facilities, waste and water treatment plants, hospitals, data centres, telcos and financial institutions.

**Future focused**

The current state of the NEM means now is the time to think to the future. Those businesses and authorities that do will have the edge. EPSA is taking a leading role with site works commencing on its first solar array project for Joule Energy in South Australia - a collaborative development of a combined solar and methane power plant. Internationally, EPSA has also developed off-grid power support for Yap Island and the Solomon Islands and worked on a coconut-fuelled generation solution also for the Solomons.



**“Heatwaves and the number of extreme fire weather days in Australia are increasing and the fire season is becoming longer.<sup>29</sup> There is also a strong correlation between hot weather events and increased demand for electricity, primarily driven by an increase in air conditioning loads.”<sup>30</sup>**

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15. T Wood, D Blowers, *Powering through: how to restore confidence in the National Electricity Market*, The Grattan Institute, May 2017 16. Australian Energy Council, *Heatwaves and Electricity Supply*, December 2016 17. C Uhlmann, *Hazelwood's closure raises threats of east coast blackouts and manufacturers quitting Australia*, ABC News, 19 March 2017 18. A Stock, P Stock, *Game On: The Australian Renewable Energy Race Heats Up*, Climate Council, 2016 19. Stock, *ibid.* 20. M Godfrey, K Loussikian, *Electricity crisis: Premier Gladys Berejiklian can't rule out summer blackouts*, The Daily Telegraph, 8 September 2017 21. C Gribbin, *Snowy Hydro scheme boost to secure electricity supply on east coast: Government*, ABC News, 16 March 2017 22. Finkel, *ibid.* 23. Climate Council's 2016 scorecard cited in The Advertiser, *Power Dossier: what you need to know* 24. N Harmsen, *Renewable energy mix played role in SA blackout, third AEMO report confirms*, ABC News, 13 December 2016 25. M Ludlow, B Potter, S Evans, *SA power crisis may spread to NSW as heatwave hits*, Australian Financial Review, 9 February 2017 26. N Harmsen, A Donnellan, *SA power: Energy Minister to be given more control in state's \$500m plan to secure future*, 14 March 2017 27. The Advertiser, *ibid.* 28. Finkel, *ibid.* All references on this page viewed 17 November 2017.

29. Bureau of Meteorology and CSIRO, *State of the Climate 2016*, p.2. cited in Finkel, *ibid.* 30. Finkel, *ibid.*

# Four options to addressing immediate power supply, security and reliability

Providing alternative electricity generation methods is the short-to-medium term solution for businesses to sustain reliable power – and suppliers with intellectual property across both renewable and ‘clean’ non-renewable generation power sources (i.e. gas-powered engines and batteries) are integral to supporting businesses during forecast summer blackouts.

## 1. Australia’s natural gas could help combat short-term energy shortfalls

Gas turbines can be turned on and off at short notice unlike coal plants that take weeks to fire up or shut down. The Finkel Review says flexible gas-fired generation is likely needed for the short to medium-term to support variable renewable energy sources but notes rising gas prices and tightening gas supply as a red flag – however in response, the ACCC is undertaking an inquiry into gas prices, transport, supply and export.<sup>31</sup>

Ideal for emergency, legally required or optional standby systems; natural gas gensets are appropriate for office buildings, data centres, retail complexes, schools, government buildings, universities and research facilities. Look for sets that easily integrate with building management systems and starts and accepts the power load in seconds.

## 2. Diesel is a smart solution and confirmed back-up for summer 2017-18 in Victoria

In November 2017, AEMO announced diesel generators will pump up to 100 MW of power into Victoria’s energy grid during the third or fourth day of any extreme heatwaves in the 2017-18 summer as back up when people ramp up their air conditioning.<sup>32</sup>

For prime, continuous or standby power service, a diesel genset delivers reliable, clean and economical power – even in the most demanding conditions. Some states will even offer excise diesel rebates to certain businesses.

## 3. Standby power generation is also crucial to operational success

Standby diesel gensets pack a unique combination of decent capacity and versatility, ready for any energy emergency – and fuel running costs are low and maintenance costs are minimal.

For businesses that demand and require power security and stability; low-cost compact, outdoor-rated gensets can be installed complete with automatic standby power. Look for packages available fully installed and commissioned with full safety certifications, and local parts and service.

## 4. Microgrid technology is a welcome innovation for ensuring power security

Integrating renewable power with smart energy storage and conventional diesel or gas-fuelled power generation is at the heart of microgrid technology – a rapidly growing alternative to complement the NEM.

Microgrids are independently functioning forms of distributed energy generation, operating costs are cheaper compared to conventional power generation, can deliver grid stability and energy security, provide value to prime power diesel and gas customers, and use digital controls and smaller-scale storage to enable consistent voltage and frequency.

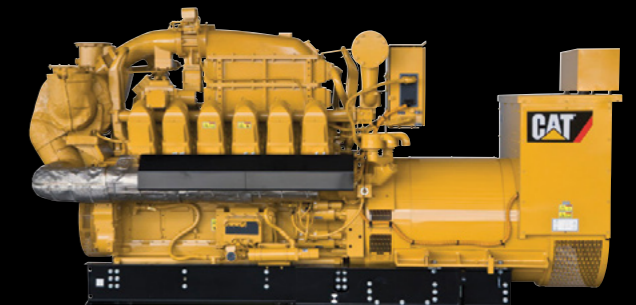
### THINK SMALL SINGLE PHASE Cat® 11kVA

This compact, outdoor-rated genset is ideal for semi-rural residents and commercial businesses. The standby gensets run single phase from 7.5 kVA to 44 kVA. Cost of ownership can be as frugal as \$2.90 per hour. These sets can be packaged with Automatic Transfer Switches (ATS) for complete autonomous operation.



### THINK GAS Cat® G3512

The first natural gas genset engineered to meet a full suite of critical standby market requirements, the reliable G3512 boasts a high power density 12-cylinder engine for market leading load acceptance and transient response.



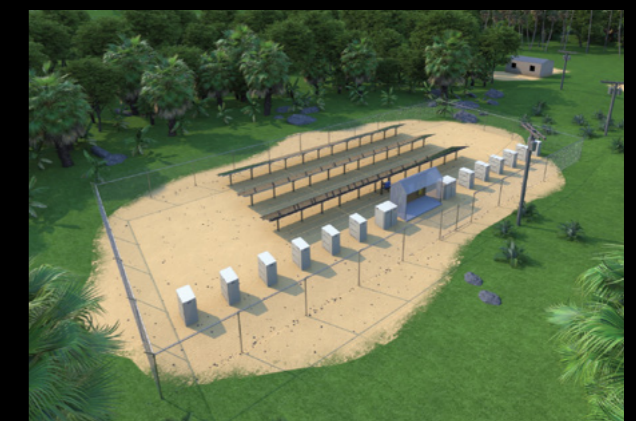
### THINK DIESEL Cat® diesel standby range

Match a single source diesel genset from 7.5kW to 17,460kW for unrivalled fuel efficiency, up to 40,000 hours between major overhauls, low life-cycle costs, excellent transient response and steady state performance.



### THINK RENEWABLES Cat® Hybrid Microgrid System

This is a fully customisable and scalable hybrid power solution delivering increased energy efficiency even in challenging environments with off-grid power solutions to commercial and large industrial sites, remote communities, new property development and government entities.



# Choose EPSA and the global reputation of Caterpillar® to experience a superior investment and reliable performance.

There are thousands of Cat® generators providing prime power, standby or emergency support in commercial and residential operations across Australia provided by Energy Power Systems Australia (EPSA) – the exclusive Cat® dealer in Australia.

Caterpillar® is renowned for reliability, safety and dependability with Cat® power systems boasting a proven lowest total cost of ownership and highest return on investment. EPSA has significant experience in the planning and construction of gas and diesel-powered generation sites and access to world-leading generator technology and equipment.

Let EPSA help you prepare for the energy crisis so you don't lose power and benefit from EPSA's technical knowledge and engineering expertise and over 100 Cat® Dealer Partners for service and support across Australia.



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