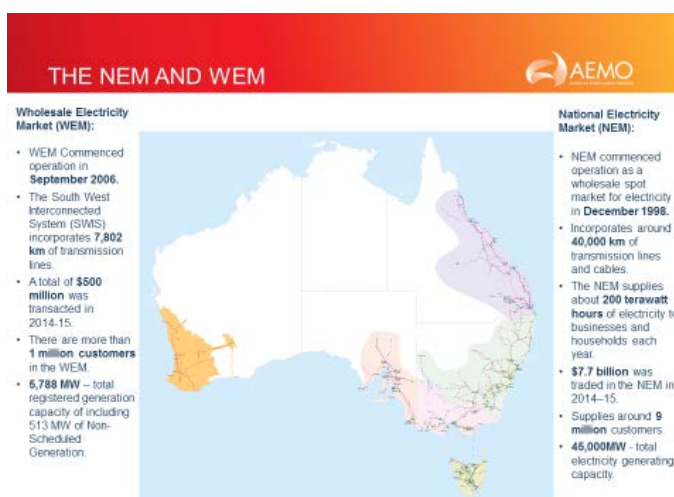


Good afternoon.

And thank you for the opportunity to share with you some of the current insights, challenges and opportunities we have seen, and continue to see, for the electricity and gas markets in Australia.

FIRSTLY – ABOUT AEMO

We are the independent energy market and system operator, and we deliver planning and forecasting advice in eastern and south-eastern Australia.



We have also recently been asked to undertake the role of independent market operator and power system operator in Western Australia.

This will officially take effect on 30 November. I am happy to discuss this more during our panel today.

THE CHANGING NATURE OF THE ENERGY INDUSTRY

Three and a half years ago, I stood in this very room addressing an audience much like today.

Back then I said the energy industry was emerging as one of the most dynamic and fast paced industries within Australia.

I also stressed the fundamental need for our industry to work together to ensure energy reliability and security, as consumers become increasingly empowered to seek a better balance between the cost they pay and the services they receive.

I think you will all agree with me when I say those words still ring true today. If not, louder than ever.

Today we are operating in an external environment that continues to transform.

A highly dynamic environment, with a range of challenging factors, such as:

- The introduction of LNG facilities for exporting gas from our eastern states;
- The rise in uptake of emerging and renewable technologies – wind and solar; and,
- Advances in battery storage.

In the National Electricity Market (NEM), the traditional issues of demand, generation, transmission and supply adequacy, are increasingly complicated by trends like growth in demand-side management, and the emergence of fuel-switching, emerging technologies and storage.

After all, the market was designed where the commodity was not intended to be stored!

Generation alone is becoming increasingly diverse and complex, as traditional thermal generation is retired and we continue to see the growth of rooftop photovoltaic (PV) and intermittent generation (such as wind and large-scale solar).

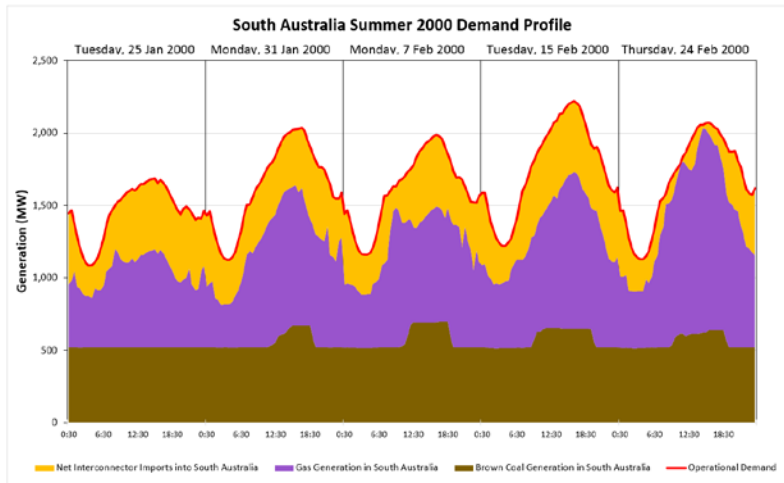
THE CHALLENGES OF FORECASTING

As the national forecaster, these challenges are no more evident than in what we continue to see at AEMO with the changing nature of demand met by the grid (operational demand).

Victoria

Keynote address: Matt Zema, Managing Director and Chief Executive Officer, Australian Energy Market Operator

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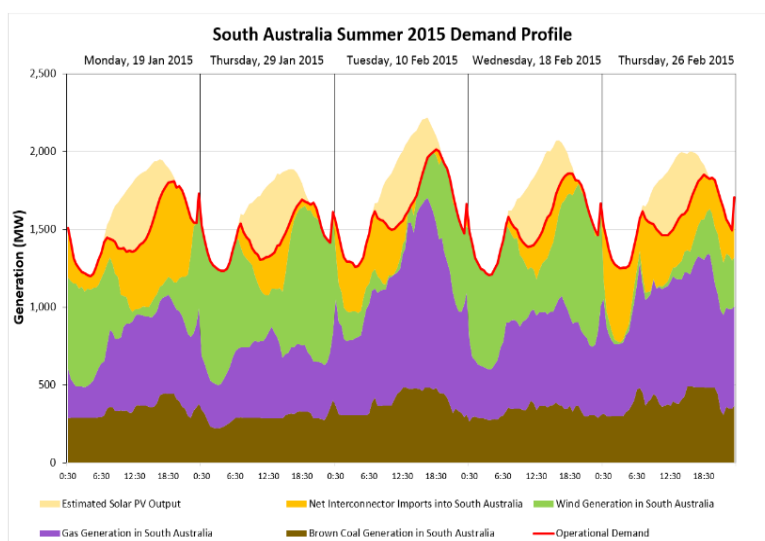
Take a look at this comparison performed on a series of random summer days (30°C) in South Australia for the summers of 2000 and 2015.

For the summer of 2000, we can see a clear, consistent generation profile, with brown coal and gas generation and the interconnector making up the operational demand profile.

There was negligible renewable energy contribution in summer 2000.

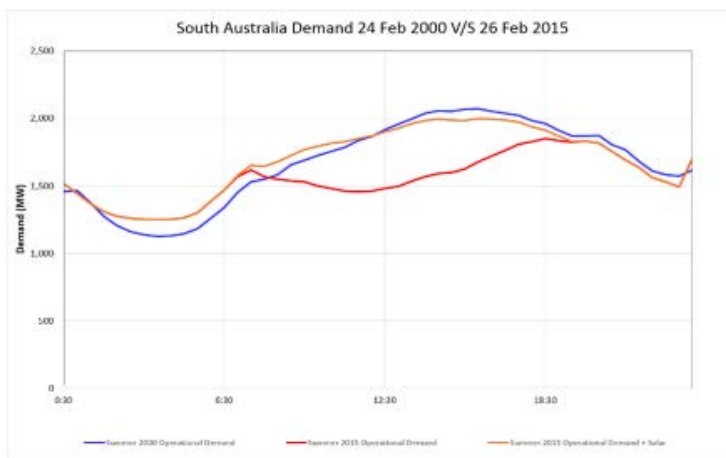
For those interested, the first non-schedule wind farm in South Australia began in 2003.

Let's fast forward 15 years.



As we can see here from 2015, it is unmistakable that renewable sources such as wind and solar PV have been one of the major drivers for the change in the operational demand profile in the last 15 years for South Australia.

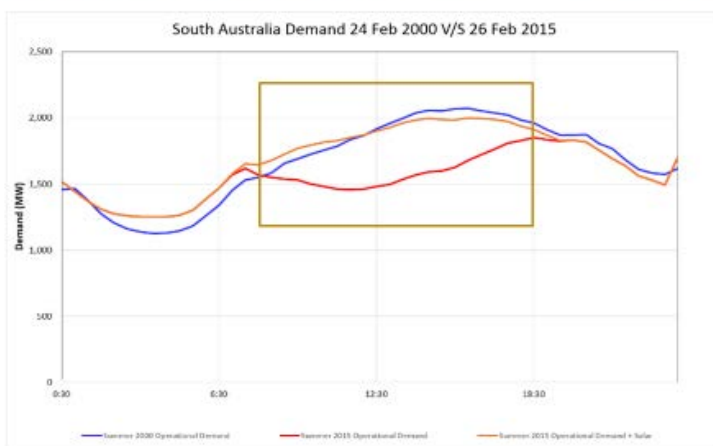
CHALLENGES OF FORECASTING



If we look a little closer, we can clearly see that solar PV output is offsetting the operational demand significantly in the summer period.

This is illustrated so plainly with this graph on this particular day.

CHALLENGES OF FORECASTING



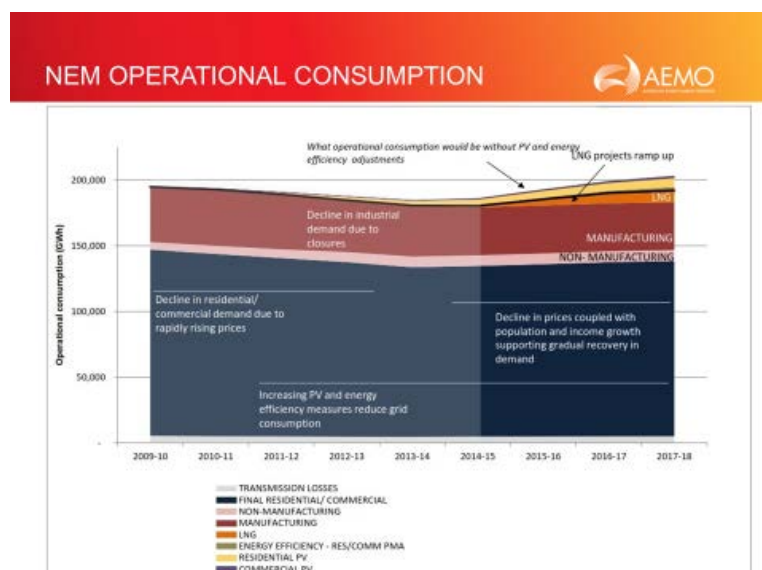
AEMO continues to enhance its forecasting system to adapt to this changing profile due to the solar contribution.

The increase of wind and solar PV energy generation as a proportion of the total generation mix is not isolated to South Australia with Victoria (15%), and Tasmania (14%), installed solar and PV while Queensland and New South Wales are around (9%).

STATEMENT OF SUPPLY

AEMO's 2015 *Electricity Statement of Opportunities* (ESOO), essentially a statement of supply, reported in August that industry was announcing approximately 4,550 megawatts (MW) of generation capacity to be withdrawn over the next ten years.

This is in addition to the fact that since 2009–10 we have witnessed electricity supplied through the grid decline each year.



It must be said that the 2014 ESOO reported a projected surplus generation capacity of 7,400 MW across the NEM.

Back to 2015, and this year's ESOO also reported that there is up to 20,000 MW of new generation, made up of predominantly wind farms and solar generation projects announced for the next decade.

Of course this doesn't necessarily mean these projects will be built but it's an indication that industry is seriously investigating the opportunities available in these new generation sources.

The 2015 ESOO showed us that the market outlook continues to adjust and adapt in response to the rapid rate of change impacting the energy industry.

In keeping with this change, just two days ago AEMO released an update to the 2015 ESOO in response to the announcement that Northern Power Station will be withdrawn by 31 March 2016, 18 months earlier than previously announced.

The ESOO Update focuses on implications for supply demand balance in South Australia over the three-year period to 2017–18.

The expected withdrawal of both Northern and Playford B power stations by 31 March 2016 removes 786 MW (or 15%) of generation capacity from South Australia.

While the revised closing date for Northern Power Station is not expected to result in Reliability Standard breaches in the three years modelled to 2017–18, it does illustrate the continual challenges of supply-side generation we face.

It must be said that we do expect that an efficient market will continue to adjust and respond appropriately to this latest information.

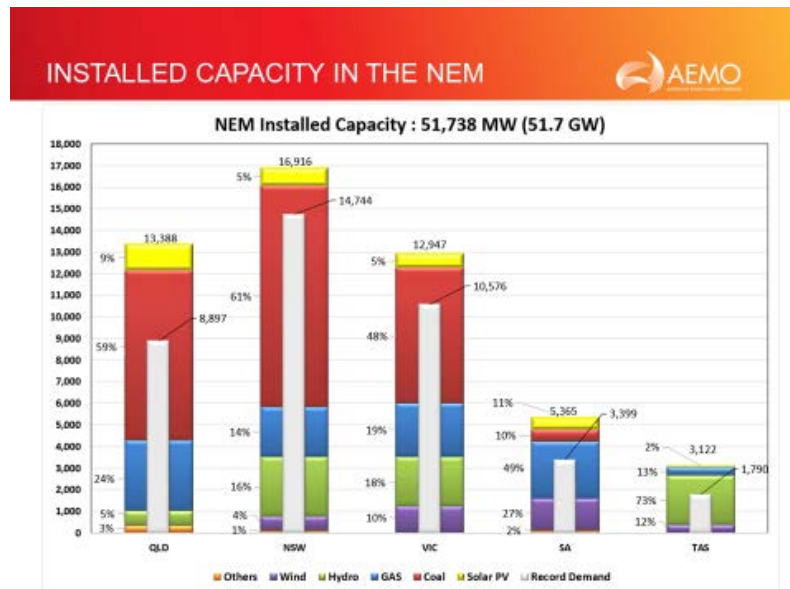
COAL STILL READILY DISPATCHED

While there is very little, if any, proposed or committed coal generation coming into the market, coal still makes up 54% of current installed capacity in the NEM.

Victoria

Keynote address: Matt Zema, Managing Director and Chief Executive Officer, Australian Energy Market Operator

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Coal is the current baseload fuel in this market and you would have to say that it is going to stay for a few years to come yet.

We have heard some large industry players talk about phasing out coal plants through to 2050.

However, right here, right now, coal is still readily dispatched into the market.

I can't ring up a solar farm overnight and ask for an extra 20 MW. Nor can I ring a wind farm and ask for a similar amount on a completely still day.

But while there is a high percentage of coal used as a generation source today, coal may not be the longest term – lowest cost.

The capital cost of running solar PV and wind farms continues to drop, and there are still new technologies coming into the market that we don't have complete price curves for.

This is where the likes of storage will play a crucial role in the energy market.

EMERGING TECHNOLOGIES

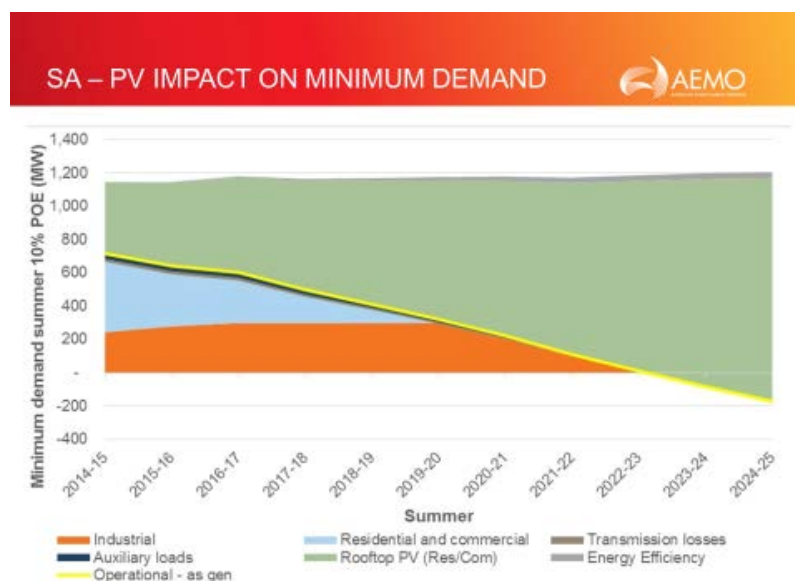
This means that AEMO's role is changing too.

Our ability to balance the security and reliability of energy supplied these by new technologies, against the changing needs and preferences of the consumer is a primary focus for AEMO.

If we look at South Australia again, before the impact of rooftop PV generation, minimum demand for SA consistently occurred in the morning.

AEMO has forecast minimum demand for the first time to investigate the impact of rooftop PV on the daily load profile. This provides useful information on network usage, which can inform further studies to evaluate operational implications.

In South Australia, existing rooftop PV systems are already a significant source of electricity supply on a clear day, and this can meet larger proportions of consumer demand during minimum demand times.



For South Australia by the end of 2024–25, continued uptake of PV could result in distribution customers in aggregate being net generators to the grid, at certain times.

That means if the uptake of rooftop PV continues, the electricity it generates will eventually become sufficient, on some days, to meet the underlying consumption of the residential, commercial and industrial sectors during the middle of the day.

A few months ago AEMO released its inaugural *Emerging Technology Information Paper* exploring the potential impacts of battery storage, electric vehicles, and fuel switching (from gas to electric appliances) on the NEM over the next 20 years.

The study is a starting point for AEMO to further progress work in this area, and to explore how each NEM region might respond to these technologies and trends in the future.

Early adopters are queuing up now but economically it will most likely not be until the early 2020s before we see a significant uptake – however it is prudent for us to prepare now for the likes of electric vehicles and battery storage.

I also note that many retailers are no longer ignoring this technology, but in fact looking to participate in this fast developing market, and embrace its potential in their business models.

We are beginning to see the cost curve on storage coming down, as it has done with solar PV.

But the real headline in this study is that for the first time in this market, new forms of energy storage technology will give us flexibility.

This means that residential, that is you and I, as well as commercial and industrial energy users, will have the ability to actually store electricity.

The electricity market is dynamic, it needs to be balanced every 5 mins. What we produce is what we use.

But with new storage technology coming on to the market, consumers can actually install battery storage systems in their households, and store electricity to use it when they need it.

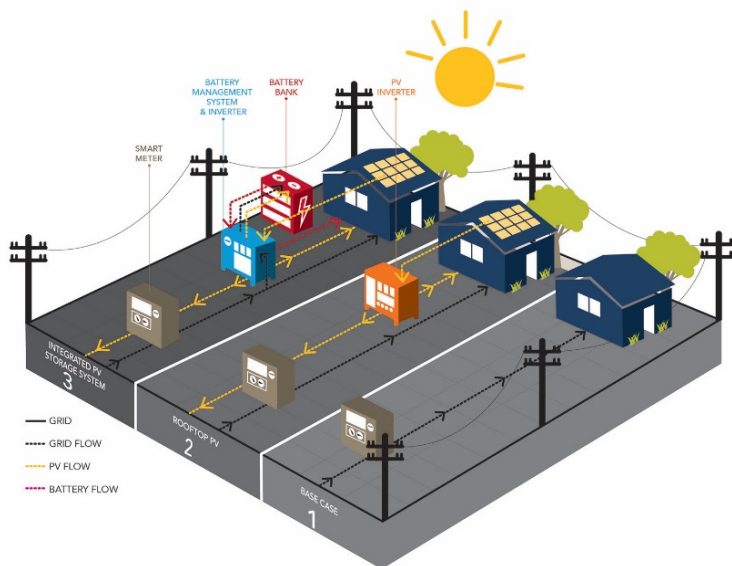
TRANSMISSION NETWORK'S VITAL ROLE

As I said from the outset, the importance of ensuring a reliable and secure supply of energy cannot be undervalued as Australia's energy sector transforms to support a higher percentage of renewable generation.

Today's national transmission network will play an important facilitation role in integrating the evolving energy generation supply mix.

However the network is ageing.

While there may be sufficient capacity to integrate growing levels of renewable generation along some transmission corridors, investment in asset replacement will be required.



AEMO's annual *National Transmission Network Development Plan* (which is due for release next month), highlights the need for decision-makers to be mindful of where this investment is included in new generation.

Today, consumers rely more and more on digitalisation – expecting increased levels of reliability and power quality, (E.g.: measure of reliability = phone charge).

The reliable integration of distributed resources into the existing power system requires substantial investments of capital expenditure to develop these projects, as well to connect to the grid.

The transition towards *Smart Grids* around the world heavily relies on the development of new software solutions and communication technologies that affect every grid operator and market participant.

A cost effective deployment of such solutions requires a high level of standardisation and interoperability, including a fair degree of tariff reform and process for dealing with ageing assets.

CONSUMERS' CHANGING BEHAVIOURS

And it's no secret to anyone that one of the main ingredients in this ever-changing industry mix has been the evolution of the consumer.

The National Electricity Market is one of the most efficient markets in the world. We have clear pricing signals. We have open access. We have customer choice. And we have customer behaviour that is driving a lot of the price and demand back up the chain.

Consumers today are more involved than previously before in actively managing their consumption, challenging traditional relationships between consumers, retailers and network businesses.

In 2008–09 usage was 200 terawatts hours (Twh) – and in 2014–15 usage was 180 Twh – largely due to population increases as opposed to any rise in GDP – a decade of lost growth you could say.

We expect this to gradually climb back to 200 terawatts by the year 2020–21.

A clear sign of the impact of consumers' changing behavioural patterns, is the uptake of energy efficiency measures and of course, solar PV.

Couple solar PV with battery storage growth in a few years and you have fundamentally changed the electricity supply chain as we know it.

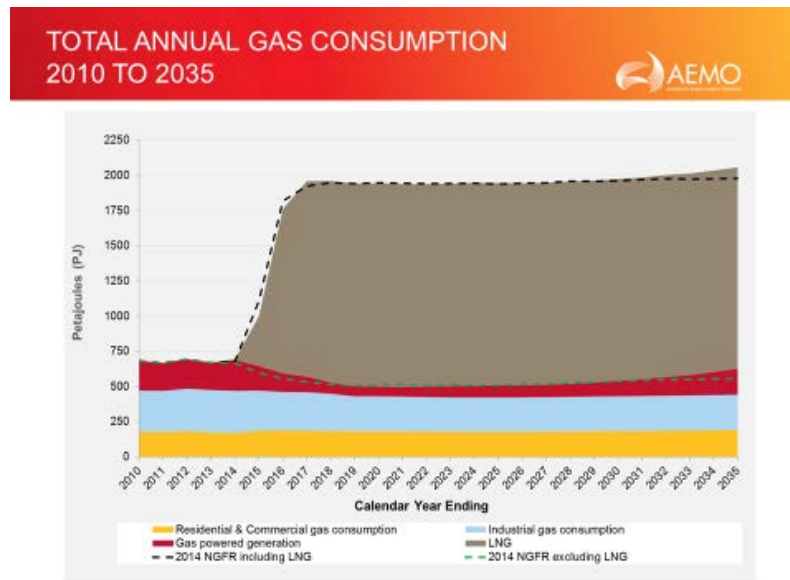
One of AEMO's biggest challenges is to forecast these changes to ensure the market and all the players within it, have the necessary information available to respond to these trends and make informed decisions.

We are no longer forecasting demand – we are forecasting consumer behaviour.

ALL ABOUT GAS

In Australia, electricity is a closed loop for us. We are an island continent – what we produce – we use. Gas has followed a similar vein – until now.

And, similar to electricity, Australia's gas industry is also facing transformational changes that are expected to have major impacts on gas consumption forecasts.



The advent of Liquefied Natural Gas (LNG) has brought with it, international pricing and international demand for Australia's gas.

In our soon to be released *2015 National Gas Forecasting Report* (NGFR) we outline three transformational changes facing Australia's gas industry, expected to impact gas consumption in the following ways:

1. The start-up of Queensland's liquefied natural gas (LNG) facilities is expected to result in increased gas prices that are forecast to contribute to lower domestic demand.
2. Structural change away from gas-intensive manufacturing in the domestic economy is likely to contribute to further decline in industrial gas consumption, despite generally improved business conditions for manufacturing.
3. A trend towards energy efficient buildings and appliances, including gas to electric appliance switching is also expected to contribute to residential and commercial consumption remaining flat, despite projected population increases. As of winter 2015, total Queensland LNG production exceeded total domestic gas consumption in south eastern Australia.

This growing LNG export industry is the key driver of anticipated changes in local gas prices for Australian households and industry.

Up until recently, what gas we produced in Australia we used in Australia.

Fast forward 5 years and we are looking to use around 25% of the gas we produce in Australia here domestically and the rest (75%) will be sent overseas.

So that brings with it, a different dynamic to gas. Being linked to the world oil prices as we are seeing at the moment, is making the price more volatile.

While this dynamic was captured in our *2014 National Gas Forecasting Report*, over the past year the international oil price has fallen substantially. So has the value of the Australian dollar.

Interconnector investment has also been driven by the LNG trains in Queensland, assisting with security of supply of the east coast gas market, by moving gas up and down the east coast.

This has given the southern jurisdictions greater access to the northern LNG gas.

The rapid growth LNG industry has also seen the first LNG participants connect to AEMO's Gas Bulletin Board.

This is a key milestone in increasing the transparency of Australia's gas industry, as the Gas Bulletin Board plays a critical role in facilitating the provision of readily accessible and up-to-date gas system and market information to enable informed supply and investment decision-making in this sector.

KEEPING PACE WITH CHANGE

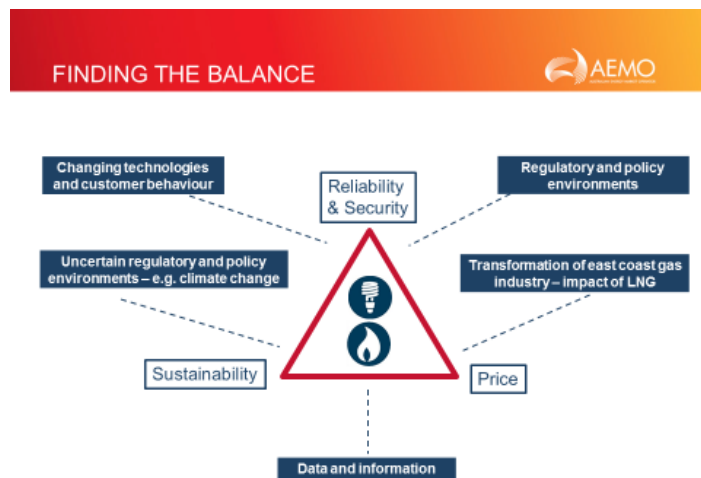
Energy markets will keep changing as consumers become more engaged and active, and as policy directions and economic pressures shift.

Renewable energy integration in the National Electricity Market continues to be an important topic of discussion for both governments and industry.

We are now in a world with increasingly active consumer behaviour, and these changing demand patterns will continue to shift and challenge traditional profiles.

Simplistically, there most likely won't be any new coal-fired generation plant built – but this is probably more a consequence of being environmentally and financially driven, as opposed to market driven.

The market is fuel neutral. But the reality is, if you go and try to get a bank loan to build a coal-fired power station, you might have more difficulty than if it were for a solar farm.



We continue to witness the increasing uptake of rooftop PV – which is changing the profile of daily demand required from the grid – and subsequently shifting peak demand times.

In network areas where there is large penetration of PV, this impact can be significant and can be further affected by non-scheduled wind generation.

Making some of the long-term calls is really hard and getting harder.

There is always, and I dare say will continue to be, the balance required between policy, environment and investment.

The key challenges for AEMO is to maintain system security and reliability as the generation mix continues to evolve and consumption patterns change as a result of new products in the marketplace, and with this increased consumer involvement.

These challenges are clearly not unique to Australia and similar issues are being played in other markets all around the world.

AEMO is an active member of the GO15 Power Grid Operators association.

The key focus areas of the GO15 continue to be:

- Market Framework: the generation mix of the markets, and how these new products will contribute and enter these markets.
- Planning and Forecasting: understanding the market mechanisms for the right investment and grid optimization, and
- Roles and responsibilities: gaining a clearer picture of the changing roles in the supply mix and demand-side management.

While we'd like to, but don't have an energy crystal ball – we do know that speed of technology – viable electricity storage, driven by customer involvement and consumer choice will dictate the next phase of where this industry is going.

Through this transformation, AEMO will continue to facilitate greater transparency of data and information, to enable the dynamic, continuing change we anticipate in these markets, to continue to deliver energy security for all Australians.

Thank you.

-END-

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