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DATA, DOLLARS AND ELECTRONS: A VISION FOR THE 2030 ENERGY SYSTEM

OCTOBER 2019

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INTRODUCTION

The only consensus on Australia's energy policy and markets is that currently both are a mess. We have an abundance of fossil fuels, sun and wind, but our energy prices are high by global standards.

The rise of large-scale wind farms and PV solar has been accompanied by the accelerated closure of coal-fired power stations that we depend on for reliable base-load power, and there is no clear plan for what will replace them as more retire in future. Blackouts due to a lack of supply (not due to technical issues as has historically been the case) are starting to take place, and more are predicted. While the contribution of fossil fuels to climate change continues to be debated, it has played a key role in the downfall of a number of prime ministers. Reasoned debate has given way to finger pointing, partisanship and, at times, hysteria.

However if we look past the current policy and political gridlock, we see signs that the ground may be shifting and that, almost despite ourselves, there may well be a way to navigate out of the current mess.

In this short paper, we paint one possible picture of our future energy system. We first identify some current trends and their implications. We then extrapolate from these emerging trends to posit what the energy system could look like in 2030.

From this model, we identify some key issues for our policy makers to consider to provide the solid framework needed to support the future system. In doing so, we hope to encourage a shift back towards the long-term thinking that is required to find a way out of the current quagmire.

In the future information centred system, regulatory and commercial drivers will focus on the combination of three key areas: **data**, **dollars** and **electrons**.

Smart devices embedded in the energy system will generate vast amounts of data on the usage, supply capabilities, asset condition and the behaviour of consumers. Harnessing the power of this data will be critical to the orchestration of distributed resources and creating incentives for efficient use and operation of the energy system. Considerable focus will be placed on the generation of, and access to, energy system data. Indeed, generation and use of data may become just as important as generation of the electrons themselves. In the new global environment that data will be more sensitive than ever. Governments will increasingly view it through a "security" lens rather than the traditional "economic" or "privacy" lenses.

Transformation of the energy system and industry structure will also drive changes to competition and regulatory frameworks. As the potential for competition emerges in parts of the system, there may be scope for a more graduated approach to regulation.

By the same token, the emergence of new services and business models, as well as the proliferation of data, is likely to open up new frontiers for regulation. For example, there is likely to be an increasing need for closer management and operation of local distribution systems, given the expected growth of distributed generation and storage resources. This will give rise to important questions around who is best placed to take on this system operation role at the local level, and how these local system operators should be regulated.

Perhaps optimistically, we project a move away from the current state of "anarchy", towards a more intelligent and better orchestrated energy system.

CURRENT TRENDS

THE WANING BATTLE BETWEEN OLD AND NEW CENTRALISED GENERATION MODELS

COAL AND GAS-FIRED POWER STATIONS

While it would take a brave person to bet on the development of a new coal fired power station in Australia (even one that incorporates carbon capture technology), coal will remain vital to our energy mix for years to come.

The question is what will replace it. Coal still accounts for more than 60% of Australia's energy generation. However, we are due for a major shift in our generation mix around the end of the next decade with Liddell, Vales Point and Gladstone having closed and Yallourn, Eraring and Bayswater approaching closure – together around half of today's coal-fired generation. As we have seen with Northern and Hazelwood, it is possible that the lower day time prices driven by the rise of solar and wind will lead to even earlier closures.

New gas-fired power stations are often described as the ideal 'transition' solution as large-scale storage solutions (as described below) are developed. While this is a popular view, ongoing high gas prices are a potential obstacle to the development of new gas-fired power stations at the pace required to ensure reliable supply in future.

LARGE-SCALE RENEWABLE PROJECTS

Large-scale wind and, more recently, PV solar farms have been (along with the explosion of rooftop solar) at the centre of Australia's transition to renewable energy. Currently accounting for around 8% of Australia's total energy generation (of which around 7% is large-scale wind and 1% large-scale solar), momentum continues to be strong. It is predicted that large-scale wind generation will double 2018 levels by 2020/21 and large-scale solar will grow at a much faster rate, potentially to 6 or 7 times 2018 levels by 2020/21.

However, we are starting to see some sector headwinds. The abundance of new projects has seen renewable power purchase agreement (PPA) prices drop to around half of what they were only a few years ago.[1] This is also driven by the price of large-scale generation certificates (LGCs) – which are typically "priced in" to the PPA price – dropping as Australia approaches the Renewable Energy Target scheme target.

Grid connection delays as the existing poles and wires struggle to cope with the surge in renewable projects in parts of the country (generally where renewable projects are popular) are delaying projects and impacting profitability. Extra responsibility has been placed on the transmission network operators to manage the impact of new connections – a pre-condition to connecting can now include, for example, the installation of a synchronous condenser.

In similar parts of the country we are seeing some big downward swings in the marginal loss factors (MLFs) adjusted annually by the Australian Energy Market Operator (AEMO).[2] This impacts profitability of both new and existing projects and is causing developers to act more cautiously and pay more attention to the projects others are planning.

It would be overstating things to say that large-scale renewable projects are reaching their peak – as the technology continues to become cheaper, and firming solutions become more available, they will continue to play a key role in Australia's energy transition. However, sector headwinds are causing investors to cast the net wider when considering renewable projects.

SECTOR HEADWINDS ARE CAUSING INVESTORS TO CAST THE NET WIDER WHEN CONSIDERING RENEWABLE PROJECTS.

[1] This has changed a little with the relatively new concept of corporate PPAs, where companies like Telstra and Westpac buy direct from renewable projects, therefore increasing the pool of buyers, but is not a substantial change.

[2] MLFs reflect the impact of electricity losses along the network and are applied to market settlements in the National Electricity Market.

LARGE-SCALE STORAGE

Pumped hydroelectric projects and chemical battery energy storage (BES) systems are gaining traction as the preferred firming solutions to the reliability challenges that have accompanied the rise of renewables. Of the 12 announced shortlisted projects under the Government's Underwriting New Generation Investments program, 6 are for renewable powered pumped hydro projects. It has been estimated that there are over 4 GWh of BES systems either existing, under construction or being planned.

How effective these solutions are remains to be seen. Pumped hydro in particular has been identified as being able to pick up some of the slack as coal-fired power stations are retired, with the current thinking around BES systems being that they are better at managing short term fluctuations in demand and providing grid support services, such as frequency control.

HYDROGEN?

Momentum is building towards hydrogen energy both playing a key role in the decarbonisation of the planet and becoming a major Australian export industry. While in Australia (and globally) a hydrogen energy industry is in its infancy, several factors point to Australia being a major hydrogen exporter in future, should the industry develop as many predict:

+ Asian countries (in particular China, Japan and Korea) identifying hydrogen energy as the key to reducing their reliance on fossil fuels; and
+ Australia's abundance of land, renewable energy, and proximity to Asia.

Many in Australia are closely monitoring the Government's development of its National Hydrogen Strategy.

NUCLEAR?

Nuclear energy is finding its way back into the debate in Australia, most recently driven by the Federal Government's consideration of a parliamentary inquiry into the prerequisites for nuclear energy in Australia. While nuclear energy has been politically unpalatable in Australia for decades, it is popular in many countries (there are over 450 nuclear reactors operating globally). It is also becoming cheaper and quicker to construct a nuclear reactor, with smaller reactors being developed (e.g. 100MW nuclear power plants costing around $500 million).

If climate change creates more extreme weather events and blackouts become more common in Australia, it would not be a complete surprise to see discussion of nuclear power stations in Australia return to the mainstream.

THE EMERGENCE OF DISTRIBUTED ENERGY RESOURCES

A key trend that has been observed by policy-makers and market players is the emergence of distributed energy resources. Most recently, in its 'Grid of the Future' review,[3] the Australian Energy Market Commission (AEMC) has highlighted the growth in deployment of behind-the-meter generation, storage and energy management resources. The AEMC expects these distributed energy resources to play a key role in our future market.

THE NEXT STEP IN ROOFTOP SOLAR

There has been an explosion in rooftop solar in Australia, with systems now installed on more than 2 million households and one of the highest per capita rates of rooftop solar adoption in the world. Increasingly, these systems are being combined with battery storage and technology – including sophisticated energy management systems. These technology developments provide the opportunity for the emergence of microgrids and virtual power plants (VPPs).

The combination of low cost generation capability in rooftop solar, battery systems and management technology enables a transformative model of distributed energy resources, disrupting the traditional one-directional, centralised model (that originated in part from the location of coal resources and health considerations). In its early days, rooftop solar served to reduce the demand from the individual premises on which the solar unit was installed and feed some power back into the grid, but in relatively small quantities and having limited impact on the market. Each premises acted on its own, in an uncoordinated fashion.

The data gathered by smart meters, combined with sophisticated energy management systems, now allows for individual small solar units to function in an aggregated and coordinated way, as if they were one much larger generation unit. This VPP model enables generation sources to be brought much closer to the end customer, in some cases into their own home or local community. Grid energy would still be available in the event of supply shortages or excess demand within the VPP, but a substantial amount of energy consumed would be generated within the VPP. This can reduce transmission losses, improve the efficiency of our energy system, and reduce costs for everyone.

Regulators and the big energy companies recognise the potential for these types of projects to play a central role in our future energy market.

AEMO has modelled (on a high-growth basis) that, by 2040, distributed energy resources could generate more power in Australia than any other source. From a near standing start today, VPPs are expected to generate 700MW (equivalent to, say, 7 reasonably sized large-scale wind farms) within the next 3 years.

Many of our major energy companies are starting to get involved. AGL, Origin, Ausgrid and Simply Energy are each running or developing pilot VPP projects. Jemena (through its new energy subsidiary Ovida), is developing Australia's largest microgrid project in the Latrobe Valley, while Origin recently acquired the embedded networks business OC Energy.

Both the market, and the regulatory framework in which it operates, need to make key changes to properly accommodate these trends.

CONVERGENCE OF ENERGY AND DATA

A bold statement around the role of VPPs in our future energy mix, and how this will be supported by technology and data, was made by AGL via its $3 billion bid for Vocus. AGL described the offer as being based in part on the belief that energy and data streams were converging, for example by using data to be the centralised controller of energy captured by households in domestic battery storage systems. This process, which AGL likened to being the composer of an orchestra, could extend well beyond using a battery to optimise an individual household's energy usage and power bill, allowing the VPP operator to:

+ use power stored in one household's rooftop battery as a source of generation for another;
+ sell aggregated power stored in rooftop batteries into the wholesale market during periods of high demand;
+ participate in the demand response wholesale market (see next section) by dialing down households' controllable loads (for example, hot water boilers, swimming pool heaters and air conditioners) on an aggregated basis; and
+ provide grid support services, such as frequency control.

We have recently seen the production and accumulation of more granular energy data increase, with the implementation of smart meters that record a customer's energy usage every 30 minutes. More sophisticated are the energy management systems being implemented by VPP and microgrid operators. These will rely increasingly on understanding individual customer usage patterns, and even artificial intelligence, to efficiently operate VPPs.

DEMAND RESPONSE

Australia is now catching up with countries such as New Zealand, the USA, Japan and the UK in recognising that supply shortages can be addressed on the demand side, and not just on the supply side. The AEMC is in the process of implementing a wholesale demand response mechanism that would open up demand response to non-retailers – such as demand response aggregators and major commercial and industrial (C&I) power users – and allow demand response to be bid into the market in a similar way to generation. VPP operators will be well positioned to implement demand response by instantly dialing down the controllable loads of customers.

SOPHISTICATED ENERGY MANAGEMENT SYSTEMS WILL RELY ON DATA AND EVEN AI TO ACCURATELY UNDERSTAND CONSUMER USAGE PATTERNS

[3] Australian Energy Market Commission, 'Economic Regulatory Framework Review – Integrating Distributed Energy Resources for the Grid of the Future', 26 September 2019.

2030 MODEL

While it is impossible to accurately predict how Australia's energy mix, and energy market, will look in 2030, we have drawn together the strands of the main trends to envisage how an efficient, secure and reliable energy market might look at the end of the next decade.

A MORE COMPLEX ENERGY WEB

In a market where distributed energy has become a key source of generation, the role of energy market participants (generators, network operators, retailers and regulators), becomes more complex.

Today, although intermittent renewable energy sources have introduced an element of uncertainty into energy markets and a need for coal and gas-fired power stations to operate more flexibly (to the extent they can), the direction of power flow is generally predictable. Most power flows from large coal or gas-fired power stations, hydroelectric sources or large-scale renewable projects in regional / rural areas into distribution systems and then through to the end user. Energy market participants all play their part in matching supply and demand.

Although this is a complicated process requiring AEMO to match supply and demand in the wholesale market in 5-minute intervals, and for generators to react accordingly, the flow of power from distributed energy resources into distribution networks is relatively small. Where this power becomes a more substantial source of generation, market participants will need to have oversight of and be able to direct a complex web of power, coming from today's traditional centralised sources but also moving from one residence to another. One of the outcomes AEMO is hoping to understand through its current VPP demonstrations program is whether aggregated distributed energy resources operating as a VPP can operate as 'on demand' scheduled generation.

This complex web of electricity will need to be overlaid with a sophisticated technology system, using data, algorithms, protocols and, probably, artificial intelligence to predict supply and demand throughout the grid and respond accordingly (including by participating in demand response and ancillary services markets). There will be an explosion in new data as smart appliances are integrated into a connected "internet of things", and energy companies will be in a prime position to accumulate and use this data.

Holding the data will be critical to operating a VPP. This means that those who hold the data are likely to be the major players in the VPP market. As we are starting to see, the major retailers have the upper hand in the race to accumulate this data with their existing large customer bases, their ability to target that large customer base to build the network of rooftop solar and battery systems needed to operate a VPP, and also their ability to participate in the wholesale market.

Further, the major retailers have the balance sheets that will allow them to grow through acquisitions. As we have seen with transactions such as Origin's acquisition of embedded networks business OC Energy, the major retailers have the money, and the incentive not to be left behind in a rapidly changing market, to consolidate what is still an immature and fragmented market segment.

As AGL signified with its bid for Vocus, retailers also appreciate the key role that data and related infrastructure will play in operating VPPs. We will be in a world where the major retailers are also major technology companies.

A NEW RANGE OF SERVICES

As contemplated by the AEMC in its recent 'Grid of the Future' review, there will be a range of services supplied and acquired by various players on a grid-enabled trading platform. Of course, households and businesses will still be able to acquire energy and access to networks over which that energy is supplied (although, as discussed below, we expect that these services will be priced in a more consumer-friendly fashion). These customers will also be able to supply energy to the grid where they have behind-the-meter generation and storage, and will be able to offer grid support and demand response services. Additionally, VPP operators will offer management of behind-the-meter resources, including scheduling of grid exports, supply of grid support services and demand response, for those within their VPP networks.

There will also be an important role for distribution system operators. These system operators will perform a similar role at the local distribution level to that currently performed by AEMO at the transmission level. These local system operators will rely on sophisticated system optimisation tools and data from distributed resources to manage constraints and orchestrate resources at the local level.

CHOICE FOR CUSTOMERS

People will have increased choice around how they engage with energy markets.

Some people may choose to remain as just consumers of energy. However, many will decide that they want to be 'prosumers', consuming and suppling energy, as well as supplying network optimisation and grid support services.

For those who choose to consume and sell multiple services, they may choose to engage with the market through a traditional retailer or a VPP operator. Under the traditional retailer model, the customer would simply pay for network access and energy consumed, and would receive payment for energy exports and any network support / optimisation benefits delivered by their behind-the-meter resources. In the VPP model, the VPP operator would provide a package of services, including management of their behind-the-meter resources, in return for a fee (that would pass through network access costs (see below) and distribution network operating costs).

The VPP market will be highly competitive. Not only will VPP operators compete for supply into the wholesale market, they will also vie for prosumers to join their VPP networks. Competition between VPP operators means that prosumers will be offered attractive packages which include network access, locally produced energy (from within the VPP), access to grid energy when required, and management of their supply of energy and grid support services. Competition will also constrain VPP operators' ability to lock in prosumers for extended periods, meaning that these prosumers will be contestable as between VPP operators.

ENERGY 'PACKS'

Changes to network tariff structures, combined with the ability of VPP operators to manage wholesale price risk, will mean that energy 'packs' can be offered at competitive fixed monthly rates. One component of the monthly charge will be a fixed network access fee. The monthly charge will also cover a sufficient amount of locally produced energy and grid energy, and will reflect the energy exports and grid support services supplied by the prosumer.

Some VPP operators could offer energy packs which allow usage outside the prosumer's home – for example, to allow off-site charging of an electric vehicle. A certain amount of 'roaming' usage could be included in the monthly package, or this could be post-paid at an agreed rate.

Under a model like this, buying power starts to look like buying mobile phone credit (particularly where a consumer can be charged for using power in more than one location). Unlimited or capped 'energy pack' offers will be prevalent.

Data and clever algorithms will be key to allowing VPP operators to tailor their energy packs to individual prosumers. Data generated from smart meters and other smart devices will contribute to a rich understanding of each prosumer's usage and export profile. This will allow VPP operators to devise a menu of energy packs that is suited to the prosumer's needs.

Accessibility and portability of customer data will also be critical to facilitating competition. As explained above, we expect that that VPP operators will regularly compete for prosumers to join their VPP networks. This competition will rely on all prospective competitors having access to data on the prosumer's usage and supply of energy and grid support services.

FROM ANARCHY TO ORCHESTRATION AT THE DISTRIBUTION LEVEL

The current state of affairs has been described, quite accurately in our view, as "anarchy". Investments in distributed energy resources are being made in an entirely uncoordinated fashion.

In the future system, local system operators will play a critical role in orchestrating distributed resources, balancing local supply and demand, managing system constraints and creating incentives for efficient investment in new distributed resources.

We envisage a patchwork of regional systems across the NEM, each with their own operator. The boundaries of these systems will be defined by physics and economics. While there may be some commonality with existing distribution network areas, the new system boundaries need not align with these legacy network delineations. Instead, the size of each system area will reflect the extent of economies of scale and scope in the delivery of energy. As we discuss below, we see the transmission network continuing to play an important role by providing the balance of supply once distributed energy resources have been taken into account.

Who will play the important role of system operator at the local level is an open question. Distribution network owners could potentially step into this role, and there may be significant efficiencies associated with integration of these two roles. Alternatively, there could be independent system operators (AEMO-like bodies) appointed in each local region – we consider this further in the following section.

These local system operators will interact with VPP operators, traditional retailers, network owners and the grid system operator (AEMO) in performing their role.

A VPP MODEL COULD LOOK SIMILAR TO BUYING MOBILE PHONE CREDIT, WITH UNLIMITED OR CAPPED "ENERGY PACKS"

THE MARKET OPERATOR

The market operator's role will continue to be important. While distributed energy resources will provide an increased proportion of our energy, it is anticipated that energy demand will grow. Transmission networks will continue to do a similar amount of work as they do today, supplying energy from large-scale generation sources.

AEMO, through its ongoing VPP Demonstrations Program, is seeking to identify among other things whether VPP generation can be 'on demand' scheduled generation, and also put in place protocols and processes to ensure that detailed forecast and actual VPP generation data is available. In short, it appears that AEMO envisages VPPs as another element of the wholesale market that AEMO is central to.

Whether AEMO is the best party to manage the system right down to the local distribution level (including operation of the VPP market) is not clear. Given that local systems will be increasingly complex, it may be that local system operation is best managed by separate regional bodies rather than a single national operator. In our vision for the future energy system, we envisage a patchwork of separately operated regional systems. The local system operator could potentially be the distribution network owner in the relevant region, or an independent body.

In a world with multiple local system operators, we see AEMO continuing to have a central role managing the wholesale market. However AEMO's role would increasingly involve working with local system operators, as well as traditional players such as large-scale generators.

Given it will be a more complex market with increasing interfaces (for example between AEMO, the local system operators and VPP operators), the risk of an emergency is, arguably, increased. If large and complex VPPs fail unexpectedly, there will suddenly be much larger wholesale demand. AEMO, working with regulators, will have an increased role in managing emergency generation sources (such as pumped hydro or BES systems, and emergency gas 'peakers') that are dedicated to supplying power in an emergency. With VPPs operating efficiently most of the time, these emergency sources of generation may not make a sufficient return to justify private investment. They may instead need to be funded by tax payers, or alternatively through levies imposed on retailers (that would then be passed through to customers).

DISTRIBUTION NETWORKS

Distribution network operators have watched with trepidation as bi-directional flows exported from behind-the-meter generation place an increasing burden on grid infrastructure, contributing to increased network costs (in particular dealing with voltage spikes caused by high reverse energy flows). These costs will increase as the volume of behind-the-meter generation grows.

At the same time, under the current model, network costs are largely recovered from customers importing power from the grid. This results in higher network costs being passed on to customers without behind-the-meter generation, effectively subsidising those that do.

As penetration of distributed energy resources grows, these issues will only become more prevalent. A new model will need to be developed to ensure that VPP operators (and their customers) who benefit from behind-the-meter energy being exported into the grid, and related services, pay their share of network costs – a focus of the AEMC's recent 'Grid of the Future' review. As VPPs grow and the bi-directional flow of energy becomes more common and complex, network owners will need more visibility over the flow of power within VPP networks to manage system stability, and to appropriately allocate network costs. It may be that distribution network operators themselves step into the system operator role in areas where they own and operate the local network.

Network price structures will be critical to signaling where distributed resources are best deployed and how their use can be optimised. Network price structures will be designed to signal where the deployment and use of distributed resources would place a strain on the network, leading to a need for increased expenditure. Conversely, these price structures would also signal where the deployment and use of such resources would be beneficial for all system users, by avoiding the need for network reinforcement. This could involve a base subscription fee for network access, supplemented by rebates for customers providing grid support or expenditure deferral benefits and/or 'top-up' fees for customers requiring extra capacity at peak times.

More sophisticated and cost-reflective tariff structures will rely on much greater visibility of constraints within the distribution network. This will be facilitated by investment by distributed network owners in feeder-level telemetry and other emerging network management technologies.

INTERCONNECTORS

It is unclear whether the prevalence of distributed energy resources will impact the economics of interconnectors. In any case, the strategic importance of transmission networks connecting critical infrastructure in population centres, ports, airports and defence establishments raises national security / emergency response issues. Potentially, governments may re-acquire certain interconnector network assets – a 'strategic backbone' concept – with the costs of managing this backbone passed through to tax payers, or alternatively subsidise these to provide existing owners with sufficient levels of return.

STANDALONE MICROGRIDS

As we have started to see, big corporates such as Westpac and BlueScope are taking a more direct approach to energy procurement by contracting directly with renewable projects under corporate PPAs. Separate to this, particularly at remote mine sites where miners have no choice but to source power from (traditionally gas or diesel powered) microgrids, hybrid-microgrids incorporating renewable generation with battery storage are becoming more prevalent.

Extrapolating this, by 2030 we expect to see plenty of major C&I users who have developed their own microgrid solutions. They will still have the opportunity to connect to the NEM, but may be tired of high prices and, in the worst case, sustained power outages resulting from the unreliable transitioning energy market. A good example of this can be seen in SA Water's "Zero Cost Energy" project where, working with renewable embedded network developer Enerven, SA Water is installing large quantities of solar PV and battery storage across its metropolitan sites to power its energy intensive pumping and treatment operations.

Similar solutions will be provided to rural towns that are not connected to the grid (perhaps with government support, as we see with some non-renewable microgrids today).

REGULATORY FRAMEWORK

The regulatory framework of the future will be focused in three main areas: flows of data, dollars and electrons.

REGULATING DATA FLOWS

Data flows between VPP operators, system operators, network service providers, retailers and generators will be critical to orchestration of the many resources operating in the future energy system. Data flows will facilitate competition, better price signals and more effective orchestration of system resources.

Much of this data will be generated by distributed resources, such as smart meters, demand management systems, and smart storage devices. As much of this data will relate to energy consumption and use of devices within the home, frameworks will need to be in place to address privacy issues and protection of this data.

We also expect issues around use of algorithms to come to the fore. As outlined above, we anticipate that sophisticated algorithms will be used to devise pricing plans which reflect the way in which different customers interact with the energy system. If there are to be accurate price signals sent to customers, this implies some degree of algorithmic price discrimination, albeit based on different patterns of usage and supply. While such algorithmic price discrimination is likely to be efficient, it may be seen as unfair, particularly to those who cannot afford to invest in technologies that could reduce their burden on the system.

Concerns around 'unfair' use of data – particularly use of data to facilitate price discrimination – could lead to heavy-handed restrictions on use of data for pricing purposes. In our view, this would be an unfortunate development, if it were to occur. Efficient price discrimination is likely to yield significant benefits for all system users, particularly better targeted deployment and use of distributed resources. Rather than preventing use of data for this purpose, any regulation should be focused on targeted protection of particularly disadvantaged customers.

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REGULATING DOLLAR FLOWS: COMPETITION PROTECTIONS AND PRICE REGULATION

With transformation of the energy system, there will be a re-thinking of where bottlenecks are likely to exist, where there is the potential for exploitation of market power, where price / revenue regulation is needed, and where competition can be relied on as the best regulator.

There will still be a need for economic regulation in some parts of the system. In particular, distribution networks will continue to bear natural monopoly characteristics, and access to at least some services over these networks will be essential for participation in the energy system.

However, the form of regulation may change, particularly where there is scope for competition to emerge with developments in technology. Like in other regulatory frameworks, such as telecommunications, there could be scope for different regulatory treatment of different services, depending on the degree of competitive constraint faced in the delivery of those services.

To the extent that network access charges continue to be regulated, there will be a much greater focus on the structure and method of charging customers, as distinct from the total volume of revenue to be recovered – in other words, regulatory processes will be less about *what* can be recovered, and more about *how*. It will be the method and structure of charging which ultimately drives incentives for efficient deployment of distributed resources and optimal use of the system as a whole.

In addition to network access services, there may also be a need for regulation of services supplied by local system operators. Alternatively, long-term contracts for system operation in each region could be awarded through a competitive tender process, with access arrangements and pricing to be determined through that competitive process.

Finally, we expect there to be some relaxation of supply chain delineations and constraints on integration. Regulators will still need to be vigilant in protecting competition where it is feasible. However at the same time, system participants will have more freedom to expand into adjacent parts of the supply chain, where this is likely to deliver whole-of-system benefits through economies of scope and/or positive vertical externalities. This may include existing market players expanding their operations to deliver new services or take on new responsibilities (e.g. network owners taking on local system operation responsibilities). Separation requirements and constraints on integration will still be imposed in some cases, but only where the benefits of such restrictions outweigh their costs.

REGULATING ELECTRON FLOWS: SAFETY, RELIABILITY AND SECURITY OF SUPPLY OBLIGATIONS

In a centralised energy system, technical regulation can be focused on a few key players: a single system operator, large-scale generation facilities and networks. As the supply of energy becomes much more decentralised, so too will the coverage of technical regulation and system monitoring responsibilities.

As explained elsewhere in this paper, we expect system operation to become decentralised and extend down to the level of local distribution. These new local system operators will be subject to a considerable regulatory burden. They will be required to work closely with local network operators, VPP operators and other operators of distributed resources to maintain the safety, reliability and security of their local systems. They will also be required to work with AEMO in managing inter-system flows.

Regulation will need to mandate that the VPP operators and network owners co-operate with local system operators to ensure system reliability and stability (and intelligent energy management systems, combined with the ability of batteries to instantly respond, are likely to facilitate this), with significant penalties for a failure to do so. Further, AEMO and/or local system operators would need to have emergency intervention powers to deal with any emergency due to VPP or network failure. This will involve both the ability to step in or direct local network operators and VPP operators, and also the maintenance of a sufficient reserve of energy to deal with an emergency. We would assume that, in an efficiently operated, competitive market with the appropriate regulatory framework in place, such emergencies would be few and far between with the cost of maintaining a reserve an additional cost to be distributed to energy market users.

AWARDS + RECOGNITION

2019 MergerMarket Australia Awards

Gilbert + Tobin won three awards:

+ M&A Legal Advisor of the Year (Business Services)
+ M&A Legal Advisor of the Year (Consumer)
+ Private Equity Legal Advisor of the Year

2020 Best Lawyers Australia

Gilbert + Tobin was named 'Law Firm of the Year' for Corporate Law and for Private Equity Law in the 2020 edition of Best Lawyers. This follows on from G+T being 'Law Firm of the Year' for Mergers & Acquisitions in the 2019 edition of Best Lawyers.

72 Gilbert + Tobin partners are recognised by Best Lawyers, representing over 92% of the partnership acknowledged as leading in their areas of expertise. Among these, 10 partners are named as Best Lawyers '2020 Lawyer of the Year', including six M&A/Corporate Advisory partners.

2019 Australasian Law Awards

Gilbert + Tobin was named 'Law Firm of the Year' (101-500 lawyers).

2019 Chambers Asia-Pacific

39 partners are recognised by Chambers in 22 areas of law. We are ranked Band 1 in Corporate/M&A, Equity Capital Markets, Private Equity, Competition & Antitrust, Acquisition Finance, TMT and Fintech.

2019 Asialaw Profiles

Gilbert + Tobin was ranked an 'Outstanding' firm in the Asialaw Profiles 2019. We were also ranked 'Outstanding' in five industry sectors - M&A, Capital Markets, Private Equity, Competition/ Antitrust and Dispute Resolution.

2019 Client Choice Awards

Gilbert + Tobin was named Most Innovative Firm at the AFR Client Choice Awards 2019.

2019 Financial Times Asia-Pacific Innovative Lawyer Awards

Gilbert + Tobin won three awards:

+ Most Innovative Law Firm in Asia-Pacific
+ Legal Innovator of the Year
+ Innovation in the Business of Law: Technology

2018 Global Competition Review & Who's Who Legal: Thought Leaders - Competition

Gilbert + Tobin was named the leading firm in Asia Pacific in the 2018 edition of the Global Competition Review and Who's Who Legal: Thought Leaders - Competition.

2018 AFR Most Innovative Companies

Gilbert + Tobin was recognised in the AFR Top 100 Most Innovative Companies and was the only law firm in the top 50.

2018 Australasian Law Awards

Gilbert + Tobin won seven awards at the 2018 Australasian Law Awards:

+ Australian Deal of the Year
+ M&A Deal of the Year
+ Equity Market Deal of the Year
+ Insolvency & Restructuring Deal of the Year
+ International Deal of the Year
+ Debt Market Deal of the Year
+ Energy & Resources Deal of the Year

TOP RANKED Chambers ASIA PACIFIC 2019 Leading Firm

2018 AUSTRALASIAN LAW AWARDS WINNER

FINANCIAL REVIEW CLIENT CHOICE AWARDS 2018 WINNER beaton

LawyersWeekly AUSTRALIAN LAW AWARDS WINNER Law Firm of the Year 2017

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Chris leads G+T's Energy + Resources Practice and sits on the firm's Board of Partners.

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Geoff's practice includes trade practices matters, with a focus on regulated industries. Geoff is experienced in dealing with both economic and legal issues in regulated industries, particularly gas, electricity, port, rail and telecommunications. He has advised a number of electricity and gas distribution businesses on the revenue and price control regimes under the National Electricity Law and National Gas Law, and has represented these businesses in numerous review proceedings.

Geoff is a co-author of the leading text on Australian access regulation. Prior to joining Gilbert + Tobin, he worked as an economic consultant, specialising in the economics of regulated industries.

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Simon leads G+T's Melbourne Competition Practice. He is one of Australia's leading competition/regulatory lawyers, with particular expertise across the energy, resources, transport and telecommunications sectors. He regularly advises clients on issues related to regulatory and access issues and economic regulation, including regulatory pricing and tariff design.

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