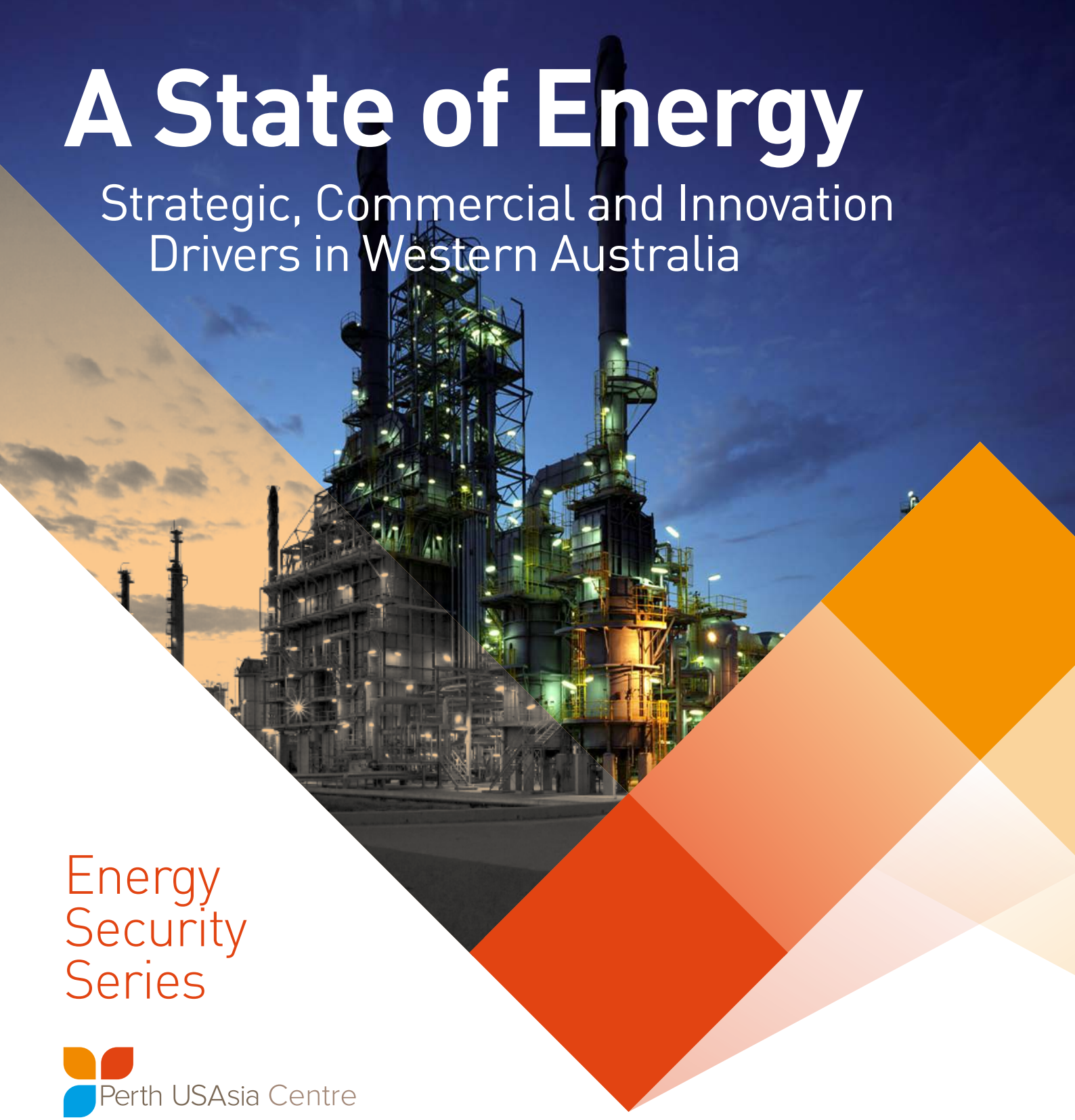
A State of Energy

Strategic, Commercial and Innovation Drivers in Western Australia



Energy Security Series

Perth USAsia Centre

The "WA Energy Map" project has been undertaken to show the energy potential of Western Australia and, for the first time, bring together different energy strands which too often work in isolation. It is a collaboration between The University of Western Australia, Perth USAsia Centre and Chamber of Commerce and Industry WA who are each involved in different parts of the energy sector. As part of the research, the collaborators considered the connection between local and international markets; legacy infrastructure; consumption patterns; and future developments. This report is designed to support energy decision makers in government, academia and business. With the right policies, investment climate and innovation, Western Australia has the potential to become an energy giant.

Andrew Pickford, Joe Doleschal-Ridnell and Mark Stickells

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FOREWORD

With every one of our 9000 members needing access to affordable, reliable, and secure energy, a project that draws together data and a qualifying narrative of energy in Western Australia is well-overdue. A prosperous State requires an affordable, secure and reliable energy system to support business and to provide the underlying essentials of what attracts our most valuable asset – people. Building on this foundation, Western Australia is clearly an energy state, having ample reserves of natural gas and uranium, abundant natural resources across solar, wind, and wave, as well as the natural geography that sees innovation as a way of life.

The Chamber of Commerce and Industry WA (CCI) is proud to have partnered with The University of Western Australia (UWA) and PerthUSAsia Centre to ensure a cross-section of expertise informed the development of this project. I trust this paper will prove to be a valuable resource – the document is open source and is living, so the authors will continue to refine and expand upon it as our energy achievements, challenges, and needs change.

Our relationship with energy is rapidly changing and becoming subject to increasing domestic and international pressures. I look forward to working with the McGowan Government as it proceeds with much needed electricity reform across the wholesale and retail market. There is much to be done to ensure a more efficient transmission and distribution system, and continuing to move toward cost reflective tariffs and introducing competition in the retail market are key priorities for CCI. Our natural gas resources will continue to be in high demand domestically and internationally, whilst our uranium reserves should benefit from a favourable regulatory system as it readies to respond to changing global demands. Of course, underpinning our success is an innovative sector prepared to push technological boundaries. I look forward to working with you, our energy influencers, as we look to shape the State's energy future.

Deidre Willmott
CEO of the Chamber of Commerce and Industry WA

INTRODUCTION

Western Australia has the potential to be an energy giant. While the state is endowed with major physical reserves of energy, it is only through the hard work of men and women that these reserves can be unlocked. The state has a track record of overcoming impediments such as limited labour, distance to markets, and a harsh environment. This has resulted in an innovative and entrepreneurial approach to projects across the entire energy sector. This process involves collaboration between governments, industry and academia. Yet, a common consensus on energy extraction and consumption methods remains difficult to achieve. To reach our potential as an energy giant, we need clear and consistent bipartisan polices to encourage vibrant energy businesses, while propagating an attractive investment climate. Bipartisanship is also needed for new industries and alternative energy projects to be realised.

It is only when energy resources, infrastructure and innovation are combined that the state will grow and prosper. The portfolio of energy in Western Australia will continue to evolve and each successive generation will define their own goals and priorities. However, we are united in our vision to leverage our energy resources in pursuit of prosperity, and to minimise environmental impacts while cultivating energy use and export opportunities. This vision has, most recently, manifested in a push to develop our large offshore gas reserves, expand solar and wind generation capacity, and harvest energy from the ocean currents.

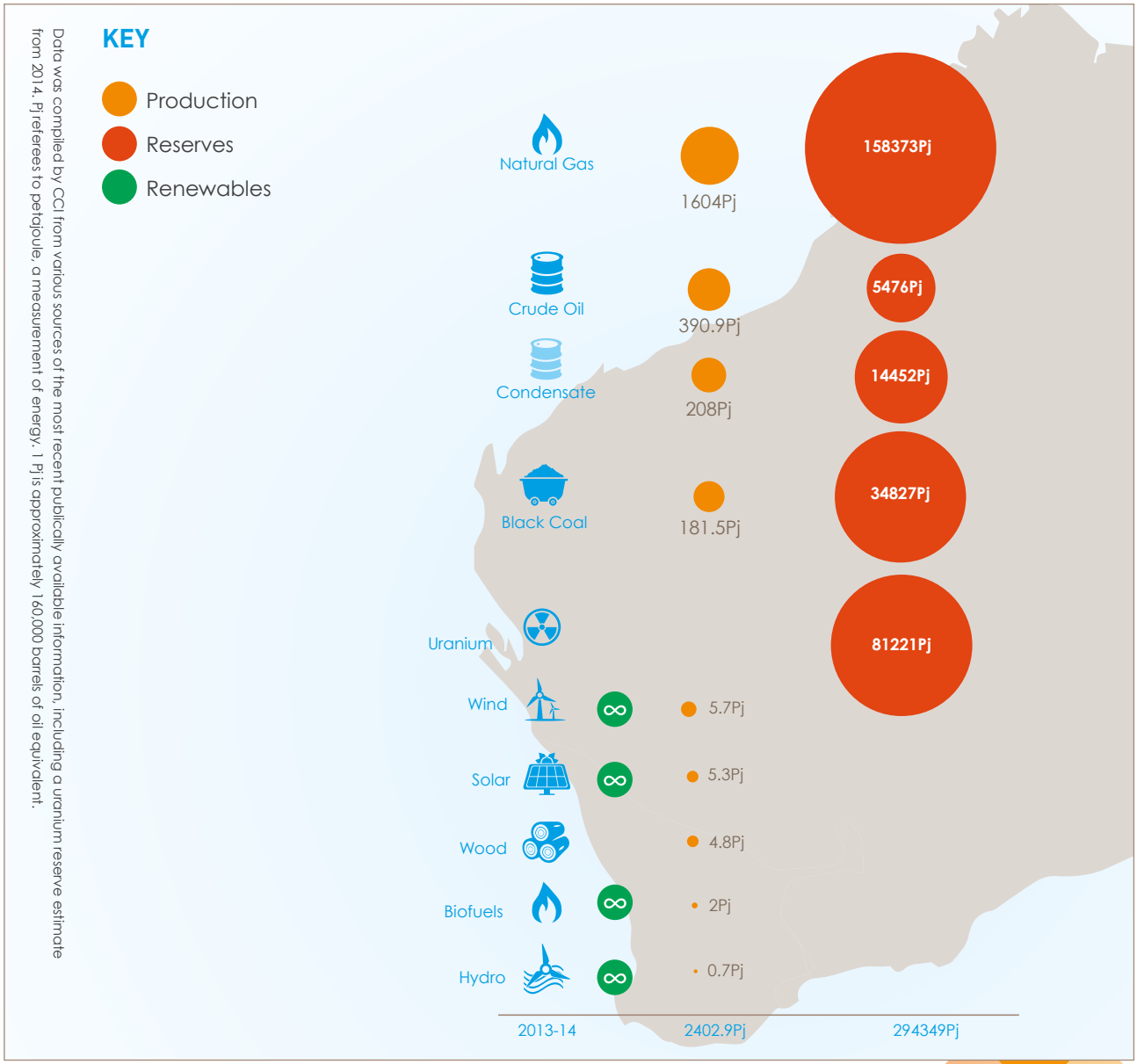
Bernadette Cullinane
Partner, Australian Oil & Gas Leader, Deloitte

WESTERN AUSTRALIAN ENERGY MAPS

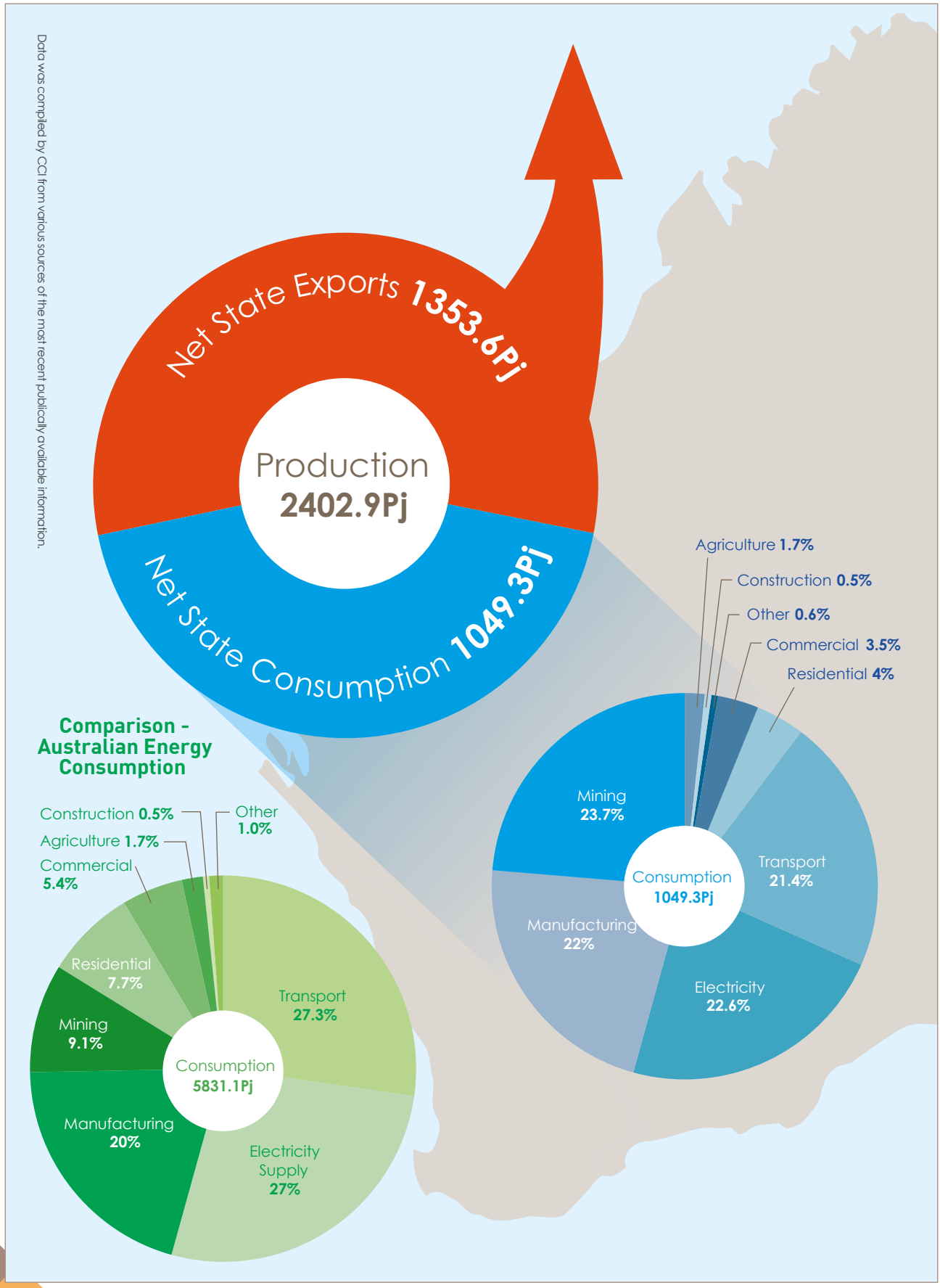
Given the complexity of the Western Australia energy sector, there is an inevitable requirement for specialisation. This occurs in government, industry, academia, journalism as well as in numerous other professions. Many careers are focused on one part of the overall sector, and often focus on a sub-field. Consider, for example, the different process engineer specialities within the natural gas industry. Some people traverse a couple of areas, but this tends to be rare. Aside from the Premier, Energy Minister and a few Chief Executives, only a limited number of people understand the complete sector and connections between the various subcomponents.

In the research completed by the three organisations involved in this study we considered the connection between local and international markets; legacy infrastructure; consumption patterns; and future developments. Collating data and visually representing this information can be done many ways. While our initial goal was to include all the data on a single map, it was impossible to capture this information and present it in a visually comprehensible manner. While there are shortcomings, we created the four "WA Energy Maps": Production and Reserves, Consumption, Major Infrastructure and Innovation to best visually express the results of these studies.

Production and Proven Reserves



Energy Consumption



Major Energy Infrastructure

Energy Innovation and Research

Each of the four WA Energy Maps are heavily interlinked with one another. Major infrastructure facilitates international exports; for example, LNG trains and associated ports. The consumption map shows that the majority of petajoules produced in the state are sent offshore to export markets. Innovation, which includes asset optimisation, reservoir characterisation and the integration of digital technologies and sensors, impacts the financial viability of both current and future projects. The interconnections between all four maps becomes obvious when there is a crisis, such as Varanus Island gas explosion in 2008 which was felt across the Western Australian economy. The WA Energy Maps aim to elevate the understanding of the numerous interconnections within the energy sector, outside of crises and debates, so that policy makers, businesses and researchers can make better informed decisions.

THE STRATEGIC ENVIRONMENT

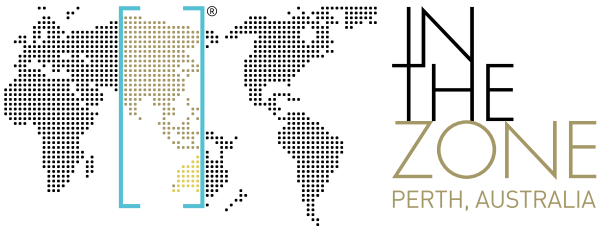
Western Australia's energy system is influenced by historical developments, significant energy resources, a federated political system and international energy markets. These internal and external influences ensure Western Australia's strategic energy environment is constantly evolving. Understanding the complex interplay of these dynamics, as well as the legacy of earlier energy decisions, helps frame discussions around WA's Energy Map.

While Western Australia's energy endowment in 2017 is well understood, this was not always the case. Prior to the discovery of coal in the 1880s, Western Australia relied on energy imports. Informing what we now refer to as 'energy security concerns', these fragile circumstances dominated policy debates. In turn, a variety of novel solutions were produced and trialled before gold drew capital and immigrants into the state. Prior to the introduction of electricity, lighting was made possible by "manufactured gas" - in which coal or wood was burnt to produce gas - which was distributed through a network of pipes to homes and businesses. In 1854, there was a proposal to use fuel derived from the local Xanthorrhoea plants, to light the then new Fremantle roundhouse prison. Interestingly, with a population of only around 6,000, the initial proposal considered exports to Asia, specifically Hong-Kong and Singapore.[1] These are but some examples of how innovation and the application of cutting edge scientific methods and technologies have long defined the Western Australian energy sector.

This ambition to connect technological innovations, Asian markets, local resources and external investment continued throughout the 20th century. It was not until the first shipload of LNG departed for Japan in 1989 that Western Australian resources were first substantially linked to Asian energy users. This is a significant legacy which has resulted in the export focus of our energy sector.

[1] "Captain Wray, R.E., to the Honourable the Comptroller-General, reporting on the lighting the New Prison with Gas, made of the Xanthorrea" Royal Engineers Office, Fremantle, The Perth Gazette and Independent Journal of Politics and News, August 26, 1854, p. 3.

Another important driver of the Western Australian outlook and approach to energy has been dealing with its isolation. Part geographic, part perception, distance has long been declared a tyrant.[2] Until the early 2000s most references to Perth included the qualification, "the most isolated capital in the world". This perception has less resonance today and has been replaced by a concept pioneered by UWA, and now adopted by the State Government and business leaders, which locates the state "In the Zone". Instead of being defined by distance to London, Western Australians now identify with a north-south bandwidth of two-time zones (in each direction). Home to 60 percent of the world's population, this zone incorporates a number of countries which promise the greatest economic growth of the twenty-first century.



The shift to the "zone" is also linked to the rapid increase in Asian energy demands, and associated export markets. This was initially focused on the East Asian Tigers, then China, and now ASEAN and India. While following the same regional trend of industrialisation and increasing energy demand, the rapid growth and expansion of China between 2003-2014 has had the most recent influence over energy trading patterns. Based on the growth of Japan, South Korea, Taiwan and now China, Western Australia has developed a substantial LNG export capacity. Western Australia is the world's third largest LNG exporter behind Qatar (80-million tonnes) and Malaysia (25-million tonnes) with 9 percent of global LNG exports (24-million tonnes) in 2016.

Like all energy commodities, natural gas, traded as LNG, is exposed to international market forces. This has meant that, in 2016, Western Australia's LNG sales fell 8 percent to $10.7-billion, compared with an annual average growth of 9 percent over the past decade. As new LNG trains are commissioned, higher volumes will offset lower prices. The outlook for the sector and future investment, however, has changed significantly. Not least with the emergence of the United States as a potential large LNG exporter, Australia is increasingly facing questions relating to sovereign risk, high labour costs and uncertain regulatory processes. The rapidly changing nature of the LNG market, sales contracts, pricing terms and consumer-producer relations do not yet seem to be fully appreciated. The potential for China to import larger quantities of US LNG[3] and Japan reorganising its LNG purchasing practices[4] are an obvious challenge when considering the focus of Western Australian exports.

Table 1: Western Australian Energy Export Markets

Petroleum	$ Million	Percent
Japan	7,805	55
China	1,936	14
Singapore	1,100	8
Korea	1,073	8
Other	2,339	16
Total	14,253	101

Source: Western Australian Department of State Development and Department of Mines and Petroleum, 2016.
*Petroleum includes LNG, crude oil and condensate and LPG

Throughout 2017, there has been an emerging consensus that LNG is heading to a liquid, spot market with efforts to create physical and virtual market hubs in Asia. This has some similarities with the evolution of the iron-ore market, yet security provisions will re-emerge when the market tightens, albeit through different mechanisms than the traditional 20+ year contracts. In the short- to medium-term it is expected that price competition and demands from buyers for flexibility will come to dominate contract negotiations. The lack of a new, single buyer on the scale of China between 2003-2014, as well as an increasing number of producers, suggests that Western Australian gas will need to compete for contracts and sales in a series of separate, disjointed and new markets during the rebalancing process.

[2] G. Blainey, The Tyranny of Distance: How Distance Shaped Australia's History, Melbourne, Sun Books, 1968.
[3] N. Snow, "US-China Economic Cooperation Plan Includes LNG Provision", Oil & Gas Journal, May 22, 2017.
[4] P. Milne, "Japanese Buyer a Dominant Player in WA LNG Market", The West Australian, April 2, 2017.

In terms of electricity, isolation also defines the Western Australian system, with the state home to one of the largest "islanded" grids in the world. This means it is not interconnected to other jurisdictions as is the case in the eastern states, Europe and most of North America. The number of small, remote systems across the state has forced innovative responses in terms of edge-of-grid solutions, grid management and peak demand management. Electricity generation, traditionally dominated by coal, then gas, is being disrupted in a manner not unlike Uber and the taxi industry. This is best understood as a series of thousands of small disruptions, as residential solar panels, batteries, smart appliances and large-scale wind power change how electricity is produced and consumed. Simultaneously, the "electricity death cycle"[5] trend may alter the economics of traditional electricity utility. Added to these uncertainties are questions over the speed with which electric vehicles are to be adopted.

Table 2: Western Australian Energy Snapshot

	Western Australia	Reference
Population (state) million	2.623	2016, Australian Bureau of Statistics
Population (national) million	24.220	2016, Australian Bureau of Statistics
State/national (population percentage of country)	11%	
Size of state (Square KM)	2,529,875	2004, Australian Government Geoscience Australia
Population density (population/ Square KMs)	1.04	
Per capita energy consumption (MMBtu per capita)	392.39	2016, Government of WA, Department of Industry, Innovation and Science
Federal elected members of H of Reps/ Senate	24	
Number in H of Reps and Senate (total)	226	
Percentage of federal legislative representatives	10.62%	
Gross State Product (AUD) Billion	240	2016,Goverment of WA, Department of State Development
State exports (AUD)	110.4	2016,Government of WA, Deparment of State Development
State exports/GSP (%)	46.00%	2016, Government of WA, Department of State Development
Top five exports	Iron Ore, LNG, Gold, Alumina, Crude oil and Condensate	2016, Government of WA, Department of State Development
Top energy export	LNG	2016, Government of WA, Department of State Development
Volume of top energy export per annum (LNG in million tonnes)	23.8	2016, Government of WA, Department of State Development
Exports (of top energy export) in AUD (billion)	10.7	2016, Government of WA, Department of State Development
Energy output (Peta joule) per unit of fuel	1 petajoule= 20 tonnes of LNG	Energy calculation LNG
Energy value of main energy export commodity (petajoules)	1190000	2016, Government of WA, Department of State Development
Petroleum refineries	1	
Domestic generation installed (SWIS) (megawatts)	6193.418	2014, Government of WA, Department of Finance
Total installed coal generation capacity (megawatts)	1744.45	2014, Government of WA, Department of Finance
Percentage of coal generation capacity	28.17%	

[5] P. Simshauser and T. Nelson, "The Energy Market Death Spiral – Rethinking Customer Hardship", AGL Applied Economic Policy Research, no. 31, 2012.

Edge-of-Grid Solutions: After bush fires destroyed significant electric grid infrastructure in the regional shire of Esperance, Horizon Power trialled a series of standalone solar systems as an alternative to replacing damaged poles and wires. Five systems were installed in total during the year-long trial, the success of which has prompted the roll out of additional systems in other remote areas of the state. For edge-of-grid communities reliant on vulnerable infrastructure, increased accessibility to self-sufficient renewable energy systems like this represents a significant step forwards in ensuring more cost efficient and reliable energy.

Changes to the electricity grid can result in policy challenges. Among the challenges for Western Australian governments are; the exposure to rapid technological change through ownership of electricity utilities; dealing with the reduction of coal generation centred on the south west community of Collie; and managing the increasing vulnerability of the system to cyber-attack. To further complicate matters, the provision of water supplies has become linked to electricity with the introduction of desalination plants.

ENERGY SECURITY

While Western Australia is a large producer of natural gas and related products, it is reliant on imports of crude oil and refined product. The supply of physical products is mainly addressed through measures implemented by the Federal Government according to International Energy Agency guidelines. Despite this, the refining of crude oil sits very much within state-level jurisdiction. A reliance on the BP refinery in Kwinana, the only such facility in the state, was made evident with the extension of the State Agreement Act from 2020 to 2050. Described by the then Minister Bill Marmion as a "strategic industry for the state", in his speech to parliament he noted that the "refinery has the capacity to refine 6-million tonnes of crude oil each year, which accounts for 80 percent of Western Australia's current fuel requirements for road, marine and aviation fuels." The reliance on this key infrastructure prompted the government to use legislative mechanisms to ensure that market forces did not result in refining capacities being outsourced to Singapore.

These various strategic drivers have influenced the development of the Western Australian energy sector. They have necessitated a significant level of private-public collaboration. External markets and investment have also been a key feature of the state's overall growth and prosperity. With the decline of OPEC as a market stabiliser[7], an oversupply of natural gas and rapid changes occurring in the US, especially the Permian basin[8], the international energy market could be entering an era of boom-bust pricing cycles and greater volatility. This will impact Western Australia which is now deeply interconnected with international energy markets.

INVESTMENT CLIMATE

Western Australia has long depended on access to foreign investment and capital to unlock its natural resources. In general, Western Australian governments and industry have worked well together. The use of State Agreements[9], as well as the general practice of the Premier to hold the State Development portfolio, are often overlooked aspects which help make Western Australia an attractive investment destination. While the use of State Agreements has varied over time, such mechanisms are important in defining the parameters and expectations for private entities for specific resource projects. One of the notable successes of State Agreements has been the bipartisan nature of these instruments. This appeared to fray, however, in the lead up to the 2017 state election when the National Party leader, Brendon Grylls, sought to open and unilaterally change existing agreements.[10] While Mr Grylls ended up losing his seat, this policy continues under the new National Party leadership. Future Western Australian governments will need to repair confidence in long-term State Agreements and, for the energy sector, consider how the international gas markets have evolved since the time of the North West Shelf deal.

[6] B. Marmion, Transcript: Proceedings of "Oil Refinery (Kwinana) Agreement Amendment Bill", 2016.
[7] R. McNally, Crude Volatility: The History and the Future of Boom-Bust Oil Prices, Columbia University Press, 2017.
[8] T. Puko and C.M. Matthews, "The Oil Play That Could Flood the Natural-Gas Market", The Wall Street Journal, May 30, 2017.
[9] R. Hillman, "The Future Role for State Agreements in Western Australia", Australian Legal Information Institute, no. 25, 2006.
[10] D. Emerson, "Grylls Vows to Force Tax on Rio, BHP", The West Australian, October 19, 2016.

State Agreements: State Agreements take the form of legal contracts between the Western Australian Government and industry proponents, outlining the terms and conditions through which major resource projects might be realised. State Agreements are most commonly utilised to secure and guide projects that require the development of infrastructure; such as railways, ports and refinement facilities. These agreements are negotiated on a case-by-case basis, and then ratified in Parliament, allowing projects to proceed independently of State laws. Utilised by successive governments since the 1950s, State Agreements came to occupy 70 percent of the total value of production in the Western Australian resources sector by 2002.[11] While some Australian states have entered limited State Agreements, Western Australia is unique internationally in terms of the scale of their use.

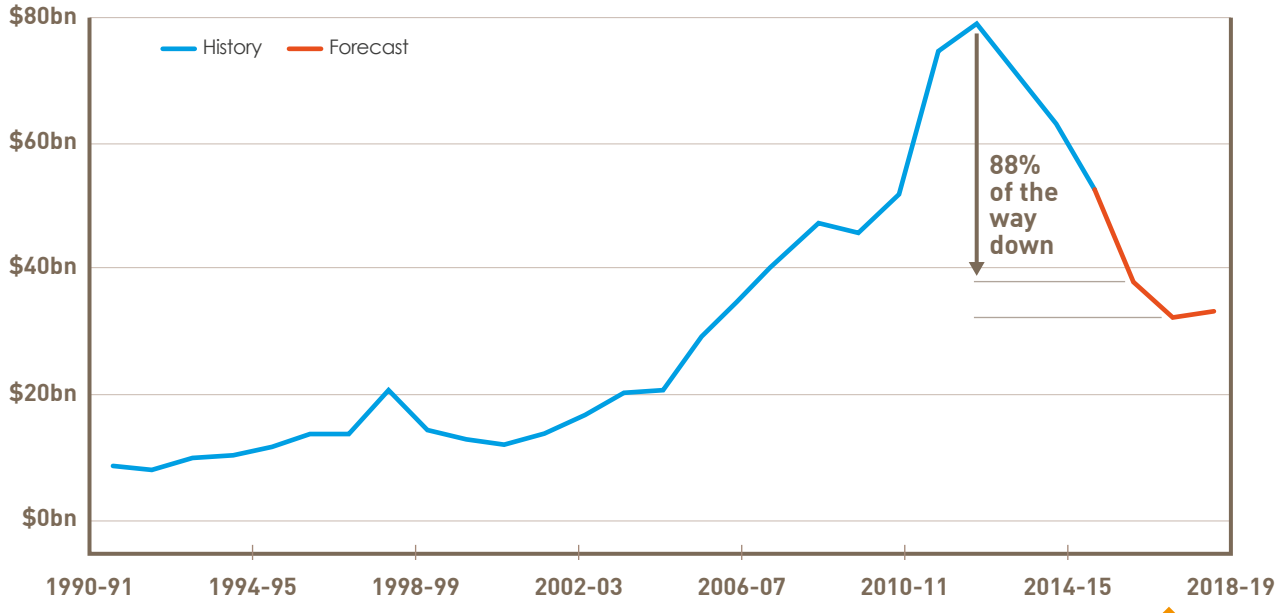
With a period of low international energy prices expected through the rest of this decade and into the 2020s, the key question is: what comes next? The prospect of returning to construction boom levels of business investment appears unlikely, despite attempts to identify the "next China"[12]. Based on analysis from CCI, the state is going through a period of adjustment, with green shoots appearing.

THE WEST AUSTRALIAN ECONOMY

The state economy continues its transition from one driven by record business investment in energy and resource projects to an economy led by export growth. Whilst exports are now the driving force of the state economy, a stubbornly high unemployment rate and low wage growth means that state final demand is not expected to return to growth until 2018-19.

CCI does see cause for optimism on the horizon, with economic analysis suggesting the State is nearing the bottom of declining business investment trends. At around $40-billion per annum, investment is expected to decline 15 percent in 2017-18 before growing at 3 percent in 2018-19. This growth is attributed largely to the capital required for the sustainment and maintenance of the state's major LNG plants. With an improvement in business investment, and dwelling investment, CCI expects the state economy to grow by around 2 percent in 2017-18 and 3 percent in 2018-19. Notwithstanding this forecast, the WA economy remains fragile.

WA Business Investment



[11] R. Hillman, "The Future Role for State Agreements in Western Australia", Australian Legal Information Institute, no. 25, 2006.
[12] The Economist, "The Next China", The Economist, July 29, 2010.

INNOVATION HORIZONS

Western Australia has risen to global prominence in the energy innovation sector. As a major exporter of commodities, the state is heavily subjected to the ebbs and flows of an international market characterised by competition and change. The result is an innovative sector characterised by a strong interrelationship between industry, the state, and universities working to activate the state's commodities sector. This is best exemplified by the large-scale development of Floating Liquefied Natural Gas (FLNG) facilities, including the Prelude facility located off the north-west coast of Australia. Like the North West Shelf a number of decades earlier, efforts to solve challenges associated with FLNG have created world class research specialities within Western Australia.

With worldwide natural gas consumption slated to increase from 120 trillion cubic feet (TcF) in 2012 to 200 TcF in 2040, natural gas production is forecast to increase by nearly 69 percent to 2040. While Australia has enough proven LNG reserves to capitalise on this emerging demand, accessing it, while remaining open and flexible enough to accommodate the inevitabilities of market instability is another challenge. FLNG technology offers just this kind of flexibility, allowing adopters to capitalise on offshore energy reserves. As FLNG technology matures and the frontier is pushed to more challenging environments, research and technical solutions can be delivered by Western Australia.

GOVERNMENT POLICY

Despite campaign rhetoric and political brinkmanship, there is reasonable consistency, at the state level, on energy policy. Differences on uranium policy and privatising certain government utilities are some of the few exceptions, although this may change. Government policy is important in many aspects of the sector, be it regulation, approach to electricity markets and the use of State Agreements.

In the context of Western Australian debt, commodity prices and general economic conditions, the State Government will be constrained in its ability to make major capital outlays. This will mean that at least until the 2020s, government policy will need to look to private capital and mechanisms such as public-private partnerships. History suggests, however, that during periods of economic downturn positive policy tends to emerge, allowing governments to enact significant change.

The future of the energy sector will be important to the Western Australian Government regardless of its diversification strategies. In 2016 minerals and petroleum accounted for 90 percent, or $95.3-billion of the state's merchandise exports. Iron ore is the largest single component, but LNG and crude oil are in the top five merchandise exports. Once alumina— often referred to as "bottled electricity" because of the large energy expenditure required for its production — and the energy requirements associated with mineral extraction are factored in, energy policy impacts a large part of the Western Australian economy.

Contemporary Western Australian governments tend to focus on two main areas of energy policy: (1) the export of LNG and petroleum products; and (2) the management of the Western Australian electricity system, particularly the South West Interconnected System where most users (and voters) are located.

In terms of the development of the LNG export industry, governments of all persuasions have focused on driving domestic growth whilst maximising export opportunities. The North West Shelf Project demonstrates the relationship between the export and domestic markets. Similarly, government investment in the Dampier-Bunbury-Pipeline and the signing of a long-term take-or-pay domestic gas contract, underpinned the investment confidence to develop the North West Shelf Project. Based on this confidence, participants could then build the infrastructure required for the liquefaction of natural gas. Other forms of policy in the name of domestic development – primarily the domestic gas reservation policy – can be more contentious. What is fundamentally important, however, is that the policy is known upfront and agreed to by an act of Parliament by the Government and associated producers. The certainty of policy frameworks in Western Australia serves to avoid scenarios such as those playing out in eastern Australia, which is struggling with the integration of domestic and international gas markets.

Electricity Prices: In Western Australia, electricity prices are set by the Government. Additionally, a significant amount of the electricity sector is owned by the Government, including transmission and distribution systems and around 85 percent of the wholesale market. Efforts to reform the sector have occurred in bursts, with over three decades of partial deregulation and privatisation resulting in an industry which has had to deal with significant technological change, while being legislatively and politically limited from major organisational restructuring. Addressing the difference between the costs of generating, transmitting, distributing and selling electricity, and the revenue received is a challenge for the State Government. To make up this difference, the Government provides a subsidy to Synergy, its electricity generator-retailer. This amounts to around $300-million per year because most household electricity bills are approximately 15 to 20 per cent below Synergy's costs.[13] A shift to cost-reflective tariffs is viewed by economists as important in ensuring the efficiency of the sector and the prudent use of public funds.

The State Government's Energy Minister, Mr Ben Wyatt MLA, refers to cost-reflective tariffs as the "Holy Grail" of Western Australian electricity policy. Like his predecessor, Minister Wyatt is also Treasurer, so he has visibility of the subsidy from both sides of the ledger. Within a few weeks of taking office, the Minister flagged this was a serious issue for the State, and on July 1, 2017, implemented changes that saw prices rise by 10.9 percent. This will result in a reduced subsidy of $146-million in 2017-18. If the move to cost-reflective tariffs is fully implemented, the subsidy could fall to zero.

Following the implementation of cost-reflective pricing there is the potential to consider 'time-of-use pricing', which sees a variable charge for electricity consumption depending on the time of day. Analysts see this as a further efficiency measure which reflects the fact that delivering electricity across the day has different costs. It is also favoured as it would reduce demand for infrastructure which is only utilised for a limited number of hours or days a year.

Horizon Power's Retail Trial:

A key element in generating support for the Government's decision to introduce cost reflective pricing structures is for the electricity sector to embrace reform and its customers through improved communication and education, and offering products that customers want and understand. Horizon Power, owner of the North West Interconnected System and regional microgrids, recently trialled an innovative demand based pricing pilot with 400 customers in Port Hedland. The participants ranged from vulnerable customers (in some cases Horizon Power provided the necessary smart phones to these customers) through to small businesses. All customers were allocated a target number of peak units to consume during the peak period of 1pm to 8pm based on their historical use at this time. Analogous to a phone plan, customers could easily understand their consumption patterns through their smart phone and adjust if they were reaching their limit. Customers were engaged through the program and made efforts to stay within their limits and shift usage. Results of the trial showed customers 'got it, liked it and made changes for it' seeing some reduction in peak demand, as expected. Horizon Power is now working with government to establish a demonstration phase of the pricing model, allowing customers to opt-in, in one or two towns.

[13] D. Mercer, D. Emerson and P. Wearne, "WA Treasurer Ben Wyatt Wants the Price of Electricity to Reflect its Cost", The West Australian, March 27, 2017.

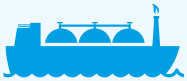
CCIWA's Position on Energy

The Chamber of Commerce and Industry of Western Australia is a champion of the energy sector. Between the natural gas that will catapult Australia to become the world's leading LNG exporter, the emergence of Lithium, and our access to renewable resources, Western Australia is an energy state. CCI develops a range of advocacy positions on energy through National Policy Adviser Joe Doleschal-Ridnell and its Energy & Resources Forum, chaired by Quadrant Energy's David Parker. "The focus of the Energy & Resources Forum is to facilitate policy development between industry and Government to encourage further investment in Western Australia and to ensure the small to medium enterprises and the community benefit through local supply chain growth," said David Parker. CCI is also working with the new Government on electricity reforms – particularly the need to adopt a constrained access model and cost-reflective tariffs. The former is critical for a more efficient electricity system which will connect new low emissions technology to the grid, while for the long-term sustainability of our network, it is essential that users pay for the true cost of electricity. CCI is engaging with federal policy makers on how changes to taxation regimes, such as mooted suggestions to the Petroleum Resource Rent Tax, will have consequence on the attractive regime that has underpinned extensive development in recent years.

FUTURE CHALLENGES AND OPPORTUNITIES

There are an array of energy-related opportunities and challenges which Western Australia will be forced to deal with in the coming decade. Some of these challenges will be manageable. Others will be more difficult and perhaps existential for some parts of the energy sector. The prospect for the future of the coal-fired power station at Collie will demand attention. Similarly, emerging opportunities will be varied and at times unexpected. It is likely that policy responses will be influenced by societal attitudes towards energy. By the 2020s, many more non-fossil fuel options will exist. Each will have a particular cost and benefit profile. Legacy infrastructure and industries will continue to heavily influence decision makers.

Through discussions with industry leaders, academics and policy specialists, we have identified the following challenges and opportunities.

Issue	Description
New products and services disrupt the electricity sector 	While cheap solar batteries have been the major cause of disruption to the electricity sector over the past decade, there are an array of new consumer, storage and production devices entering the market. These technologies may force the existing South West Interconnected System to shrink, but may also radically change the valuation of state owned electricity utilities.
The LNG market shifts to a spot pricing model 	A shift to a fluid, spot market for LNG sales may make it more difficult for subsequent LNG projects to be commissioned in Western Australia. With untapped reserves in deep water requiring significant investment, Western Australian projects will need to be competitive against other new ventures which have different cost structures. Greater agreements between companies and with backfill options for existing plants appears to be the likely scenario.
Restrictions placed on unconventional gas 	Unconventional gas reserves remain an untapped resource in the State. Proponents suffer under the politicisation of the resource, with environmental opposition to exploration in the Kimberley and other regions now excluded from the possibility of development. While offshore development has been the focus for Western Australia, the act of restricting development of certain forms of gas may appear to company boards as the 'thin edge of wedge'.
Domestic Gas Reservation policy is modified 	The Australian Energy Market Operator's Gas Statement of Opportunities recognises there is excess supply in the Western Australia domestic gas market to the early 2020s. From this point, there is a question regarding where new supply will be sourced. Domestic gas reservation policy may have to be revisited if it has had the result of deferring investment in domestic-specific fields. With new, large LNG facilities unlikely, there may be potential to revisit the method of defining domestic gas reserves. There is additional risk that Western Australia will be caught in the Federal Government's domestic gas security mechanism.
Western Australia improves investment climate 	Despite being an attractive investment destination for large energy projects, the competition for the next wave of LNG projects will be intense. To improve the investment climate, it is possible for the government to address the issues which occurred during the construction boom to increase the flexibility of the labour force and to also continue to reduce the compliance and regulatory burden.
Australia becomes uncompetitive due to tax policy and regulatory uncertainty 	The current settings of the Petroleum Resource Rent Tax (PRRT) has facilitated over $100-billion of investment for the State. Changing or threatening to change the tax regime, however, will have consequences on future projects. Altering the PRRT will affect the attraction of global capital to explore for new reserves, where activity is already at a decades-low level.
Asian energy demand rebounds and accelerates 	Most forecasts expect over supply in the LNG market in Asia into the next decade. Surprises often occur in the energy market, however, and assumptions are regularly turned upside down. It is possible that an acceleration of economic growth, rapid change in government policy within mature markets (Japan/South Korea) or other Black Swans could see gas demand growth kick-start the next wave of investment. Floating Storage and Regasification Unit are already altering the parameters of the LNG market. Other technological and business process innovations may emerge.
Bipartisan support for uranium mining shifts 	Western Australia has extensive reserves of uranium, but at the current low global price and a historic ban on development, currently does not have any operating mines. The current low price will not always be the case, and subsequently local industry needs the regulatory framework in place to react nimbly to international demand.
The future of Collie 	In considering the future of energy, it is easy to forget the legacy components of the industry which have employment implications and localised impacts. The future of coal mining and coal generation communities is an issue across the Western world. If coal generation capacity continues to shrink, it will impact the viability of Collie and the surrounding region. This will be a policy issue of the late 2010s and 2020s which will require some type of adjustment plan.

BECOMING AN ENERGY GIANT

Becoming an energy giant involves understanding and responding to international forces, while remaining open and attractive to international investment. These Western Australian Energy Maps are a starting point in bringing the various threads of the sector together. Like the sector itself, it is an incomplete project. New technologies and events will change the parameters of energy production and consumption. The next stage of the Western Australian Energy Map will involve an interactive component and the potential for an energy information service.

Perth USAsia Centre

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The Perth USAsia Centre located at The University of Western Australia is a non-partisan, not-for-profit institution strengthening relationships and strategic thinking between Australia, the Indo-Pacific and the United States The Centre is a leading think tank focusing on geo-political issues, policy development and building a strategic affairs community across government, business and academia.

Chamber of Commerce and Industry WA

CHAMBER OF COMMERCE AND INDUSTRY WA

CCI is an independent, not-for-profit organisation that has been the voice of business for more than 125 years. With more than 9,000 members from across all regions and industries, its mission is to make it easier to do business in this state and ensure that WA is a place where businesses of all shapes and sizes can succeed.

THE UNIVERSITY OF WESTERN AUSTRALIA

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The University of Western Australia is one of Australia's leading universities and has an international reputation for excellence in teaching, learning and research. IIt has almost 24,000 students enrolled across four faculties.

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A STATE OF ENERGY

Strategic, Commercial and Innovation Drivers in Western Australia

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