Energy

The growth in renewables, batteries and innovative technologies will lead to a **vastly different looking energy system** to the one originally designed for a small number of large fossil fuel sourced generators. Considering the **speed of change in the energy sector**, the WA Government should continue to prioritise proactive transition.

What IWA heard

During consultation on the draft strategy, stakeholders raised the importance of achieving the net zero emissions by 2050 target (in line with feedback on the Climate change and sustainability chapter), highlighting the opportunity for the energy sector to achieve net zero in a more ambitious time frame. Relevant energy sector recommendations reference the achievement of emission reduction targets, including net zero emissions by 2050, and interim targets once they are established. Stakeholders also highlighted the opportunity for additional modelling considerations in the next Whole of System Plan (WOSP). This included gas and hydrogen transmission and use, and large-scale electrification by domestic, commercial and industrial end users as the South West Interconnected System (SWIS) decarbonises. The opportunity to model or apply relevant assumptions to the next WOSP is now discussed.

Feedback on natural gas and hydrogen varied. Some stakeholders highlighted the importance of transitioning away from natural gas and the potentially risky nature of the blue hydrogen industry, due to challenges in capturing and offsetting greenhouse gas emissions. Others raised the need for the blue hydrogen industry to support effective transition to renewable hydrogen and for state government support for carbon capture and storage and sequestration opportunities. Reference is now made in this chapter to hydrogen proposals being considered in the context of emission reduction targets and environmental approvals.

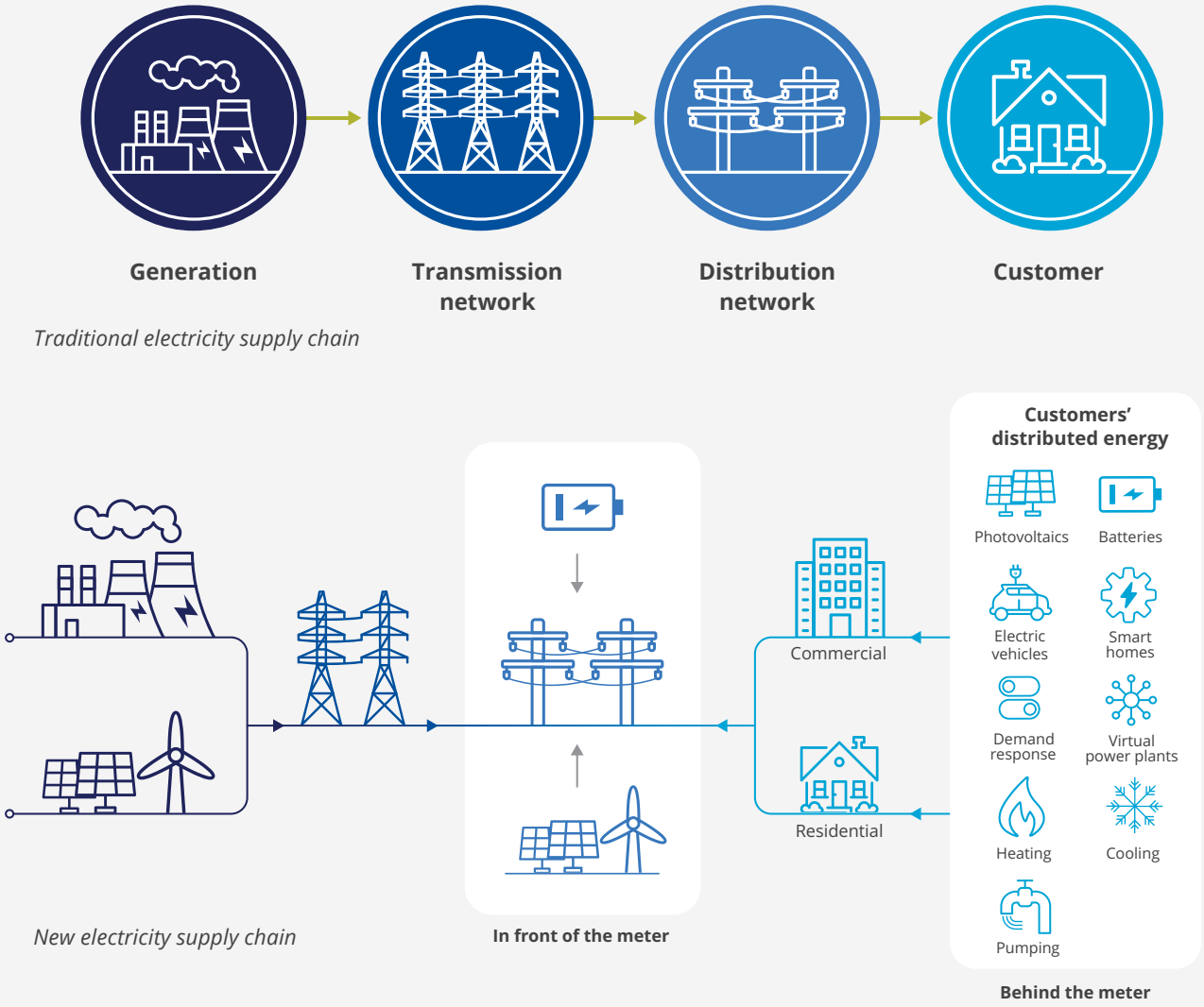
Feedback also highlighted that land use, land tenure, native title, cultural and environmental value and coordination should be better considered in the state's hydrogen program. This is now considered under relevant recommendations.

Around 1 in 3 households in WA have solar power systems on their roofs.[1] In 2020 alone, more than 300 megawatts of residential solar power were added in WA, which is almost equivalent to the annual output of the state's largest coal-fired power station.[2] As more renewable energy resources are added to the network, it will increasingly transform from a traditional linear system to one that is further decentralised (Figure 32).[3]

While advancing renewables is enabling the transition to net zero carbon emissions (as detailed in the Climate change and sustainability chapter), it comes at a cost to existing large-scale infrastructure, which was developed in a different era. Coal-fired power generation is becoming more challenging to operate as it needs to run at a minimum level of service to ensure stable supply, regardless of availability of other power sources. The state has already commenced the transition away from coal-fired power generation to renewable sources. Two of the 4 operating units at Synergy's Muja Power Station are programmed for retirement from October 2022. Further consideration may need to be given to the retirement of remaining coal-fired power sources, particularly in light of the Glasgow Pact, which seeks to phase down coal power.

Generating energy from zero emission sources will reduce dependency on fossil fuels and greatly assist the state's transition to net zero emissions by 2050. It presents a significant opportunity to progress early achievements in emissions reduction, compared to other sectors where progress may take longer. As WA is a major exporter of liquefied natural gas, there will be increasing pressure to transition to cleaner energy for the state to remain competitive, as global customers commit to substantial interim and long-term emission reduction targets. While gas-fired power is used as a transition fuel in the medium term, longer-term reliance on gas would mean the state will find it harder to achieve emission reduction targets.

Figure 32: Transformation of the electricity supply chain[4]



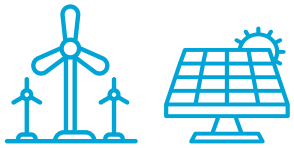
Renewable energy, combined with storage, has the potential to enable energy users to disconnect from the main network, particularly in remote areas. Although renewable energy provides opportunities for lower-cost generation and a less emission-intensive energy network, there are challenges with the intermittent nature of the generation, which can impact system reliability and security.[5] As the state's energy systems are geographically isolated, each network needs to have enough power to meet peak demand, while retaining sufficient backup energy for unplanned outages.

Energy storage will increasingly be a key requirement of reliable supply in a renewable environment. Currently, this storage capacity is limited to small loads of several hours through distributed battery storage. From a system-wide perspective, the current cost of batteries for storage and supply purposes to enable transition to a fully renewable system is a challenge. Until further advances are made to enable lower prices for battery storage, or until alternative storage solutions and supply sources such as pumped hydro and renewable hydrogen develop, energy systems including the SWIS will need to partially rely on gas-based energy sources to maintain sufficient system supply. There are a number of hydrogen projects currently proposed that could connect into the SWIS and consume excess power to convert into hydrogen.

If they proceed, these hydrogen projects could further stabilise the SWIS and accelerate the retirement of coal-fired power generation.

Renewable hydrogen is emerging as an opportunity to decarbonise local industries, create new exports and accelerate the green energy economy.[6] Considerable activity is underway as jurisdictions and industry seek to rapidly advance technologies, establish production capability and harness international market interest. WA is well positioned to become a global leader in the international supply of renewable hydrogen.[7] The state has demonstrated capability in mass production through its liquefied natural gas (LNG) projects. It also has superior co-located solar and wind renewable energy resources, and available land to support large-scale hydrogen precincts and aligned industrial uses.[8] Both the state and Australian governments are ready to invest to attract proponents through initiatives such as the WA Renewable Hydrogen Fund and the Australian Renewable Energy Agency's Renewable Hydrogen Development Fund. Ensuring appropriate infrastructure is in place will help to unlock future strategic industries for the state.

The energy sector plays a fundamental role in supporting the state's resilience. Impacts to energy supply, alongside broader challenges associated with demand and dependence, have the capacity to shape how many industries and assets prepare, respond and recover in the face of shocks to the energy network. Overall, a rapidly changing energy sector requires modified frameworks, infrastructure and regulations as the state continues to plan for a more sustainable, reliable and cost-effective energy system. Considering the speed of change in this area, the WA Government should continue to prioritise proactive transition to renewable energy solutions.



As detailed in the Climate change and sustainability chapter, the outcomes of the recent international negotiations at the 26th United Nations Climate Change Conference of Parties (COP26) in Glasgow calls upon countries to 'accelerate efforts towards the phasing down of unabated coal power, recognising the need for support of a just transition'.[9] The summit called upon governments to 'accelerate the development and deployment of technologies and adopt policies that transition to a low emission energy system, including rapidly scaling up clean power generation and energy efficiency measures'. In 2020, 2 action plans were released: the *Economic Development Action Plan for the Collie and Bunbury Regions* and *Collie's Just Transition Plan* to **strengthen the transformation of the local economy, acknowledging the diminishing role that coal will play**.[10] Depending on the uptake of renewable energy and the level of commitment from all levels of government following COP26, coal-fired power retirement could be faster than anticipated. If this is the case, the support for diversification of Collie's coal-fired, power-related businesses and communities may need to accelerate.

Governance

Compared to most other jurisdictions, WA is in the unique position of having most of its electricity network in public ownership. This presents a number of strategic opportunities, as well as several challenges.

Through state government ownership, specialised energy utilities established as government trading enterprises (GTEs) can more easily implement and direct change but are also required, by legislation, to provide a financial return to government and operate commercially in the market. This includes satisfying an independent economic regulator on the suitability and cost efficiencies of their investments.

WA has 2 main energy systems – the SWIS and the North West Interconnected System (NWIS) (Figure 33) – and many more isolated energy systems throughout the state.

Figure 33: Location of the North West Interconnected System and South West Interconnected System[11]

South West Interconnected System

The SWIS is an interconnected electricity system in the south-western part of the state. Western Power is the GTE responsible for the electricity network that connects electricity generators to customers in the SWIS, while Synergy is the GTE generator and retailer for the SWIS. A significant proportion of power generation in the SWIS is privately owned and operated.

North West Interconnected System

The NWIS is in the Pilbara region and includes a number of variously owned interconnected electricity networks. The 3 largest participants in the NWIS are Horizon Power (a GTE), Alinta Energy and Rio Tinto. Other large mining companies, including BHP and Fortescue Metals Group, also own major energy infrastructure in the NWIS and the broader Pilbara region to service their individual operations.

The WA Government is currently implementing the Pilbara electricity reforms for the NWIS to improve the efficiency and effectiveness of electricity services in the Pilbara. The 2 main components of these reforms are:

- light-handed regulation to facilitate third-party access to designated electricity network assets in the Pilbara, which will apply to the interconnected networks of Horizon Power and Alinta Energy
- an independent system operator, which will apply to the interconnected network in the NWIS.

The Pilbara independent system operator functions are performed by Pilbara ISOCo, an incorporated not-for-profit company limited by guarantee under the *Corporations Act 2001* (Cth). The founding members of Pilbara ISOCo are the 3 main operators of electricity networks in the Pilbara: Horizon Power, Alinta Energy and Rio Tinto.

Other energy sector participants

Horizon Power is responsible for energy generation, transmission, distribution and retail services in many rural and remote areas, and energy infrastructure across WA that sits outside the SWIS. Beyond GTEs, there are a range of private market participants in electricity and gas generation, distribution and retailing.

Domestic gas provides approximately half the state's primary energy needs, supplying gas largely through 2 major pipelines: the Dampier–Bunbury Natural Gas Pipeline and the Goldfields Gas Pipeline. The Carnarvon Basin on the North-West Shelf supports the LNG export industry, as well as the major domestic gas market in the state's south-west. The WA Domestic Gas Policy aims to secure WA's immediate energy needs by ensuring that LNG export project developers also make gas available to the domestic market. The policy makes gas equivalent to 15% of exports available for WA consumers.

Energy strategy and policy

Energy Policy WA is leading WA's energy transformation and includes the Coordinator of Energy function. Energy Policy WA is driving considerable policy reform in partnership with the Australian Energy Market Operator (AEMO), energy sector GTEs and other participants. The major initiative is the Energy Transformation Strategy, which sets out a vision, objectives and high-level action areas to enable energy transformation. These include:

Stage 1 (2019 to 2021)[12]

- Developing the Distributed Energy Resources Roadmap, which outlines key actions to integrate small-scale renewable energy and storage resources in a sustainable and cost-effective manner to support a reliable energy system[13]
- Developing the WOSP, which includes a set of energy system modelling scenarios that detail future energy generation and network needs in the SWIS[14]
- Updating the Wholesale Electricity Market (WEM) Rules to modernise measures relating to supply and trade of wholesale electricity between retailers and generators[15]
- Revising the Electricity Networks Access Code to improve access arrangements to Western Power's distribution and transmission network, including facilitating contemporary technologies, and changes that include amendments to the New Facilities Investment Test[16]
- Trialling energy price signals to encourage households and businesses to consume renewable energy during the day rather than exporting energy during periods of oversupply

Stage 2 (2021 to 2025)[17]

- Implementing the Energy Transformation Taskforce decisions including actions from the Distributed Energy Resources Roadmap and delivering the next WOSP
- Integrating new technology into the power system through trials, including the virtual power plant trial Project Symphony, preparing for electric vehicles through the Electric Vehicle Action Plan and trialling microgrids at the fringe of the Western Power network as part of the long-term transition to a modular grid
- Ensuring system security as the SWIS continues to transition away from coal to decarbonise the energy sector, as well as to growing levels of Distributed Energy Resources Roadmap (one element of this includes reviewing the Reserve Capacity Mechanism to ensure it continues to support a reliable energy supply)
- Regulating for the future including the establishment of a governance framework that can keep pace with ongoing energy transition

Energy coordination and regulation

The WEM supplies electricity to the south-west of WA via the SWIS. The WEM consists of GTEs and private companies that generate and sell electricity, and a network operator.

The AEMO is responsible for operating the WEM in accordance with the WEM Rules and the related WEM Market Procedures. A unique feature of the WEM is the Reserve Capacity Mechanism (RCM), which ensures there is enough energy generated to meet demand at all times. RCMs are set every 2 years and include the certification of reserve capacity and the allocation of capacity credits. The SWIS is a geographically isolated electricity network with strong summer peak demand.[18] Due to its isolation, the SWIS cannot receive electricity from neighbouring states, unlike the National Electricity Market for the east coast of Australia.[19]

Under WA's *Electricity Industry Act 2004*, the current objectives of the WEM are to:

- promote the economically efficient, safe and reliable production and supply of electricity and electricity-related services in the SWIS
- encourage competition among generators and retailers in the SWIS, including by facilitating efficient entry of new competitors
- avoid discrimination in the market against particular energy options and technologies, including sustainable energy options and technologies such as those that make use of renewable resources or that reduce overall greenhouse gas emissions
- minimise the long-term cost of electricity supplied to customers from the SWIS
- encourage measures to manage the amount of electricity used and when it is used.[20]

Within the WEM, the Economic Regulation Authority monitors market participant behaviour, determines approvals requested by the AEMO, undertakes reviews required by the WEM Rules and provides an annual report to the Minister for Energy on the effectiveness of the market, compliance and enforcement.

The Economic Regulation Authority also regulates and licenses the gas and electricity industries and services throughout WA. It aims to ensure that the delivery of utilities is in the long-term interest of WA consumers by maintaining a competitive, efficient and fair commercial environment. Economic Regulation Authority processes seek to allocate market and technological risk to commercial parties to help ensure consumer electricity prices are as low as can be sustained.

Technological change and emissions reduction policy are having (and will continue to have) a significant impact on WA's energy system and regulation. Energy Policy WA is progressively amending regulatory instruments in line with the changes in the external environment. However, regulation and legislation changes can be resource intensive and lengthy. Ensuring regulation keeps pace with energy transformation and government policy is a continuing challenge.

Recommendations

Whole of System Plan

Using data provided by industry, the WOSP models 4 scenarios of how changes in demand, technology and the economy may shape the way electricity is used and supplied in the SWIS. An underlying principle of the current WOSP is the 'lowest cost supply of energy'. With new energy connections being the highest cost to construct and maintain, the most likely scenario currently directs renewable energy into the Collie/Bunbury area, where existing transmission lines exist. Despite the name, the WOSP does not present as a plan with clearly defined implementation actions.

It is a requirement of the WEM Rules that the WOSP will be updated at least every 5 years. It is understood that the next update of the WOSP is intended to consider many of the matters that IWA is proposing in Recommendation 43a. Due to the absence of data at the time of developing the first WOSP, the modelling did not completely capture the nature of change potentially occurring in the SWIS over the medium to long term. For example, it did not capture opportunities for renewable energy growth in alternate locations outside the Collie/Bunbury area (in particular the Mid West region at the northern end of the SWIS) and industry growth oriented around that renewable energy supply. This region has substantial capability for increased renewable

energy generation, as it can capitalise on high wind speeds and strong solar resources. Along with other considerations, these conditions are contributing to areas such as the Mid West becoming potential locations for large-scale renewable energy and renewable hydrogen supply in WA.

Similarly, the WA Climate Policy had not been released at the time of the original WOSP modelling. While the WOSP model can assess the emissions profile of each scenario, it did not test the lowest-cost pathway to reach the net zero emissions by 2050 target. Interim and net zero emissions targets set by sectoral emission reduction strategies, and developed in consultation with portfolios and industry stakeholders, are expected to set a decarbonising trajectory for the SWIS. As detailed in the sectoral emissions reduction strategies information, electricity will be critical to decarbonising the state's economy through the electrification of key sectors.[21] Energy Policy WA, in consultation with stakeholders, will undertake electricity modelling for the sectoral emissions reduction strategies which should also be considered in all WOSP scenarios in future modelling.[22]

An additional opportunity for the WOSP is to refine the model's approach to the curtailment of renewable energy generation, whereby energy sources connecting into the grid are reduced to enable overall system stability under certain circumstances. A degree of curtailment to ensure the system remains within its technical capabilities is expected in a power system with growing levels of intermittent renewable energy generation. However, as supporting technologies are developed and reduce in cost, future WOSPs should consider new measures that are expected to contribute to maintaining the output from renewable energy generation in the coming years (and therefore reduce the curtailment of renewables in the modelling). This includes an increased role for battery storage in the near term and the aggregation of residential rooftop photovoltaic systems in the medium term. Energy Policy WA have recently released the *Emergency solar management policy* paper that details the last-resort measures to assist the AEMO to maintain power system security during extreme load events.[23] This policy paper has been supported by a range of consumer and industry consultation information.[24] However, the next WOSP should also address practicality and community acceptance of any curtailment measures.

Future WOSP modelling exercises could align inputs, assumptions and scenarios used in AEMO's forecasting and planning for the National Energy Market, where it applies and is easily translatable to the WEM context.[25] In 2021–22 National Energy Market energy scenarios, AEMO modelled the impacts of economy-wide decarbonisation and the extent of transport and industry electrification that has occurred under each scenario.[26] AEMO also has a scenario dedicated to strong renewable hydrogen industry development in response to global action towards emissions reduction and international demand for renewable energy exports. AEMO's scenarios have been aligned to the International Energy Agency's World Energy Outlook 2020.[27]

As industries seek to decarbonise their activities, it is quite possible that large-scale industries located in the SWIS may seek to transition from standalone fossil fuel energy generation to electrification and connections into the SWIS. This could occur as the SWIS decarbonises and where high energy users seek to cost-effectively progress towards emission reduction targets set by their own organisation or government. Similarly, commercial and residential energy users may also seek to electrify to reduce associated emissions. Future WOSPs should consider rates of electrification of all sectors in relevant scenarios. The sectoral emissions reduction strategies will be supported by modelling to assist with determining rates of electrification of key sectors, and will be developed in consultation with the relevant portfolios, industries and stakeholders.[28]

The role of gas in the energy network and assumptions about the degree of electrification across the network were excluded from the WOSP. While the WOSP model is based on the electricity network and consumption of electricity, some assumptions should be made that model the impact gas has on electricity consumption and associated infrastructure needs over time.

Future WOSP exercises should be accompanied by a detailed short-term to medium-term implementation plan for the most likely scenario. This implementation plan should detail the current and planned investment, future locations of constraints in the network and priority projects eligible for streamlined approval processes.

Recommendation 43

Enable transformation of the South West Interconnected System by evolving the Whole of System Plan and ensuring implementation actions are transparent, including:

a. updating modelling inputs, assumptions and scenarios to incorporate the following:
   - achieving interim emissions reduction targets (once defined) and net zero emissions by 2050 targets through the lowest-cost mix of generation, storage, network transmission and distribution
   - potential renewable energy generation locations on the network, such as the Mid West, on energy network infrastructure requirements
   - electricity offtake associated with the development of new industries in line with state government industry development objectives
   - potential entry of existing off-grid large users connecting to the South West Interconnected System and rates of potential electrification across commercial, industrial and residential users
   - using technologies (such as energy storage) to reduce the curtailment of renewable energy generation, and the practicality and community acceptance of any curtailment assumptions
   - accelerated delivery of energy storage and other Distributed Energy Resources technologies, including the impacts these have on the overall energy infrastructure investment program
   - increased uptake of electric vehicles on the energy network, including increased demand for energy and energy storage opportunities from electric vehicle batteries

b. publishing a detailed short-term to medium-term implementation plan for the most likely scenario, which is updated periodically and identifies:
   - current and planned investment
   - network constraints
   - opportunities for investment in programs and projects to deliver energy transformation, including the nomination of priority projects eligible for streamlined approval processes.

North West Interconnected System

There are unique challenges in the NWIS, including large distances and high associated costs of energy network connections. Despite its name, energy infrastructure ownership is often fragmented, and operations lack coordination, with the primary energy users – the minerals, oil and gas industries – largely seeking self-sufficient power supply.

Like the SWIS, the NWIS is also expected to experience transition in the way energy is supplied and used. This may influence the extent to which the NWIS and the wider East Pilbara grids could be better connected. Major disruptors that may impact the NWIS energy landscape include industry proposals for significant new renewable energy generation and advancing net zero emissions targets, particularly by the resources sector.

As part of the Pilbara electricity reforms, the Pilbara ISOCo will have responsibility for long-term planning in the NWIS. The ISOCo will be required to develop a transmission development plan and a Pilbara Generation Statement of Opportunities every 2 years. It is expected that these reports will focus on the core interconnected elements of the NWIS, but there is potential to expand beyond this over time.

However, there is no strategic plan that sets out the long-term interplay between emerging industry and energy opportunities with infrastructure requirements in the NWIS.

It is therefore difficult to determine:

- the role and uptake of potential common user infrastructure, such as the East Pilbara Link and Burrup Common User Transmission Line, which would enable customers to benefit from reliable service through increased access to renewable energy generation
- how evolving options in large batteries, standalone power systems and microgrids may play a role for industries in the future, and potentially reduce the need for a more interconnected network
- what level of investment is required to facilitate industry growth and who should pay, while not over-investing in a network that will likely change in the future.

Recommendation 44

Provide a long-term view on energy generation, demand and network infrastructure requirements by preparing a North West Interconnected System energy futures report. The report should:

- align with interim emission reduction targets (once defined) and net zero emissions by 2050 targets
- test and resolve to what extent interconnection should occur in the system and the infrastructure needs to support this, along with any adjustments to access arrangements
- define the role of state agencies, government trading enterprises and the private sector
- support the identification of suitable sites for large-scale renewable energy generation and storage in proximity to industrial land and high energy users
- inform the evaluation of key project proposals, including the Burrup Common User Transmission Line and East Pilbara Link
- provide recommendations to align regulatory regimes to the outcomes of the report.

WA's mid and north-west regions have some of the **most significant solar radiance resources in the world**.[29] Wind speeds across the coast and inland areas are well above the thresholds required for commercial-scale renewable developments.[30] WA also has an advantage in our vast available land.

Energy storage, microgrids, virtual power plants and standalone power systems

Greater distribution, decentralisation and technological advances of energy infrastructure presents opportunities to reduce costs, emissions and energy loss through transmission, as well as increase the stability of supply. Infrastructure solutions that will help achieve these objectives include energy storage, microgrids, standalone power systems and virtual power plants.

Until emerging options such as renewable hydrogen, pumped hydro or other technologies can be realised, batteries will need to play a foundational role in energy storage to address fluctuating energy supply and demand.

Distributed battery storage is in its relative infancy in WA and elsewhere. The WA Government has recently committed $155 million towards the construction of a significant battery at Synergy's decommissioned Kwinana Power Station.[31] The battery is expected to be operational by the end of 2022.[32] At a domestic level, batteries have had significantly lower levels of uptake compared to rooftop photovoltaic systems.

By April 2021, there were fewer than 3,000 customers with behind-the-meter battery installations, with price being the primary barrier.[33] However, the cost of batteries is declining and greater distribution of large-scale, community and domestic batteries across the network could support system stability.

Energy storage, microgrids, standalone power systems and virtual power plants are being considered in several locations across the state and these should be advanced through a dedicated funding program to accelerate rollout. WA's rural and remote areas are prime recipients for these energy solutions, given their heavy reliance on expensive, emissions-intensive diesel generation. Emerging programs being established by the WA Government include registrations of interest for Western Power's first disconnected microgrid and virtual power plants at a number of schools receiving commercial batteries and solar panels.[34]

Recommendation 45

Increase energy system reliability and resilience, reduce emissions and drive cost-effectiveness by accelerating a dedicated program of energy storage, microgrids, virtual power plants and standalone power systems. The program should include:

- providing appropriate coordination and allocating funding
- identifying feasible locations across the state
- investigating future energy storage options, including hydrogen, pumped hydro, batteries and other energy storage technologies.

Energy legislation, regulation, approvals and funding

Legislative and regulatory reform

Energy legislation and regulation details how the electricity infrastructure is coordinated, approved and funded. Energy legislative and regulatory reform is led by Energy Policy WA. Previous versions of energy legislation and regulation objectives were narrowly focused and had the potential to limit energy transformation and long-term value to the end consumer. Objectives and investment tests that only focus on financial and short-term economic aspects can limit technology choices and innovation, create uncertainty for market participants, and lead to higher prices for consumers in the long term. The energy sector's ability to respond to broader government policy settings can also be constrained. For example, narrow objectives used in investment tests can create approval barriers for energy infrastructure that enables progress towards interim and net zero emissions by 2050, urban infill and industry development opportunities, such as renewable hydrogen.

In recent times, legislation and regulation has been revised by Energy Policy WA to include environmental objectives and respond to changing market conditions, particularly growth in renewable generation and facilitation of battery storage. Among many other improvements, the *Electricity Networks Access Code 2004* objectives have been updated to include non-financial considerations relating to the 'environmental consequences of energy supply and consumption, including reducing greenhouse gas emissions, considering land use and biodiversity impacts, and encouraging energy efficiency and demand management'.[35] Energy Policy WA has also recently proposed that an overarching objective be included in the *Electricity Industry Act 2004* for 'the protection and advancement of the interests of consumers (present and future) through energy services that are fair, secure and reliable, of appropriate quality, and affordable and sustainable, while also accounting for environmental considerations more broadly'.[36] This is a key step in reinforcing the related Electricity Network Access Code objective, and ensuring that these considerations inform decisions across all aspects of the Act.

The broadening of the electricity legislation and regulation objectives is a significant step towards achieving more-balanced outcomes in accessing and augmenting the electricity networks. However, Energy Policy WA will need to continue to review and revise legislative and regulation instruments to enable progress towards emissions reduction targets set for the energy sector (which will have a considerable impact on energy sector transformation and its infrastructure requirements), and other broader community and economic outcomes.

Once the NWIS energy futures report (see Recommendation 44) is implemented, NWIS-related regulation should also be reviewed by Energy Policy WA and, if required, updated and aligned with the outcomes of that report. This will ensure the regulatory framework is consistent with the government's view on energy generation, demand and network infrastructure requirements in the Pilbara. The energy market's highly dynamic nature means that the regulatory environment should be regularly reviewed to reflect a contemporary operating environment.

Legislation and regulation application

Energy legislation and regulation is applied by several energy sector stakeholders. In particular, the Economic Regulation Authority uses WEM objectives and investment tests detailed within legislation and regulation to ensure energy network investments deliver long-term value to WA consumers. As the Code objective of environmental consequences is, so far, unproven in investment tests, there is some debate about the necessary level of detail required of proponents to support proposals and how the Economic Regulation Authority will assess this information. Test cases are required to establish the operational effectiveness of the environmental Code objective, following which a review should determine if the objective is being applied in the intended manner.

Given the long-term nature of environmental consequences, these test cases should also consider medium-term and long-term horizons, beyond those that currently apply for the 5-year Network Access Arrangement, and energy scenarios such as those used in the WOSP.

Legislation, regulation and funding arrangements

Energy transformation and infrastructure, particularly new transmission lines, can be expensive to fund and deliver. New infrastructure may be required to connect renewable energy generation and storage to enable transition to net zero emissions and economic growth.

Currently it is difficult for stakeholders such as energy GTEs to obtain approval for electricity infrastructure via the Economic Regulation Authority or state government budgeting processes where costs are to be borne by the end consumer or the wider community. A symptom of the current arrangements is 'first-mover disadvantage', where one market participant may be left with no option other than to fully fund some or all electricity infrastructure, and participants who follow benefiting but bearing no cost, or a limited amount of the cost. While there are some mechanisms in place to recover costs from subsequent new customers connecting to the energy grid, payback periods may be slow or unpredictable. Where infrastructure investment is significant, such as transmission lines, the costs can be prohibitive even for large participants. Similarly, it is understood that there are some instances of 'last-mover disadvantage'. Last-mover disadvantage results where surplus capacity is absorbed by market participants without upgrading utilities. At the point of energy system constraint, the last mover is then required to fund the full upgrade.

A range of funding and financing sources should be considered to deliver energy infrastructure that enables broader public policy outcomes, such as a low-carbon future and new industry growth.

Funding and financing sources could include federal and state government, the finance sector, private industry, community and energy consumers. To explore this potential, the WA Government should establish a clear policy position on the role of government, GTEs and the private sector in funding, financing and delivering enabling infrastructure, particularly transmission lines.

Recommendation 46

Ensure the legislative and regulatory framework enables energy infrastructure that aligns with broader public policy outcomes by:

a. reviewing and revising energy legislation, regulations, codes, guidelines and associated decision-making documents and processes (particularly relating to the New Facilities Investment Test) to include the interim emissions reduction (once defined) and net zero emissions by 2050 targets, urban infill and industry development objectives in a manner that does not unduly disadvantage first or last movers

b. reviewing the effectiveness of guidance and assessment for investment proposals under the current objectives of the Electricity Network Access Code 2004, as well as the expected levels of information and analysis required from proponents.

c. consistent with Recommendation 40 in the Infrastructure delivery chapter, establishing a clear policy position on the role of government and the private sector in funding, financing and delivery of enabling infrastructure, such as transmission lines, in order to support industry growth and decarbonise the energy sector.

Hydrogen industry

The objective of developing an energy system highly dependent on renewable energy opens opportunities for the hydrogen industry that can be scaled up locally before moving into international exports. The WA Government has set a 2030 target for WA's market share in global hydrogen exports to be similar to its current share in LNG.[37] For context, in 2019, WA accounted for 12% of global LNG exports.[38]

Hydrogen is currently used primarily as feedstock for industrial chemical processes. Emerging uses include transport, heat, electricity generation and energy storage (Figure 34).[39] Renewable hydrogen (otherwise known as 'green hydrogen') is produced by using renewable electricity to electrolyse water, splitting it into hydrogen and oxygen (Figure 35).[40] As a zero-emission energy source, renewable hydrogen is expected to experience high international and domestic demand as countries seek to decarbonise energy-intensive industries and infrastructure sectors. However, blue hydrogen (produced from natural gas, coupled with carbon capture and storage) is likely to play a role as a transitional energy source, using the state's existing LNG capability, production and distribution infrastructure, and customer base to generate initial growth. This is reflective of forecasts that suggest it will take 10 to 15 years for renewable hydrogen to achieve price parity with blue hydrogen.[41]

Figure 34: Uses of hydrogen[42]

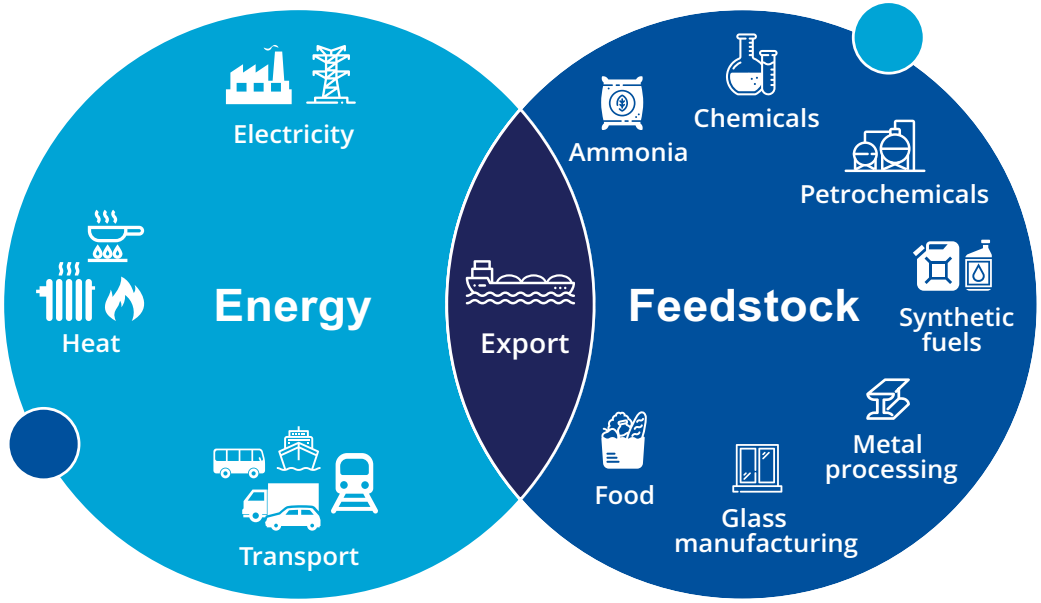
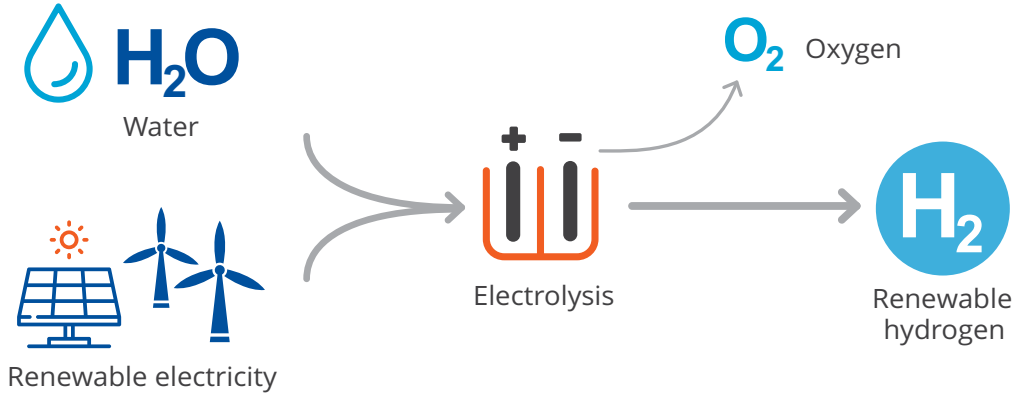


Figure 35: Production of renewable hydrogen (simplified)[43]



All hydrogen proposals should be considered in the context of interim emissions reduction and net zero emissions by 2050 targets and will need to meet expectations set in the Environmental Protection Authority's *Environmental Factor Guideline: greenhouse gas emissions*.[44]

The WA Government's *Western Australian Renewable Hydrogen Strategy* sets out a vision, mission and strategic focus areas for a future hydrogen industry.[45] Strategic focus areas include export opportunities, remote application, hydrogen blending in the natural gas network and transport.[46] Actions outlined in the strategy are now being progressed by the Department of Jobs, Tourism, Science and Innovation together with partnering organisations. These actions include a review of the state's policy and legislative framework, market sounding for hydrogen development at Oakajee and supply chain modelling to identify limitations affecting the renewable hydrogen export industry. This has been coupled with $61 million towards renewable hydrogen initiatives in the 2021–22 WA Government State Budget, which includes a fund to stimulate local demand for hydrogen in transport and industrial settings and an infrastructure plan to activate Oakajee for renewable hydrogen.[47] In addition, the federal Department of Industry, Science, Energy and Resources has produced *Australia's National Hydrogen Strategy*, which explores the country's clean-hydrogen potential and details nationally coordinated actions involving governments, industry and communities.[48]

By capitalising on its comparative advantages, WA has the potential to establish itself as a leading participant in the rapidly developing global hydrogen market. Key to this will be demonstrating lowest cost of production.[49] Initial studies have shown that co-located WA wind and solar farms, which can be used to power renewable hydrogen, are more financially attractive than co-located renewable energy generation in other jurisdictions.[50] This is due, in part, to WA's access to excellent solar and wind resources.

In a hotly contested national and global environment, government action should be prioritised with coordinated plans across state agencies and GTEs. Hand in hand with industry, the state government should continue to prepare for legislation and policy amendments and plan for a pipeline of enabling infrastructure for the hydrogen industry, including ports, roads, water and energy transmission.

The potential to connect the developing hydrogen industry into the SWIS has not yet been modelled in the WOSP. Planning for hydrogen has progressed significantly since WOSP modelling commenced and, now that more industry information is available, hydrogen inputs and assumptions should be modelled more effectively to understand the potential role of hydrogen as energy storage and an energy source for the SWIS. Preliminary investigations into enabling infrastructure for the hydrogen industry have indicated that significant planning and investment is required to expand port capacity to cater for future exports. Studies should consider:

- the most suitable zones/hubs for hydrogen production and export
- opportunities to leverage access to energy, water and transport infrastructure, a skilled workforce and market proximity
- potential volumes of supply
- infrastructure requirements and supply chain needs
- costs and benefits for renewable hydrogen in these respective locations
- land use and tenure requirements, including the consideration of suitable sites for large-scale renewable energy generation and storage in proximity to industrial land and high energy users.

Recommendation 47

Support the development of the state's hydrogen industry by:

a. accelerating the reform of legislation, standards and policies

b. investigating options for stimulating domestic market demand, as a precursor to establishing export industry demand

c. investigating the feasibility of a hydrogen refuelling network on key freight routes across the state through the planned detailed supply chain model for renewable hydrogen

d. publicly reporting the *Western Australian Renewable Hydrogen Roadmap*'s actions on an annual basis, including timing, available funding and transition pathways such as the role of blue hydrogen

e. investigating the feasibility of, and prioritising, large-scale hydrogen industry precincts that leverage energy, water and transport infrastructure, a skilled workforce and market proximity, including:

   i. consistent with Recommendation 43, developing energy consumption and generation projections for use in the Whole of System Plan modelling to determine the need for energy infrastructure to enable hydrogen precincts, such as the Mid West Transmission Line

   ii. coordinating activities for development readiness of precincts across environment, heritage, planning and tenure matters

   iii. consistent with Recommendation 40 in the Infrastructure delivery chapter, establishing a clear policy position on the role of government and the private sector in funding, financing and delivering enabling infrastructure to support the hydrogen industry (including factors such as seed funding, co-investment and cost recovery)

   iv. developing and implementing a staged program of hydrogen-industry-enabling infrastructure including publicly and privately funded upgrades or new infrastructure for energy networks, refuelling stations, water and transport infrastructure.