



GOVERNMENT OF
WESTERN AUSTRALIA

Future Battery Industry Strategy Western Australia



Contents

Minister’s Foreword 1

Chief Scientist’s Foreword..... 2

Future Battery Industry Strategy..... 3

Why a Future Battery Industry Strategy? 4

Lithium-ion Battery Value Chain 5

Western Australia’s comparative advantages..... 6

Western Australia’s Battery Metals 2019..... 9

Government approach 10

Action theme 1: Investment attraction..... 12

Action theme 2: Project facilitation..... 13

Action theme 3: Research and technology sector development 14

Action theme 4: Adoption of battery technologies – new opportunities 15

Implementation and stakeholder engagement16

Acknowledgements17

Minister's Foreword



Western Australia is uniquely placed to become a world leader in the future battery industry. We have the minerals, the technology and the expertise to seize this once in a lifetime opportunity to transform our economy. The State Government is committed to this vision, which will deliver jobs, skills, economic diversification and regional benefits across the State.

The *Future Battery Industry Strategy* sets the pathways to deliver this vision for the benefit of all involved in this emerging industry as well as all Western Australians.

The opportunity is now. Manufacturers around the world are seeking to consolidate their supply chains to meet the ever-growing demand for electric vehicles and energy storage systems. In a very competitive environment, our ambition is to build on our recognised mining excellence to become a central player in the global battery value chain.

Our ambition goes beyond mining. The State can build on its strong industrial base to attract more investment into diversifying mineral production and increasing the scale of domestic processing activities. Establishing strong foundations at the precursor stages of the supply chain will create favourable conditions for further downstream manufacturing activities.

Western Australia can capitalise on its unique comparative advantages to achieve this ambition. It has significant reserves of all critical battery minerals, world-class skills and expertise to extract and process these minerals, exceptional ethical and sustainable production standards, infrastructure and workforce, and world-leading research capacity in mining and mineral processing.

The State's vision also focuses on opportunities arising from the growing domestic uptake of battery technologies. Western Australian companies are already excelling at assembling, installing or controlling battery-based energy storage systems, and we hope to build on their expertise to transform our economy and export our technologies.

The Western Australian *Future Battery Industry Strategy* showcases the State's competitive advantages and provides a framework for Government leadership and clear, practical actions to deliver our vision for the Western Australian industry.

I would like to thank representatives from across government, industry, research and development organisations and the community for their integral contribution and continuing support.

The Government's vision and this strategy have the potential to transform the State and place it at the centre of a global industrial revolution. I am confident the collaborative approach adopted in the State's Strategy will unlock this potential. I look forward to seeing it come to fruition.

Hon. Bill Johnston MLA
Minister for Mines and Petroleum; Energy

Chief Scientist's Foreword



I am absolutely delighted to be writing this Foreword for the *Future Battery Industry Strategy*. There are few times in a person's life when they find themselves at the epicenter of worldwide technological interest. With the advent of new battery technologies, Western Australians now find themselves precisely in that position.

The revolution in battery technology has been swift, and the pace of change relentless. This technology is transforming our world from electric vehicles, to storage units for renewable energy, cordless power tools, and numerous other applications.

Western Australia is unbelievably well poised to take full advantage of this remarkable phenomenon. As highlighted in this Strategy, this State has all the components necessary for modern battery technology, including lithium, nickel, cobalt, manganese, aluminium, vanadium, and rare earth metals; in addition, there are reserves of untapped, high-quality graphite. This State also has world-class research institutions, internationally-competitive manufacturing capability, and a highly capable workforce.

Western Australia has a proud tradition in mining, and the resource sector generally, that goes back over 130 years. With the emergence of new battery technologies, Western Australia can build on this solid bedrock, and seriously investigate downstream opportunities that could take the State in a new direction. What a time to develop new mines, pursue mineral processing, explore manufacturing of battery components and cells, as well as battery assembly and recycling. What an opportunity for economic diversification, value adding and job creation!

This is not a time to be timid or risk averse. The world is moving ahead at a rapid rate, and other nations not blessed with our natural resources are pushing ahead strongly. This is a highly competitive field, and time is of the essence. The risk to Western Australia is not if we explore downstream opportunities, the risk is if we do NOT examine these prospects assiduously. Future generations could look back and rightfully ask "What were you doing when you had all the elements necessary for battery production, and you chose to ignore them?"

This is a landmark Strategy, which illuminates the State's unique capabilities in an amazing new technological arena. Furthermore, this Strategy emphasizes the State's commitment to a long-term, multi-sectorial approach that builds on comparative advantages. So, let's go forward confidently and make the most of this exciting, once-in-a-generation opportunity. This is our moment!

Professor Peter Klinken AC
Chief Scientist of Western Australia

Future Battery Industry Strategy

Vision

In 2025, Western Australia has a world leading, sustainable, value-adding future battery industry that provides local jobs, contributes to skill development and economic diversification and benefits regional communities.



Western Australia to be globally recognised as a leading producer and exporter of future battery materials, technologies and expertise.



Improve the competitiveness of Western Australia's future battery minerals and materials industry.



Expand the range of future battery minerals extracted and processed in Western Australia.



Increase the scale of processing, manufacturing and service activities across the breadth of the battery value chain in Western Australia.



Increase research and development activities focused on the battery materials and high technology energy sectors in Western Australia.

Why a Future Battery Industry Strategy?

Western Australia needs a dedicated strategy to grow the industry and reap the full potential of its battery minerals, processing and manufacturing capacity, technical expertise and research capability.

The rapid uptake of electric vehicles and battery-based energy storage systems across the world is driving global demand for lithium-ion batteries. Electric vehicle and battery manufacturers are securing sources of minerals, materials and components to meet this increase in demand. As these manufacturers are consolidating their supply chains, countries around the world are competing to capture investments at different stages of the production process.

Western Australia is well placed to seize this opportunity. It has the minerals, the expertise, the standards, the infrastructure and the research capability to become a key player of the global battery value chain. However, it is unlikely that Western Australia will move into further processing, the manufacturing of battery components and the assembly of energy storage systems without leadership from the State Government.

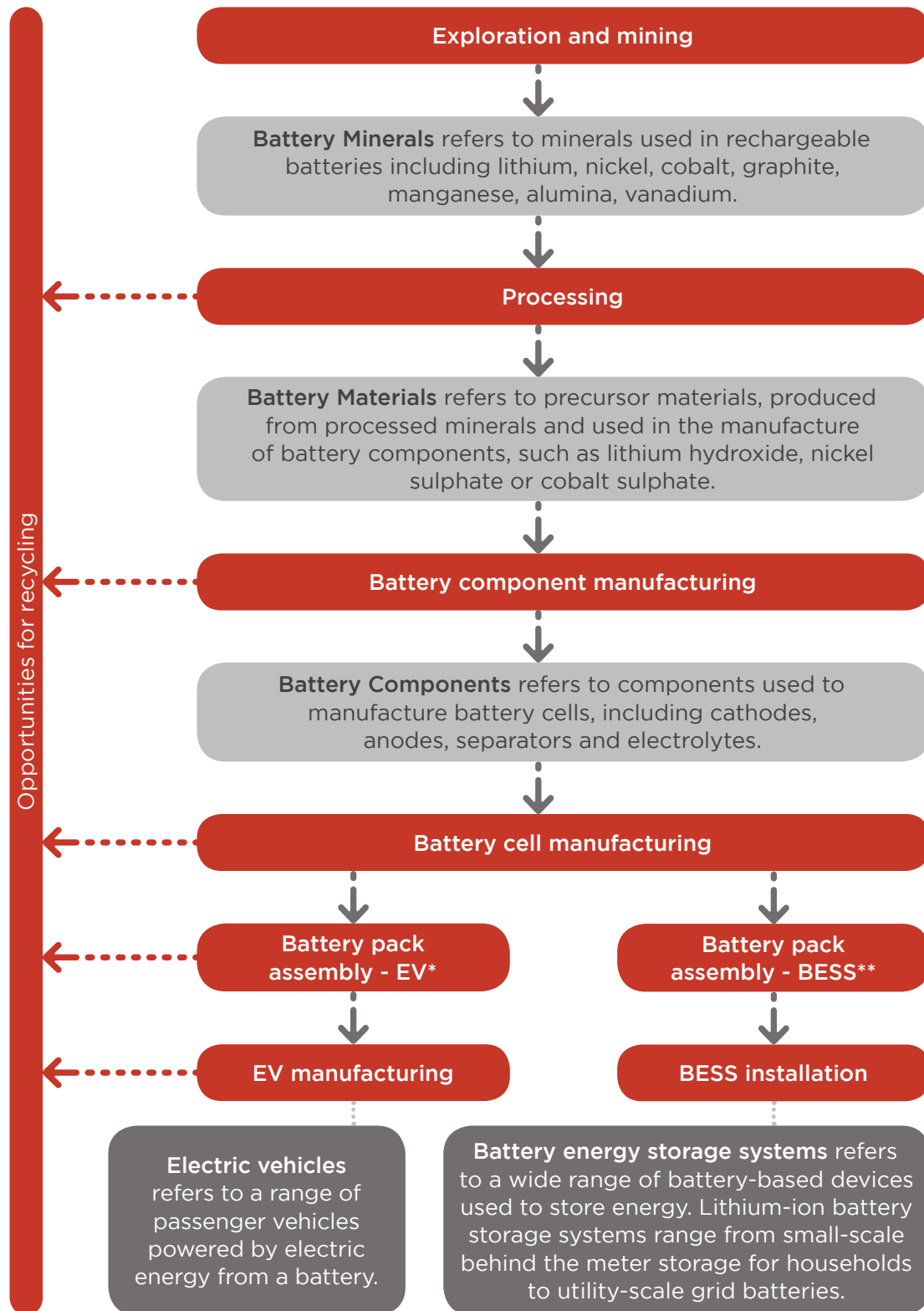
This leadership is needed now. The window of opportunity is limited in time. The rapid development of production capacity across the world is increasing competitive pressure and changes in future battery technologies are affecting the State's competitive advantages.

The *Future Battery Industry Strategy* provides a framework with consistent, clear and coordinated actions that can be implemented immediately. It is necessary to ensure that all government agencies and external stakeholders work toward a common vision for the Western Australian future battery industry, in line with the State Government's broader economic and environmental agenda.

The growth of the industry will be an important source of economic development, diversification, jobs and skills.



Lithium-ion Battery Value Chain



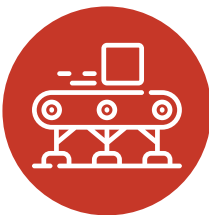
*EV - electric vehicle

**BESS - battery energy storage system

Western Australia’s comparative advantages



Battery minerals



Capacity to value-add



Ethical and sustainable ways



Project-ready



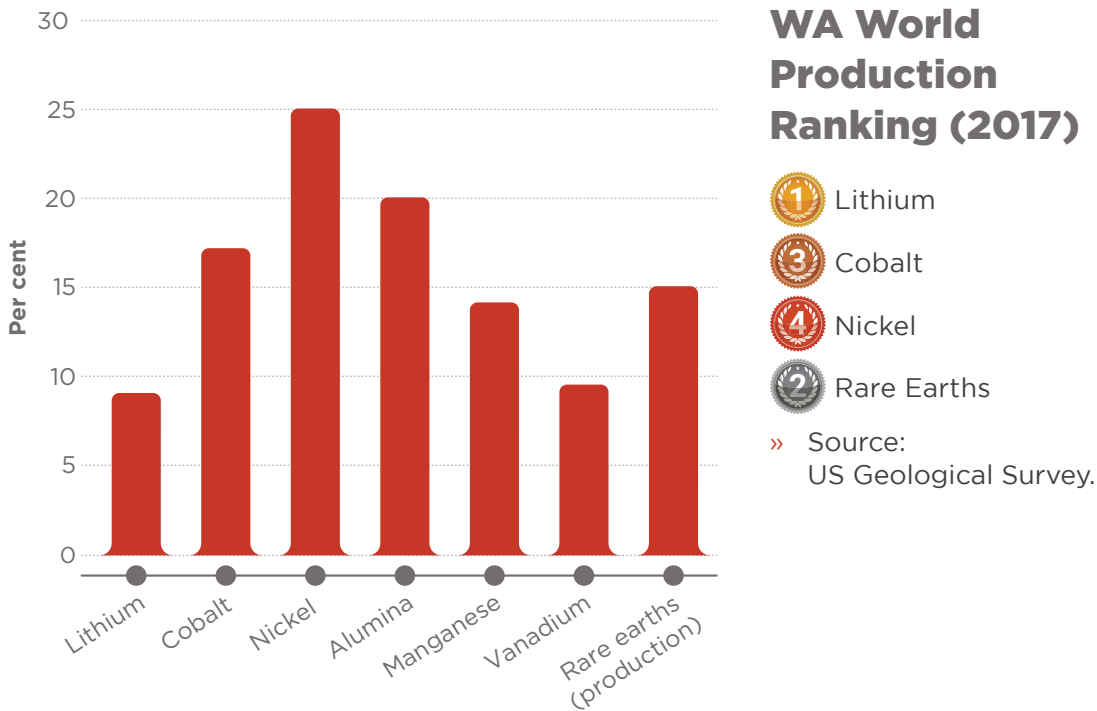
Innovation

The *Future Battery Industry Strategy* builds on Western Australia’s comparative advantages to attract capital in a very competitive global environment.



Western Australia has among the largest reserves in the world for all the battery minerals used in the manufacturing of rechargeable batteries. It exploits these reserves to produce large quantities of lithium, nickel, cobalt, manganese and alumina. It also has reserves of high quality graphite suited for battery production, although these are relatively small and currently undeveloped.

Western Australia also produces non-battery minerals used in the manufacturing of electric vehicles and energy storage systems, such as rare earth elements that are necessary for the production of electric motors.



» Figure 1: Western Australia’s portion of production and reserves of key battery materials. (Source: Department of Mines, Industry Regulation and Safety).



Western Australia has industry-leading value-adding expertise. It is transforming a growing share of its battery minerals into higher value products. The State has a strong track record and expertise in processing and manufacturing activities for the mining, processing and building industries, as illustrated by the successful development of a world-class heavy engineering centre at the Australian Marine Complex. This expertise has been key in attracting investment into the processing of battery-grade lithium hydroxide, lithium carbonate and nickel sulphate.

Western Australia can build on this strong industrial base to attract more investment into diversifying the State's mineral production and increasing the scale of domestic processing and manufacturing activities. Establishing strong foundations at the precursor stages of the supply chain will create favourable conditions for further downstream manufacturing activities.

Three of the world's four largest producers of lithium are looking to develop downstream processing projects in Western Australia. The three companies plan to invest more than \$2 billion in the development of these projects, creating more than 1,000 jobs during the construction phase and 800 during the operation phase.



Western Australia has best practice environmental and ethical standards.

It is well placed to respond to consumers' sustainability concerns, which have led electric vehicle and battery manufacturers to pay increasing attention to environmental and ethical considerations in their supply chains.

The State's comprehensive, transparent and well-practiced project approval system guarantees strong environmental and social standards, which sets Western Australia apart from its competitors in the battery space.

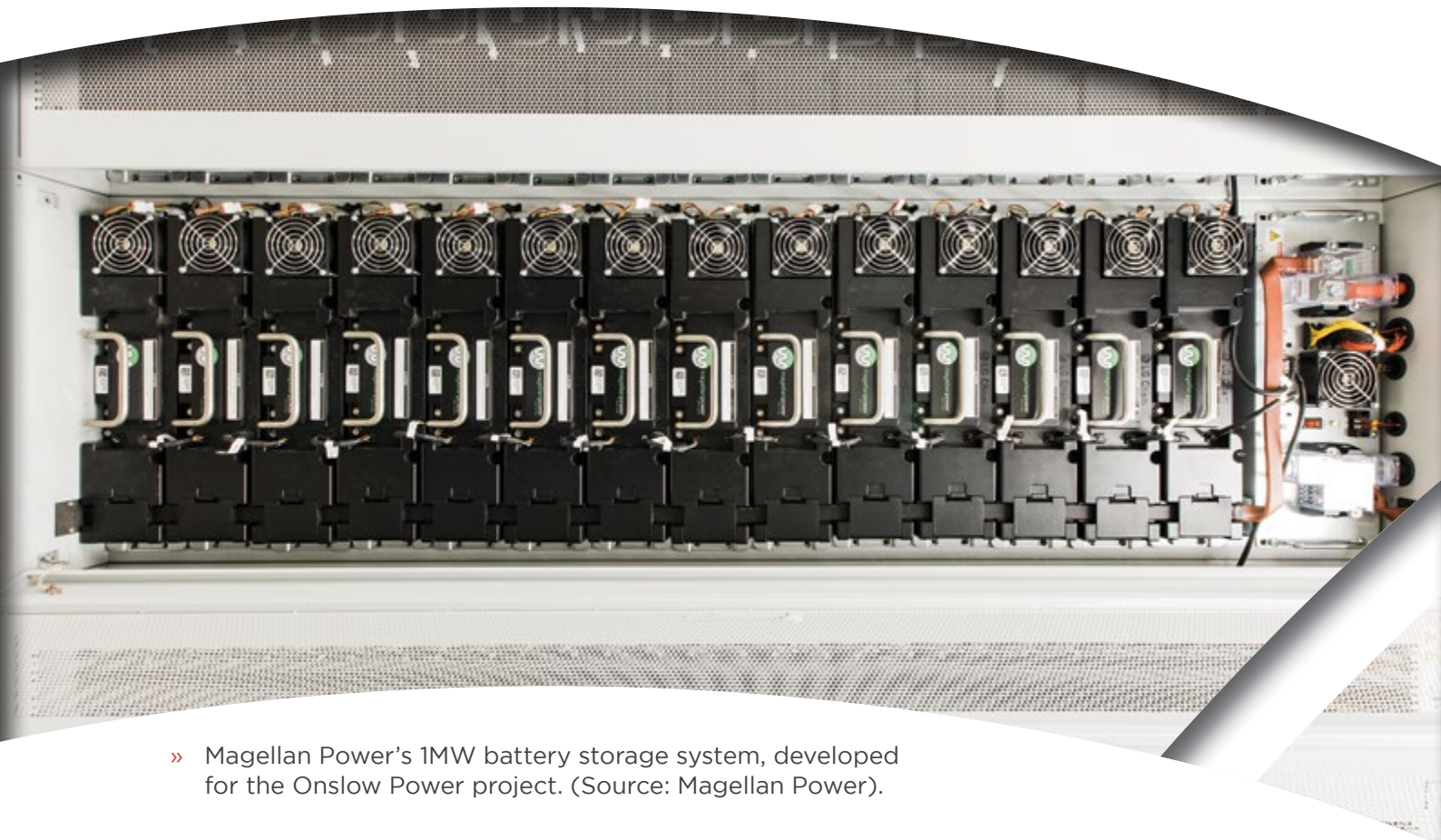
» Northern Minerals' Browns Range Heavy Rare Earth Project. (Source: Northern Minerals).





Western Australia has globally recognised expertise and research capacity in mining and mineral processing. Its mining industry is a world leader in the development and adoption of innovative technologies and cooperates closely with universities and both the State and Federal Governments.

Western Australia is also a leading innovator in battery-based energy storage systems. The remoteness of certain communities and operations and the abundance of renewable energy sources have driven innovative research into the installation and management of such systems.



- » Magellan Power's 1MW battery storage system, developed for the Onslow Power project. (Source: Magellan Power).

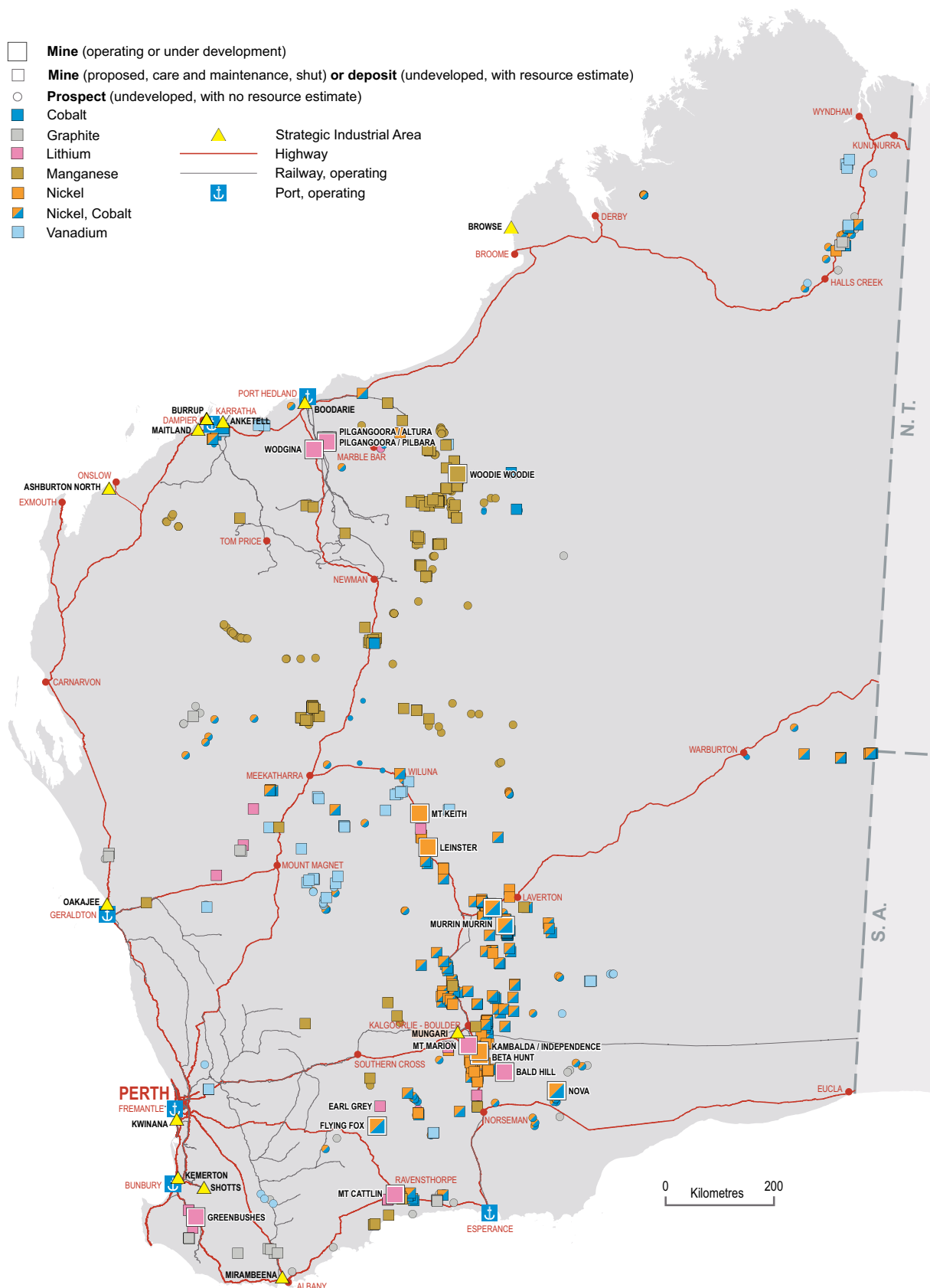


Western Australia has world-class industrial and export infrastructure.

It offers project-ready strategic industrial areas that can facilitate the co-location of battery-related projects and the creation of industry-driven industrial hubs. Proximity to export infrastructure, suppliers, pools of skilled workers and research centres strengthen the attractiveness of these hubs.

The Western Australian Government has established 12 strategic industrial areas to host downstream processing and other heavy or strategic industrial activities. These areas are located close to key infrastructure and resources and are ready to connect to essential services, such as water and electricity. Environmental and planning frameworks are in place to guide approvals for industrial activities in these areas.

Western Australia's Battery Metals 2019



» Source: Department of Mines, Industry Regulation and Safety.

Government approach

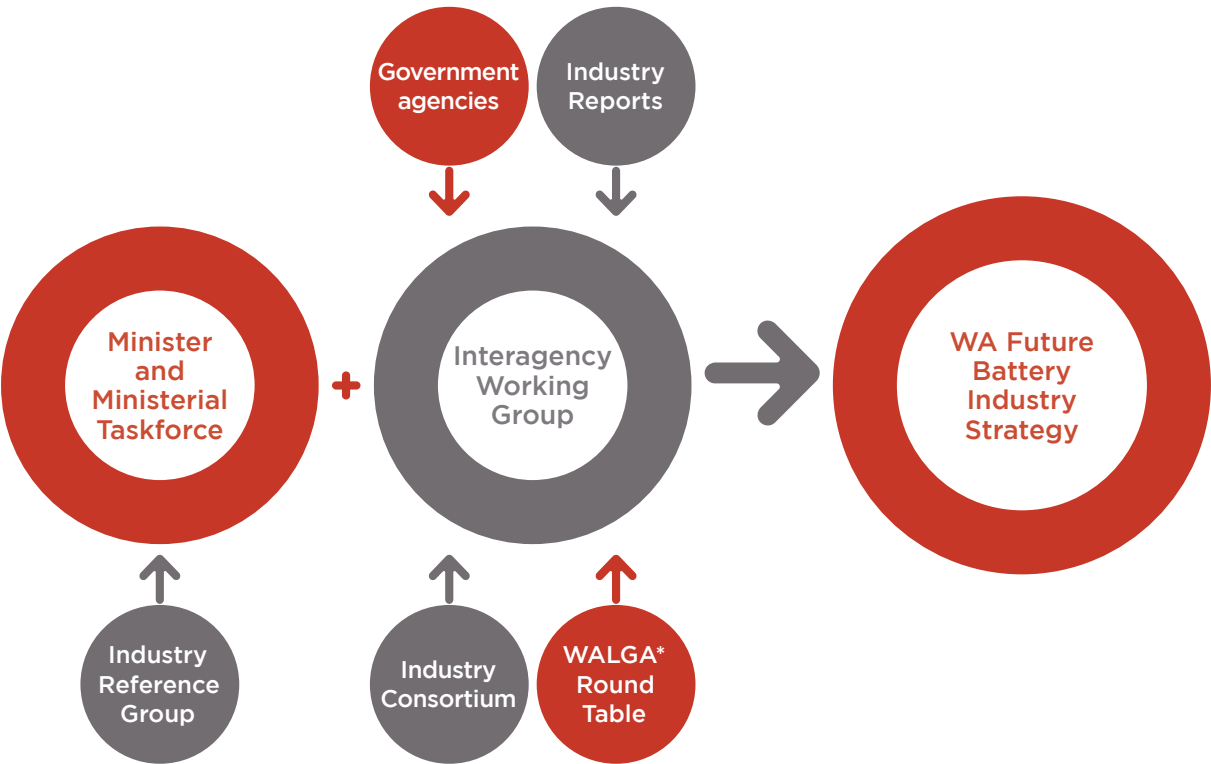
Western Australia’s *Future Battery Industry Strategy* provides a framework for the State Government’s leadership to build on comparative advantages and grow Western Australia’s future battery industry. The strategy aligns with the State Government’s broader economic agenda and will support local jobs, skill development, economic diversification and regional benefits. It is closely linked to a number of energy initiatives the State Government is implementing to facilitate the transition toward modern, cleaner and more secure energy and transport systems.

The strategy considers opportunities across the breadth of the battery value chain. It aims at establishing strong foundations at the precursor stages of the global battery supply chain to create favourable conditions for further downstream manufacturing activities. It also aims to build on the State’s expertise in battery-based energy storage systems.

The strategy was developed by an interagency working group under the guidance of a Ministerial Taskforce. It draws from the findings of an industry consortium and a local government round table, the feedback of an industry reference group, and consultation across government agencies. It also draws from recommendations from recent industry and government reports.



» Figure 2: Western Australia’s progress across the value chain.



» Figure 3: Cross-government approach.
*WALGA: Western Australian Local Government Association.

The Western Australian Government will deliver its vision for the future battery industry by focusing on four action themes. Each action theme will enable a number of pathways to achieve the objectives of the State Government's vision.

Objectives	Pathways	Action Themes
O1 Western Australia to be globally recognised as a leading producer and exporter of battery materials, technologies.	<ul style="list-style-type: none"> • Increase integration in global supply chains. • Increase awareness about Western Australia's capacity. • Increase involvement in global research. • Increase domestic uptake of battery technologies. 	A1 A2 A3 A4
O2 Improve the competitiveness of Western Australia's future battery minerals and materials industry.	<ul style="list-style-type: none"> • Support the reduction of project costs. • Streamline project approvals. • Differentiate Western Australian production from competitors. • Facilitate technology transfer and innovation. 	A1 A2 A3
O3 Expand the range of future battery minerals extracted and processed in Western Australia.	<ul style="list-style-type: none"> • Increase exploration. • Engage new mining investors and manufacturers. • Develop mining and processing innovations. 	A1 A2 A3
O4 Increase the scale of processing, manufacturing and service activities across the breadth of the battery value chain in Western Australia.	<ul style="list-style-type: none"> • Establish new industrial projects. • Develop skills. • Develop mineral processing innovations. • Accelerate the domestic uptake of EVs and BESSs. • Develop pro-recycling policies. 	A1 A2 A3 A4
O5 Increase research and development activities focused on the battery materials and high technology energy sectors in Western Australia.	<ul style="list-style-type: none"> • Increase investment in research and development. • Facilitate local and international collaboration. • Develop technology skills. • Accelerate the domestic uptake of BESSs. 	A1 A3 A4

» Note: A1 – Investment Attraction; A2 – Project Facilitation; A3 – Research and Technology Sector Development; A4 – New Opportunities from Adoption of Battery Technologies.

Action theme 1: Investment attraction

A1

The Western Australian Government will promote Western Australia as a prime destination for investment in the battery value chain.

Many countries are competing to secure a role in global battery supply chains. These supply chains are complex. Changes in technologies and industry players, competing supply chain strategies, varying market regulations and evolving manufacturers and consumers' expectations all contribute to this complexity and make market information costly, difficult to access and time-sensitive.

Building on the State's strong competitive advantages, the Western Australian Government will promote Western Australia as a prime destination for investment. The State Government's investment strategy will include ministerial investment attraction missions, the distribution of promotional material, the diffusion of market information, the creation of project databases and the promotion of Western Australia and Australia's environmental and ethical standards.

The State Government will:

- Develop and implement an investment attraction strategy.
- Develop relationships with investors and manufacturers in global battery and electric vehicles supply chains.
- Facilitate access to pre-competitive geological information.



» Figure 4: Lithium-ion battery manufacturing hotspots.

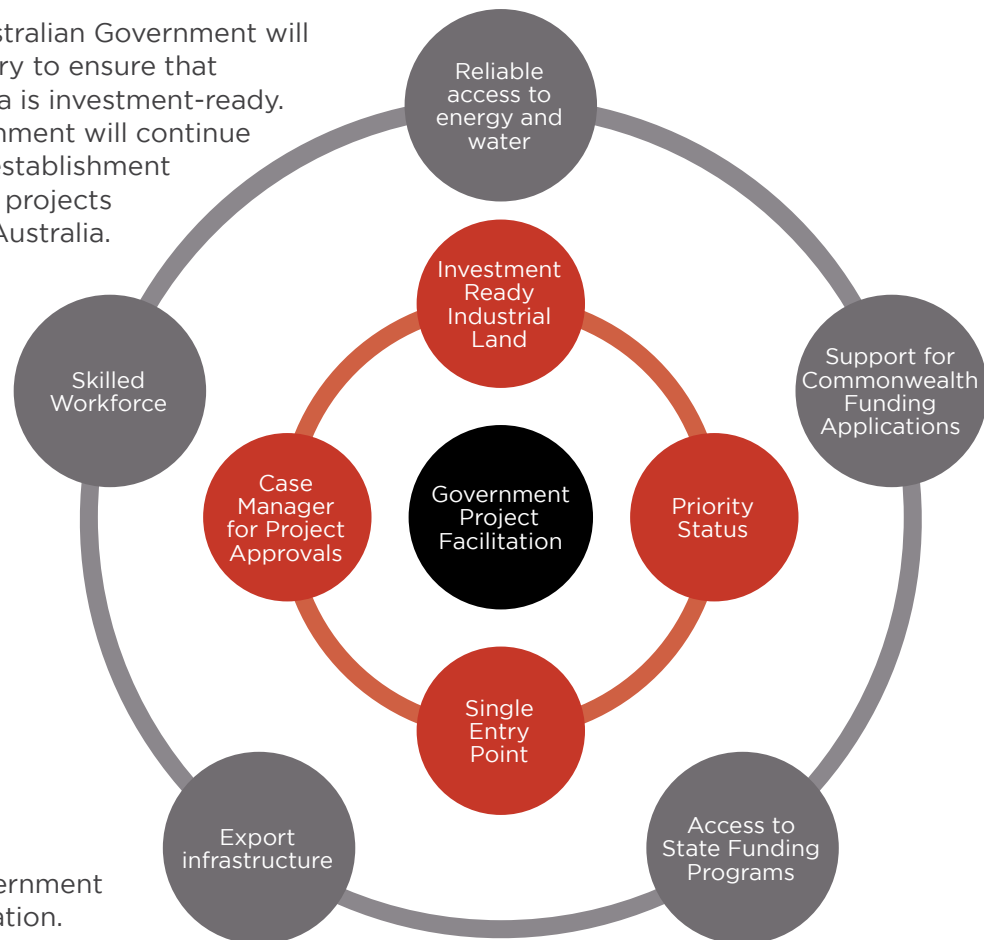
Action theme 2: Project facilitation

A2

The Western Australian Government will continue to facilitate the establishment of new future battery projects in Western Australia.

Mining, processing and manufacturing projects require access to adequate land, infrastructure, water and energy, supplies and workers. Investors are looking for locations where these elements can be accessed readily, which provide more certainty for project delivery, accelerate development and minimise costs.

The Western Australian Government will work with industry to ensure that Western Australia is investment-ready. The State Government will continue to facilitate the establishment of future battery projects across Western Australia.



» Figure 5: Government project facilitation.

Through its Lead Agency Framework, the Western Australian Government will:

- Facilitate projects in the future battery industry through the State's approvals process.
- Support future battery materials projects to establish in strategic industrial areas by:
 - Providing support with project scoping and interagency coordination;
 - Offering advice and assistance to address State policies and processes.
- Ensure policies are in place to facilitate timely access to adequate energy and water supplies for future battery industry projects in the State.
- Assess and develop strategies to address current and future skills gaps.
- Help Western Australian projects to access State and Federal Government financial assistance, where available.

Action theme 3: Research and technology sector development

A3

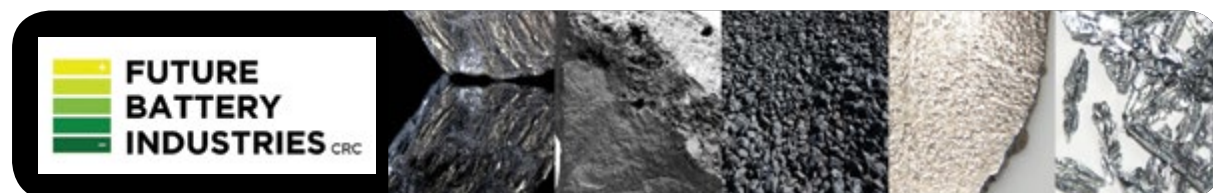
The Western Australian Government will continue to support research into future battery materials and technologies.

Battery technologies are evolving rapidly. Battery and electric vehicle manufacturers are continually making improvements to the stability and performance of their batteries and looking at ways to address weaknesses in their supply chains.

Western Australia has globally recognised research capacity in mining and mineral processing. The State Government will continue to work with research organisations, industry and the Federal Government to build on this research capacity to influence battery technologies globally and ensure Western Australia's minerals and expertise remains relevant. In particular, Government will support directly industry-lead research and technology SMEs.

The State Government will:

- Support the Future Battery Industries Cooperative Research Centre bid or a State-based Battery Industry Research Priority Program, if the CRC bid does not progress.
- Work with the Federal Government on adequate research and development tax incentives.
- Facilitate access to infrastructure and funding for technology SMEs.



- » Top right: L-R Graphite, nickel, manganese, cobalt and vanadium.



Action theme 4: Adoption of battery technologies – new opportunities

A4

The Western Australian Government will explore opportunities associated with the uptake of batteries in Western Australia and globally.

Rechargeable batteries, both in electric vehicles and in electricity grids, are a key part of transitioning to modern, cleaner and more energy-secure societies. Uptake for energy storage systems in Western Australia has been relatively widespread. Western Australia's remoteness and its abundance of renewable energy sources have driven the adoption of battery technology for off-grid and behind-the-meter purposes. The uptake of electric vehicles has been more limited in the State, primarily due to geographical, infrastructure, policy and technological hurdles.

The domestic uptake of battery technologies will create new opportunities for battery-related economic activities. The Western Australian Government will work with industry, the Federal Government, research organisations and local governments to better understand and seize opportunities associated with the increasing uptake of batteries in Australia and globally. In particular, it will look at facilitating the development of new activities based on the growing uptake of batteries domestically, such as the assembly of battery-based energy storage system, the design of grid management software, the recycling of waste at all stages of the battery value chains and the manufacturing of niche battery products.

The State Government will:

- Explore domestic and export opportunities associated with the assembly, installation and management of energy storage systems.
- Assess recycling needs, opportunities and regulatory requirements.
- Explore manufacturing opportunities associated with the demand for niche battery products.

» DeGrussa Solar Plant
(Source: Sandfire Resources).



Implementation and stakeholder engagement

Contribution from all stakeholders is important to achieve the State Government's vision for Western Australia's future battery industry.

The Western Australian Government is working closely with industry, research organisations and Federal Government. The industry reference group with representatives from across industry, will remain in place with an expanded membership throughout the implementation of the strategy.

An intergovernmental working group led by the Department of Jobs, Tourism, Science and Innovation under the direction of the Hon Bill Johnston, MLA, Minister for Mines and Petroleum; Energy will be responsible for delivering the strategy's actions.

The department will provide regular updates on the implementation of the strategy to all stakeholders. This will include newsflash on the department's website, regular industry briefings and an annual progress report.

The strategy will remain flexible throughout implementation to address changing market conditions and maintain alignment with other State Government priorities. An annual review of the strategy will allow for changing and fine-tuning activities as required.



» Figure 6: Action themes.

Acknowledgements

The Western Australian Government acknowledges and thanks the many stakeholders who have contributed to the development of the *Future Battery Industry Strategy*.

For further information please email the Future Battery Industry Strategy Team:
energymaterials@jtsi.wa.gov.au



» Mt Cattlin Lithium Mine (Source: Galaxy Resources Limited).



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Cover images
Top: Greenbushes Lithium Operations
(Source: Talison Lithium)
Bottom left: Greenbushes Chemical Grade Lithium
Processing Plant (Source: Talison Lithium)