AUSTRALIAN CAPABILITY IN POWER
LEADING POWER SERVICES AND SOLUTIONS
Australia is a leader in solutions and services for the power industry, with strong market design and project management capability, advanced engineering, maintenance and rehabilitation expertise, and innovative renewable energy technologies.

The Australian power industry is increasingly being driven by emerging technologies, changing business models and consumer preferences, and by sector-specific government policies supporting renewable technologies and reductions in emissions. Australian companies have contributed to this transformation of the electricity market, providing the services required to operate, maintain and rehabilitate existing assets, commercialise technology and deliver power projects.

This industry capability statement provides an overview of Australian capability across key sub-sectors of the power industry. It includes examples of some of the many Australian companies with specialist expertise. Talk to your local Austrade representative for more tailored advice and information about connecting and partnering with the Australian power industry.
The electricity supply sector accounted for 29 per cent of Australia’s energy consumption in 2015–16. Coal was the major source of electricity generation in Australia, accounting for 63 per cent of total generation, followed by natural gas (20 per cent) and renewables (15 per cent). Government policies, industry investment and funded research are expanding opportunities to utilise Australia’s substantial renewable energy resources. Wind accounts for one-third of renewable energy generation in Australia and one-third of total generation in South Australia. The increase in renewable energy use will contribute to a lower emission intensity.

The shift from coal-fired generators to wind and solar photovoltaic (PV) generators has implications for security and reliability. In response the Australian industry is bringing together intellectual capital, research and technology to adapt the way the power industry operates.

AUSTRALIA’S EASTERN STATES – THE NATIONAL ELECTRICITY MARKET

The introduction of competitive electricity markets in Australia is one of the enduring stories of microeconomic reform, leading to increased competition, economic efficiency and consumer choice. The National Electricity Market (NEM) has proved to be a sustainable reform – capable of being built upon and a fundamental contributor to the performance of the Australian economy. Variations to this design addressing specific government policy objectives and regional priorities have been progressed in other states such as the Western Australian Electricity Market.

The NEM operates on the world’s longest interconnected power systems. It stretches from Port Douglas in Queensland to Port Lincoln in South Australia and across the Bass Strait to Tasmania – a distance of around 5,000 kilometres. The NEM supplies about 200 terawatt hours of electricity to businesses and households each year – supplying around 9 million customers. It has a total electricity generating capacity of 45,000 megawatts. Around $7.7 billion was traded in the NEM in 2014–15.

WESTERN AUSTRALIA – SOUTH WEST INTERCONNECTED SYSTEM

The South West Interconnected System (SWIS) incorporates over 7,800 kilometres of transmission lines. The SWIS is the major interconnected electricity network in Western Australia, supplying the bulk of the south-west region. It extends to Kalbarri in the north, Albany in the south, and Kalgoorlie in the east.

The Wholesale Electricity Market for the SWIS supplies about 18 terawatt hours of electricity each year to more than one million customers. It includes 5,798 megawatts of registered generation capacity, including 513 megawatts of non-scheduled generation and a total of $500 million was transacted in 2014–15.
INTRODUCTION

INDUSTRY OVERVIEW

WESTERN AUSTRALIA, PILBARA REGION – NORTH WEST INTERCONNECTED SYSTEM (NWIS)

The North West Interconnected System (NWIS) is an electricity system in the Pilbara region in Western Australia. The majority of customers are located in the coastal strip between Port Hedland and Cape Lambert in an area serviced by the network owned by Horizon Power. The electricity grid essentially consists of two large transmission networks, loosely interconnected to form the NWIS. This system interfaces with electricity transmission and generation assets owned by private sector companies supplying major resource companies.

NORTHERN TERRITORY

The Northern Territory’s electricity industry is small, reflecting its population of around 200,000. There are three relatively small regulated systems; the largest is the Darwin-Katherine system. Territory Generation owns and operates eight power stations across the Northern Territory with a capacity of 582 megawatts, generating 1,973 gigawatt hours in 2015–16. There are six independent power producers in the resources and processing sector which generate their own requirements. Power and Water Corporation also supplies electricity generation and retail services to 72 remote communities.

OFF-GRID AND REMOTE SUPPLIES

Off-grid generation comprised approximately 19 per cent of total electricity generation in Australia, in 2015–16. Australia has well-developed off-grid solutions, with the energy sector accounting for around 77 per cent of total off-grid electricity consumption.

There is growing industry capability and opportunity for renewable energy sources, and hybrid energy solutions are expected to play an increasing role in meeting off-grid power demand in the future. These solutions are evolving as energy storage technologies improve. Australian network providers and innovative suppliers are moving to provide reduced-cost systems with high reliability.
Australian companies have contributed to the transformation of the electricity market through effective market design, technologies and commercial energy solutions. Innovative products and services are meeting the demand for lower emission and alternative technology solutions, as well as providing consumers with a range of energy supply choices. Australian expertise is addressing all facets of power project and market development including:

- planning and investment
- operation, maintenance and rehabilitation
- market design, governance and regulation
- research, technology and climate change

Australian companies offer the enabling services required to engineer, procure and construct; effectively operate, maintain and rehabilitate existing assets; commercialise technology; and efficiently deliver projects across the industry.
A key element of Australia’s electricity reform agenda is the separation of policy and regulation from industry, industry restructuring and introduction of competition. Careful market design and management under the NEM has delivered market systems which maximise the benefits of these reforms while minimising costs and disruption to consumers.

The deeply interconnected energy sector is undergoing rapid changes, including the linking of electricity and gas networks, addressing policy issues such as environmental sustainability and spreading technological innovation across new energy services for consumers.

Australia’s governance of the sector, utilities and regulators brings together expertise and leadership in their respective market supervisory, compliance, rule-making, operational and advisory roles. The National Electricity Market has been a key reform, however economic growth and prosperity is a continuing process of structural change. The legislated governance and consultation processes ensure there are effective and transparent pathways for government, industry and stakeholders to follow when refining market design and rule changes.

Australian consulting organisations, industry and consumer associations, research groups and registered participants are a reference pool of expertise and active contributors to market development and regulation review. Australia’s innovative product manufacturers and new technology companies are also advocates for early adoption, driving rule changes and evolution in electricity market design.

This has expanded Australian capability in:

- economic, regulatory and policy advice on energy market design and operation
- new technology, products and services supporting emerging technologies, grid connection and network supply options
- information and intelligence systems which support market and system modelling, operation, planning, trading and dispatch
- engineering and design services for projects and energy management solutions.
Energy Market Consulting completes in-depth reviews of power utilities’ operations

Case Study

Energy Market Consulting associates (EMCa) specialises in the policy, strategy, implementation and operation of electricity and gas markets, electricity network services and associated network pricing access and regulatory arrangements. EMCa works across Australia and New Zealand, with experience in Malaysia, Singapore, the Philippines and Vietnam.

In Australia, EMCa is the principal technical advisor to the Australian Energy Regulator (AER), which regulates energy markets and networks under national energy market legislation and rules.

EMCa has undertaken 15 planning and expenditure reviews of Australia’s distribution and transmission-regulated electricity network businesses for the AER. It has also undertaken three such reviews for the Economic Regulation Authority in Western Australia for gas pipeline businesses and has assisted with reviews for the Commerce Commission in New Zealand.

These reviews typically comprise assessments of utilities’ governance, budgeting, compliance and risk management, planning and asset management frameworks, network development plans, demand and expenditure forecasting and project and program prudence and efficiency. EMCa’s reports support the regulator’s decision about the individual utility’s expenditure proposal.

In Malaysia, EMCa assisted Tenaga Nasional Berhad (TNB), the largest electricity utility in Malaysia, to develop its expenditure forecasts as part of its regulatory submission to the Malaysian Energy Commission, Suruhanjaya Tenaga (ST), for the RP2 regulatory period (2018 to 2020).

The forecast expenditure is a key input to the development of electricity tariffs and becomes a baseline for assessing future expenditure efficiency carry-over amounts.

EMCa assisted the Distribution, Transmission, Customer Service, Single Buyer and Grid System Operator entities within TNB to develop their expenditure forecasts and the suite of supporting documents that regulators and governments require when assessing whether a business has met the objectives of an Incentive Based Regulatory regime as part of a tariff determination. EMCa provided tools and guidelines and facilitated workshops, challenge processes and knowledge transfer sessions.

emca.com.au
Electricity generation in Australia was 252 terawatt hours (927 petajoules) in 2015–16. Coal was the major source of electricity generation, accounting for 63 per cent of total generation. This was well below its share of more than 80 per cent at the beginning of the century. Natural gas–fired generation accounted for 20 per cent and renewables 15 per cent of total generation in Australia. Wind and solar continue to grow, with wind contributing to one-third of renewable energy generation in Australia and one-third of total generation in South Australia in 2015–16.

Between the NEM’s start in December 1998 and March 2017, new investment added over 15,200 MW of registered generation capacity. Over the same period, almost 5,500 MW of capacity was withdrawn from the market, either through permanent retirement or mothballing (removal from service for a specified or indefinite period). All plant retirements over this period have been in coal-fired plants, but some gas powered plants have been mothballed.8 Since 2012–13, capacity additions to the NEM have largely been in wind and solar. The rise in wind and solar photovoltaic (PV) generation over the past few years reflects wider shifts in the energy generation technology mix. This is driven by technological change and government policies to mitigate climate change.

The electricity sector contributes over one-third of national greenhouse gas emissions, mainly due to its high reliance on coal-fired generation. This is being addressed through innovation and legislation.

The Australian Government’s $2.55 billion Emissions Reduction Fund, complemented by the Renewable Energy Target, is focused on reducing emissions and increasing energy productivity. The target is to reduce emissions to 26–28 per cent on 2005 levels by 2030. This target represents a 50–52 per cent reduction in emissions per capita and a 64–65 per cent reduction in the emissions intensity of the economy between 2005 and 2030.9 While coal plants will continue to contribute to baseload energy in the foreseeable future, Australian emission policies and environmental performance standards will place increasing pressure on the operational and environmental performance of coal-fired plants. The financial risks of energy markets require generation portfolios (coal, gas and renewable) to deliver outstanding availability and reliable performance. Operation and maintenance is necessarily focused on achieving the highest levels of plant utilisation, minimising planned outage periods and avoiding financial increases.
Australian companies’ capabilities, experience and international networks cover the full spectrum of professional services, from concept design and feasibility studies, through to all aspects of operations and asset management of conventional, renewable and emerging technologies. Services extend from the design and construction of new power-generation facilities to the upgrading of existing plants. Australian companies have completed contracts for public utility providers, industrial complexes and remote resource projects in countries including Australia, Indonesia, Malaysia, Pakistan and Thailand.

Specialist services include owner’s engineer and independent engineer roles, plant performance assessment and audit, training and asset due diligence. Capabilities include delivering brownfield projects, conducting pre-feasibility requirements analysis, feasibility studies, front-end engineering and design (FEED) and undertaking full project implementation from concept design to commissioning. Many companies hold the major steam cycle and boiler technologies and licences that are necessary to deliver most power and steam-generation projects in Australia, New Zealand, the Pacific Islands and South East Asia.

At the same time, new power projects are responding to the opportunities for innovative technologies, delivering an alternative fuel mix, hybrid technologies and new designs to lower emissions and increase standards for power system reliability and security.

Australian companies’ hybrid off-grid energy solutions are supplying renewable energy to remote island, mining and Indigenous communities, displacing high-cost, emission-intensive fossil fuels. The hybrid power systems include combinations of wind, solar, battery storage, flywheels, dynamic resistor technology, dynamic load control and biofuels. Solar-diesel-hybrid power stations are being containerised and commercially redeployed to match project timeframes.
Gas Generators reduces bulk gas, freight and logistics costs for Thai refinery

Case Study
Gas Generators Australia designs, manufactures, packages and distributes process skid systems for onsite production of nitrogen, hydrogen and oxygen, as well as gas compression and filtration systems. The company’s distribution network spans Australia, the Middle East and South East Asia, with clients in the oil and gas, mining, power, energy and water sectors.

In 2016, Gas Generators won a contract to supply a nitrogen generation system to PTT Energy, one of Thailand’s leading petroleum and biofuels distribution businesses. PTT Energy operates a biodiesel refinery and storage site in a remote area of Thailand, and was looking for ways to reduce freight and logistics costs.

Gas Generators provided a skid-mounted, membrane nitrogen generator, complete with air compressors, air dryers, nitrogen storage and fully integrated control systems.

The generator can be operated onsite or from a remotely located control centre. Gas Generators uses efficient nitrogen membranes and advanced pressure swing absorption technology, enabling large quantities of 95 per cent to 99.5 per cent pure nitrogen to be generated in a short amount of time.

By producing nitrogen onsite, PTT Energy will lower bulk gas costs by more than 35 per cent each year. Generating nitrogen at the point of use is a sustainable, environmentally friendly and energy efficient approach and creates far fewer greenhouse gases. The company has also reduced logistics and freight costs.

gasgeninternational.com
WorleyParsons delivers coal-fired generation plants for Santee Cooper

Case Study

WorleyParsons delivers projects, provides expertise in engineering, procurement and construction and offers a wide variety of consulting and advisory services. The company covers the full lifecycle, from creating new assets to sustaining and enhancing operating assets in the hydrocarbons, mineral, metals, chemicals and infrastructure sectors.

WorleyParsons has a long history of delivering customised power solutions around the world, including coal-fired power stations, gas turbines, renewable energy, power networks, nuclear stations and D4 (decommissioning, deactivation, decontamination, demolition) services.

Responsible for the design of 38,000 MW of successful coal-fired projects worldwide, WorleyParsons has positioned itself as an industry leader in conventional coal. The company provides coal project designs that are compliant with the latest local environmental regulations, including supercritical pulverized coal and circulating fluidized bed boilers, to ensure all projects are sustainable and profitable.

The company can also tailor its full-service coal-fired plant capabilities to improve heat rate availability, optimise cooling systems, and implement the latest pollution control innovations. WorleyParsons’ advanced coal capabilities utilise its customers’ coal resources by maximising efficiency, minimising environmental impact, and optimising lifecycle costs.

WorleyParsons engages with state-of-the-art material advances capable of providing advanced supercritical/ultra supercritical steam conditions, which directly improve plant efficiency and reduce emissions. Working with global alliance partners, WorleyParsons develops carbon capture designs coupled with transportation of CO₂ for sequestration or enhanced oil recovery.

WorleyParsons’ expertise can be seen in its construction of coal-fired generation facilities for South Carolina’s Santee Cooper Cross Generating Station. The company’s goal was to meet its near-term power demand forecast while maintaining its status as the lowest-cost producer of electricity in the state. WorleyParsons was engaged to provide project management, engineering, procurement, construction management, startup and testing for Cross Generating Station Units 3 and 4 in South Carolina.

The site is in a high seismic zone. After the contract was awarded, a new law was introduced, significantly affecting seismic design. WorleyParsons completely changed the subsurface design, saving millions of dollars in construction costs and significantly minimising the impact on building schedules.

Santee Cooper also required Unit 4 to be constructed immediately after Unit 3. Creative construction planning, exercising of prior supply contract options, and responsive and creative engineering and procurement enabled the construction of Units 3 and 4 to overlap.

Santee Cooper and WorleyParsons worked as an integrated team in the early stages of design, through construction management and startup. Cross Units 3 and 4 were placed into operation on schedule, with one of the lowest total installed cost of any coal-fired project of its generation.

worleyparsons.com
COAL SUPPLY

Fossil fuels will keep making an indispensable contribution to the world’s energy for some time to come. Accordingly, the responsible development of energy resources will continue to provide benefits in terms of wealth creation for Australia and energy security for its trading partners.

Australian firms are competitive across the complete coal supply chain, from exploration and mine development, to mineral processing, engineering, environmental management and safety, fuel supply and power generation. Australian capability in power generation includes turnkey engineering, procurement and construction of steam cycle and boiler technologies and the design, supply, installation and servicing of engineered conveyor products, fuel handling equipment and combustion technology. Australian companies can provide all stages of project delivery from concept design and feasibility studies through to every aspect of asset management.

Australia has considerable technical expertise in materials handling, flow design, milling, combustion technology, testing and analysis, as well as longstanding experience in electrostatic and fabric filter dust collection technologies, ash processing and research into ash reuse.

The beneficial use of coal combustion products from coal consumption is important for the sustainable use of coal. The fly ash products can displace the use of other energy-intensive raw materials. Australian producers and marketers of power station ash formed the Ash Development Association of Australia (ADAA) with the objective of investigating and expanding the market opportunities for the use of these materials in construction, agriculture and manufacturing.

The Australian Government is engaged in domestic Carbon Capture and Sequestration (CCS) programs and international collaborative activities to accelerate the development and deployment of CCS. An independent report commissioned by government, industry and research organisations has laid down a comprehensive plan for carbon capture and storage deployment in Australia. The Australian coal industry has committed over $300 million under the COAL21 Fund to demonstration projects, including capturing carbon dioxide in power stations; sequestering carbon dioxide in depleted gas fields; searching for storage sites and contributing to the international research and development (R&D) effort. Australian National Low Emissions Coal (ANLEC) Research and Development has invested $100 million in over 25 institutions nationwide. Its present focus supports carbon dioxide storage across three Australian geological basins.

Australian and international collaborative research continues in clean coal and low-emission technologies. CSIRO is carrying out collaborative research projects with India, China, Japan and the US. Its research projects include gas processing, post-combustion capture, coal gasification, direct injection carbon engine and direct carbon fuel cells.
GAS SUPPLY

Australia has three distinct regional gas markets comprising:

- Eastern Australian states interconnected by a network of transmission pipelines, principally supplied by the Surat–Bowen, Cooper, Gippsland and Otway basins
- Western Australian market, supplied by the Carnarvon and Perth basins
- Northern Territory market, supplied by the Bonaparte and Amadeus basins.

While the three markets are not interconnected, Jemena’s Northern Gas Pipeline from Tennant Creek to Mount Isa is planned to be completed by the end of 2018. The pipeline will effectively link the Bonaparte Basin off northern Australia with gas markets in southern and eastern Australia.

Most gas is traded bilaterally via long-term contracts. The wholesale markets in the eastern region allow retailers or large customers to purchase gas without entering long-term contracts. The gas market allows participants to manage contractual imbalances, and is supported by a Gas Bulletin Board.

Western Australia does not have a short-term gas trading market. Participants enter agreements with gas suppliers and pipeline operators to purchase and transport gas, which they then on-sell and supply to end-users.

The Australian Energy Regulator (AER) regulates covered pipelines in jurisdictions other than Western Australia, where the Economic Regulation Authority is the regulator. The Western Australian Government intends to transfer gas pipeline regulation to the AER as part of its energy market reforms.

Australia’s low-cost coal sources historically capped gas prices as an alternative fuel for power generation. Queensland’s liquefied natural gas (LNG) industry is now exerting considerable influence on the domestic gas market. Gas comprises 19 per cent of capacity and 9 per cent of total generation in the NEM. Gas plants will have a continuing role in peak energy supply and power system security. Australia’s gas market reform and policy commitment to international exports have delivered strong gas network interconnections and expanded access to gas resources. The country has the potential to deliver internationally competitive gas supplies for domestic needs and those of its trading partners.

Australian companies are well positioned to contribute to power development and energy markets in the Asia-Pacific region through leadership and experience in gas market design, pipeline regulation and delivery of gas-fired power generation and gas supply projects.

Australian companies have specialist knowledge of Asia-Pacific energy markets and can provide market systems, software, analysis and modelling. They have experience in gas policy, strategy, implementation and operation of electricity and gas markets, including associated pricing, access and regulatory arrangements.
Australian capability includes whole-of-project lifecycle services, asset management and engineering services for gas plant condition assessment, operations and maintenance.

Western Australia’s Gorgon Project is developing two gas fields – Gorgon and Jansz-IO. Raw gas from the Gorgon field contains about 14 per cent carbon dioxide. While standard industry practice is to vent the separated carbon dioxide to the atmosphere, the Gorgon Project will inject the carbon dioxide reservoir into the Dupuy Formation saline aquifer beneath Barrow Island. Storing over three million tonnes per year, it will be the world’s largest carbon dioxide storage project in a dedicated geological storage formation. The project will be required to demonstrate integrated monitoring, reservoir management and risk management strategies.
The mix of energy-generation technologies in the NEM is evolving in response to technological change and government policies to mitigate climate change. The Australian Government ratified the Paris Agreement in 2016 and has set a strong, credible and responsible target to reduce emissions to 26–28 per cent below 2005 levels by 2030. This amounts to a halving of emissions per person and is among the strongest targets of any major economy on that basis. The Emissions Reduction Fund, introduced in 2014, is the centrepiece of Australia’s climate change policies. It provides incentives for Australian businesses and others to adopt new practices and technologies to reduce Australia’s greenhouse gas emissions, and provides funding for the Clean Energy Regulator to purchase emissions reductions at the lowest available cost through competitive auctions.

The Renewable Energy Target (RET) is a scheme designed to reduce emissions of greenhouse gases from electricity generation and encourage additional generation of electricity from renewable sources including large-scale wind and solar. The target for large-scale generation of 33,000 GWh in 2020 means that about 23 per cent of Australia’s electricity generation in 2020 will be from renewable sources.

The penetration of renewable energy in the Australian market is significant, and is set to continue its strong growth. Australia’s renewable energy capabilities include solar, wind, microgrids, energy storage, ocean energy, hydro power, geothermal and bioenergy.
Hydro Tasmania puts renewable energy to work on King Island

Case Study

The King Island Renewable Energy Integration Project (KIREIP) is a world-leading hybrid off-grid power system capable of supplying 65 per cent of King Island’s annual energy needs using renewable energy. The system is capable of 100 per cent renewable operation – the only megawatt-class off-grid system with this capability in the world.

KIREIP is an initiative of Hydro Tasmania, with assistance from the Australian Renewable Energy Agency. Being a remote island community, King Island is not connected to either mainland Tasmania or mainland Australia for its electricity supply. Electricity on the island was traditionally generated entirely from diesel fuel via the six-megawatt power station, serving 12 gigawatt hours of annual customer demand, peaking at 3.2 megawatts.

As the owner and operator of the King Island power system, Hydro Tasmania developed an integrated solution that comprised wind and solar generation supported by a range of innovative enabling technologies, coordinated by its proprietary hybrid control system. Installed over several earlier phases of development were 2.45 megawatt of wind generation and 470 kilowatts of solar PV.

When conditions are suitable, KIREIP delivers 100 per cent of King Island’s power from renewable sources, reducing the cost of providing electricity to the island. The KIREIP system has reached a milestone of 4,000 hours of ‘diesel off’ operation, including periods of several days with no use of diesel generation, a world record for a grid of this scale. The project, inclusive of prior renewable investments, has reduced the use of diesel for power generation by over 21 million litres – a saving of more than $30 million – and avoided the emission of over 55,000 tonnes of carbon dioxide to date.


While the renewable energy sources being used were well established, the enabling and storage technologies were new and emerging. The hybrid system includes a 3 megawatt/1.5 megawatt hours battery energy storage, two 1 mega-volt ampere (MVA) flywheels that significantly aid system security and stability, a 1.5 megawatt dynamic resistor to manage surplus renewable generation, and an aggregated demand response system to provide additional reserves.

hydro.com.au

Image courtesy of Hydro Tasmania
TRANSMISSION AND DISTRIBUTION

The Australian Energy Regulator (AER) sets the amount of revenue that network businesses can recover from customers for using electricity networks in the NEM and the Northern Territory. Western Australia has announced a transfer of network regulation functions from the Economic Regulation Authority to the AER, pending legislative approval and other regulatory processes. The AER assesses a network business’s forecasts of the revenue that it requires to cover efficient costs and deliver an appropriate return.

Reforms and incentive-based regulation encourage network businesses to seek more efficient ways of operating, to ensure consumers pay no more than necessary for a safe and reliable electricity supply. The reforms include schemes that incentivise network businesses to invest and spend efficiently, and to share efficiency benefits with consumers.

The AER also monitors the compliance of network businesses with the National Electricity Rules, and reports on outcomes, including in quarterly compliance reports.

The nature and function of energy networks are evolving. Industrial customers and retail consumers are changing the way they use electricity. Escalating cost pressures have led to demand response solutions (whereby users adjust their energy use in response to price signals), small-scale local generation (such as rooftop solar photovoltaic generation) and more recently, energy storage technologies.

Innovations in network and communications technology, including smart meters and interactive household devices, are allowing consumers to access real-time information on their energy use, and to better control how they manage that use. The Australian Energy Market Commission (AEMC) has progressed rule changes as part of reforms to promote efficient use of energy networks and to empower customers to make efficient energy decisions.

Australian network companies’ considerable resources are dedicated to operating and maintaining extensive networks, mitigating bushfires and delivering grid connection and energy services. Rapid responses and emergency services are necessary to address regional risks of cyclone, storm and bushfire activity. The network companies are supported by Australian consulting and engineering service companies, specialist services, technology providers and equipment suppliers.

Networks are responding to the challenges of delivering renewable technologies and smart grid initiatives that integrate into existing networks and off-grid applications.

Australian capability in transmission and distribution includes:

A. transformers and switchgear
B. power grid and control
C. project lifecycle
D. education and training.
A. Transformers and switchgear

Australian companies specialise in the design, manufacture, supply and service of transformers, high-voltage electrical equipment and switchgear. Products include:

- power and distribution transformers up to 250 mega-volt ampere (MVA), to standard and custom designs
- substation-class power transformers and pole, pad mount and industrial-style transformers.

Services include supplying magnetic cores to the Australian and Asian markets, transformer overhaul and rewind, field services and testing.

Australian companies can design, manufacture and supply:

- electrical power distribution systems
- electronic equipment
- optical fibre sensors
- metering
- test equipment and products
- solutions for the power utilities sector.

They can also provide low and medium-voltage switchgear, specialising in auto reclosing circuit breakers for industrial, infrastructure and electricity distribution utilities.

Data centre power solutions are available, including the design and supply of specialised switchboard products and solutions for power distribution, motor control centres, generator control systems and power factor correction.
NOJA Power ensures reliable power supply with automatic circuit reclosers

Case Study
Based in Brisbane, NOJA Power manufactures medium-voltage switchgear and is known for its pole-mounted automatic circuit reclosers. These devices are essentially high-energy circuit breakers, with integrated energy sensors and a control system computer. The NOJA Power OSM Recloser system has been deployed in over 85 countries. The company has also developed specialist application technology for connecting renewable energy, in preparation for the global transition to green power.

Energy utilities worldwide must ensure they can provide a reliable supply of power to their clients. To overcome variable network quality and standards, NOJA Power developed an Automatic Changeover System for the Kenya Power and Light Company using its proprietary communications techniques and inbuilt intelligence in its medium-voltage switchgear products.

The Automatic Changeover System ensures the electricity for Kenya’s city hospitals comes from two alternative supply connections. NOJA Power’s OSM Recloser System is used to control and monitor the system.

NOJA Power has subsequently standardised the automatic changeover feature in all its Automatic Circuit Recloser products, which have had widespread success, including being deployed at the 2014 FIFA World Cup tournament in Brazil as the critical power connection point for stadiums.

nojapower.com.au
B. Power grid and control

Australian companies manufacture and supply industrial electrical and process control products. Some specialise in energy management, automation and engineering design solutions for energy control and power distribution applications in the mining, utility and industrial sectors.

They can provide power and automation products, systems, services and software solutions across the generation, transmission and distribution value chain. Australian companies also offer optical fibre current sensors that can be integrated into power monitoring and metering systems to allow users to measure electric currents with high levels of accuracy and ease.

Australian capability in electrical, communications and turnkey engineering solutions extend across all facets of power transmission. They include:

- designers and manufacturers of multi-mode power inverters for on-and-off-grid use
- power system protection
- automation
- system design
- market modelling and data management applications.
Ampcontrol delivers customised power substations to clients worldwide

**Case Study**

Founded in 1968, Ampcontrol engineers, manufactures and supports integrated electrical, electronic and control solutions for customers across a variety of industries and applications globally.

Ampcontrol designed and manufactured Australia’s first 132/11kV 25MVA Emergency Response Mobile Substation. Designed for use on the New South Wales power network, the trailer-mounted substation consists of two road-registered Special Purpose Vehicles that can be quickly transported to provide emergency and temporary load support to re-energise the power network in the event of catastrophic failure of onsite equipment such as transformers, switchgear or electrical cables.

Designed for Ausgrid, the mobile substation had to be safe to use, quick to set up in an emergency, consider environmental impacts and be suitably manoeuvrable to negotiate the various access ways and layouts of fixed substations.

To meet size and weight restrictions and ensure the solution was manoeuvrable, the substation was designed across two trailers: a custom-designed trailer mounted switchroom with a Gross Vehicle Mass (GVM) of 30 tonnes and a custom-designed trailer-mounted transformer with a GVM of 188 tonnes. An environmentally-friendly vegetable oil, Envirotemp FR3™ ester dielectric fluid, was used to reduce the risks associated with oil spillage during both transport and use.

Ampcontrol also developed a compact, safe and weatherproof substation for installation at Sheung Wan, Hong Kong, on the MTR West Island Rail Line. The project required temporary power for heavy plant and machinery. The equipment had to meet regulatory authority requirements and be able to be positioned discreetly on one of Hong Kong’s busiest roadways.

Ampcontrol supplied 11kv 630A VCB switchgear and metering equipment installed into a 10-feet container, making it easy to unload and install onsite, and reducing turnaround time and costs. The 11 kV (kilovolt) / 400 volt 1250 kVA (kilovolt-ampere) substation was purpose-built and included power factor correction equipment. Ampcontrol also provided 1000 kVA and 500 kVA packaged substations for installation underground. The containerised substations deliver reliable power that is environmentally safe and supplied in robust enclosures.

ampcontrolgroup.com
Romtek designs fuel management system for remote PNG mine operator

Case Study
Romtek designs, manufactures, installs and maintains control systems and telemetry systems for a range of industrial process control, power utility, commercial and mining applications. The company has distributors in Asia, the Middle East, the UK, South Africa, Canada and the US.

Romtek solutions have been installed at remote sites worldwide. For example, the company provided a fuel management system (FMS) for the Ok Tedi open-pit gold and copper mine near the headwaters of the Ok Tedi River in Papua New Guinea.

Mine owner Ok Tedi Mining Limited (OTML) was searching for an FMS to manage and reconcile all fuel deliveries and dispensations. The system needed a fuel reconciliation function that produced a daily snapshot of the location and quantity of all fuel, including fuel in transit, used across the operation.

The FMS also had to operate over distances of up to 200 kilometres, in temperatures ranging from 10 to 50 degrees Celsius, in very high humidity and rainfall, and within a rugged setting with challenging communication links. It had to be highly secure, simple to operate due to language barriers and easy to maintain.

Only Romtek’s FMS met these exacting requirements. The company undertook a comprehensive site survey to develop a detailed requirements and specification analysis document. Next, an innovative customised plug-and-play console was designed and developed. This meant the FMS consoles could be easily fitted or replaced without the need to disturb electrical wiring.

Romtek developed a prototype and OTML participated in factory acceptance testing to ensure compliance with its requirements.

To cater for the remote nature of the installations, Romtek developed specialised installation diagnostics equipment that ensured all electrical wiring was correctly set up before the consoles were mounted.

‘Romtek Australia were adaptive to the challenges presented and demonstrated a willingness to present options and solutions at every opportunity,’ said Alan Messenger, Slipstone Senior Lubricants & Fuels Technical Consultant. ‘Since the engagement, Romtek Australia has been responsive, supportive and consistently met and exceeded project targets.’

romtek.com
C. Project lifecycle

Australian specialist power consulting firms will partner with clients to deliver practical and commercially sound solutions across the project lifecycle for power and water assets. Engineering, project management and specialist services are available for the power, water and other infrastructure sectors.

From advanced power stations to smart grid technology integration, electrical substations and transmission lines, Australian companies can deliver reliable, efficient and flexible operational outcomes for clients. Services include:

- developing, building, owning and operating energy and infrastructure assets, drawing on expertise in power generation
- transmission and distribution of electricity and natural gas
- natural gas gathering, processing, storage and liquids extraction.

Australian companies can provide end-to-end engineering and construction services for electrical transmission, distribution, instrumentation and control systems, as well as engineering, construction, commissioning and asset support services that span the full asset lifecycle.

D. Education and training

The Australian Power Institute (API) is a not-for-profit organisation whose aim is to ‘deliver a sustainable supply of highly skilled power engineering professionals, working effectively to meet the challenges of Australia’s emerging energy future, and to support the technical and commercial success of member companies in the energy sector’.

The API established the Collaborative Power Engineering Centres of Excellence to provide an industry relevant program of modules and resources designed to integrate with university undergraduate and postgraduate curricula.

It is a collaborative program between the API and its university partners (Curtin University, Queensland University of Technology, University of Queensland, University of Sydney, University of New South Wales, University of Tasmania, University of Technology Sydney, Victoria University and University of Adelaide).

The API is a member of Australasian Transformer Innovation Centre, which focuses on the asset management of power transformers in the electrical network. The centre offers continuing professional development programs delivered by transformer experts.
EIT provides engineering education and training to the world

Case Study

The Engineering Institute of Technology (EIT) is a globally focused, Western Australian company that pioneered ‘live’ online classroom delivery of electrical engineering training and innovative short face-to-face courses, used by some of the world's largest corporations.

EIT is a private college, a Registered Training Organisation for the vocational sector (ASQA Accredited) and a Higher Education Provider (TEQSA Accredited).

Delivery of electrical engineering training has been a key component of EIT’s evolution and success, with 58 short course titles (not including Instrumentation and Control), 21 online certificates, and eight fully accredited online diplomas and degrees. All online programs are delivered for part-time study.

EIT has been presenting short, professional development courses to engineers, technologists and technicians around the world, in classrooms and on-site, for over 25 years. More recently, EIT has employed a synchronous, live and interactive online platform for teaching and learning. Students apply learnt principles via remote, interactive laboratories and simulation software, in concert with live instructors and lecturers.

With students from over 140 countries studying accredited and non-accredited online courses including professional development, Diplomas, Advanced Diplomas, Bachelor and Master Degrees, research indicates EIT is the only provider in the world offering legitimate, accredited electrical and other engineering qualifications, all online with no attendance on campus required.

A number of international companies are profiting from EIT’s unique training delivery. Rolls Royce is using instructor-led, hands-on training – in just over a year, 180 of its staff have received electrical safety training at Rolls Royce sites around the UK.

Chevron has so far put over 50 staff through Advanced Diploma-level qualifications, while BP takes advantage of EIT’s live online mode of teaching to reach remote staff, with excellent knowledge transfer and economic benefits.

EIT was awarded the 2015 Western Australian Industry Export Award in the Education and Training category.

The institute regularly adds courses and accredits degrees, and work is well underway to introduce a doctoral program. On-campus delivery of degrees commenced this year for local and international students in East Perth, Western Australia.

eit.edu.au
## Australian Power Industry Capability and Experience

### Technology, R&D, Market Design & Climate Change
- **Capabilities:**
  - Emission Control
  - Clean Technologies
  - Fuel Handling & Supply
  - Gas & Steam Turbines
  - Planning
  - Power Delivery
  - Renewable Energy
  - Remote Area & Off-grid Supply
  - Storage

- **Services:**
  - Instruments & Control & SCADA
  - Power System Security
  - Network Modelling
  - Hybrid Systems
  - Software
  - Demand Management

### Transmission & Distribution
- **Power Control**
  - **Capabilities:**
    - Smart Grids
    - Microgrids
    - Distributed Generation
  - **Services:**
    - Energy Efficiency
    - Research & Development
    - Consulting

- **Power Grid**
  - **Capabilities:**
    - HV DC Transmission
    - Substations
    - Network Performance

### Project Lifecycle
- **Project Development**
- **Project Finance & Investment**
- **Design, Engineering & Procurement**
- **Construction & Commissioning**
- **Operations & Maintenance**
- **Upgrades & Rehabilitation**
- **Decommissioning**

### Power Generation
The following are some of the organisations involved in the Australian power sector. Contact your local Austrade representative about connecting and partnering with this sector.

**Australian Energy Council** represents major electricity and downstream natural gas businesses operating in competitive wholesale and retail energy markets
energycouncil.com.au

**Australian Energy Market Commission (AEMC)** is the rule-maker for Australian electricity and gas markets
aemc.gov.au

**Australian Energy Market Operator (AEMO)** is responsible for operating Australia’s largest gas and electricity markets and power systems
aemo.com.au

**Australian Energy Regulator (AER)** regulates energy markets and networks under national energy market legislation and rules
aer.gov.au

**Australian Institute of Energy** promotes understanding and awareness of energy issues and the development of responsible energy policies in Australia
aie.org.au

**Australian Pipelines and Gas Association (APGA)** is the peak body representing Australasia’s pipeline infrastructure, with a focus on gas transmission, but also including transportation of other products, such as oil, water and slurry
apga.org.au

**Australian Power Institute (API)** provides a power engineering education platform to ensure Australia has a sustainable supply of future power engineering professionals
api.edu.au

**Australian Renewable Energy Agency (ARENA)** is tasked with accelerating renewable energy technology innovation and expanding Australia’s technology footprint, investment portfolio and long-term market impact. ARENA-funded activities have increased Australian business capability to advance renewable energy technologies towards commercial readiness, improve business models and reduce overall industry costs.
arena.gov.au

**CIGRE Australia** is a global technical forum for large electric systems. It support its members by leveraging its global network to develop enhanced solutions for Australian organisations and the community
cigreaustralia.org.au

**The Clean Energy Council** is the peak body for the clean energy industry in Australia. It represents and works with hundreds of leading businesses with capability in solar, wind, energy efficiency, hydro, bioenergy, energy storage, geothermal and marine, along with more than 4,000 solar installers.
cleanenergycouncil.org.au

**Department of the Environment and Energy** supports the Australian Government to maintain the economic and social values of natural resources while ensuring the environmental value of Australia’s natural assets is conserved for future generations
environment.gov.au
INTRODUCTION

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INDUSTRY CAPABILITY, INNOVATION AND ENABLING SERVICES

† INDUSTRY ASSOCIATIONS AND GOVERNMENT AGENCIES

FURTHER INFORMATION

Electric Energy Society of Australia (EESA) is a national society established to advance interests in electric energy
eeesa.org.au

Electrical Regulatory Authorities Council (ERAC) coordinates the activities of Australian states and territories in respect to electrical regulatory strategies, policies and ongoing reforms
erac.gov.au

Energy Networks Australia is the national industry association representing Australian electricity networks and gas distribution businesses
energynetworks.com.au

Energy Users Association of Australia (EUAA) represents and services the needs of Australian energy users
euaa.com.au

National Electrical and Communications Association (NECA) is the peak industry body representing the interests of the electrical and communications contracting industry across Australia
neca.asn.au

Power and Energy Society (PES) provides the world’s largest forum for sharing technological developments in the electric power industry, developing standards that guide the development and construction of equipment and systems, and educating members of the industry and general public
ieee-pes.org
REFERENCES

6. Territory Generation. territorygeneration.com.au
10. Ash Development Association of Australia. adaa.asn.au
HOW AUSTRADE CAN HELP

The Australian Trade Commission – Austrade – is the Australian Government agency that promotes trade, investment and education, and develops tourism policy and research.

Austrade helps companies around the world to identify and take up investment opportunities in Australia as well as to source Australian goods and services.

Our assistance includes:

- providing insight on Australian capabilities
- identifying potential investment projects and strategic alliance partners
- helping you to identify and contact Australian suppliers.

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