Pathways to Power Engineering

A guide to careers in the power industry



Pathways to Power Engineering

A collaboration between Study Work Grow and the Australian Power Institute.

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In this guide...

UNDERSTANDING THE POWER INDUSTRY FUTURE TRENDS IN POWER ENGINEERING TERMS YOU NEED TO KNOW KEY AREAS OF POWER ENGINEERING WHAT IT'S LIKE TO BE A POWER ENGINEER KEY TASKS STRENGTHS AND SKILLS THE CLUSTERS IN POWER ENGINEERING PATHWAYS TO POWER ENGINEERING YOUR STUDY OPTIONS WHERE TO FIND MORE INFORMATION

> AP The Australian Power Institut



Understanding the power industry

The power industry is responsible for generating, transmitting, and distributing electricity to homes, businesses, and industries.

Almost every aspect of modern life requires power, ensuring everything from your smartphone to city lights stays powered up, meaning that this is an essential sector.

With population growth and technology advancements combined with dwindling natural resources, the Power industry is evolving rapidly, driven by the urgent need to address climate change and transition to renewable energy sources.

IT'S NOT ALL SOLAR PANELS AND WIND FARMS

Working in the power industry doesn't necessarily mean you'll be directly involved in building renewable energy projects like wind farms or installing solar panels.

While those tasks are important, they represent just a small part of what the industry does, and there are many roles which don't involve hands-on construction of large-scale renewable projects.

You could be involved in planning for future power needs, ensuring the grid stays connected, and managing transmission pathways. Some people in this industry are also involved in preparing for surge events and the impacts of climate change on our power grid.

In this dynamic and forward-thinking field you'll need to be focused on keeping everything buzzing through connectivity and innovation. It's about seeing the big picture and ensuring that our energy needs are met both now and in the future.





It's about innovation & connectivity

People in the power industry need to be strategic thinkers, who can think outside the box. They need to look beyond individual projects to understand how everything fits together to plan a stable and resilient energy grid that can adapt to changes and challenges.

Many careers are related to these three areas:

SYSTEM DESIGN AND INTEGRATION

Designing the systems that integrate renewable energy sources with traditional power grids, managing energy storage systems, and optimising the flow of electricity.

ENERGY MANAGEMENT

Ensuring that energy is used efficiently and sustainably across various sectors. Planning and implementing strategies to address future energy challenges. Taking into consideration factors like population growth, urbanisation, and the increasing use of electric vehicles, all of which impact energy consumption and demand.

RESEARCH AND DEVELOPMENT

The industry requires continuous research and development of new technologies and methods to improve efficiency, reduce environmental impact, and meet the growing energy demands of the future. From smart grids and advanced energy management systems, to cutting-edge research in new energy sources.





Future trends in power engineering

The future of the power industry is increasingly focused on sustainability and innovation. Here are some key future trends that could shape your career:





PATHWAYS TO POWER ENGINEERING

Common terms and abbreviations

Grid	The interconnected network for delivering electricity from producers to consumers.
Load	The amount of electrical power consumed by all users at any given time.
Peak Demand	The highest electrical power demand within a specific period.
Capacity	The maximum output that a power plant or system can produce.
Generation	The process of producing electrical power through a variety of methods.
Transmission	High-voltage transport of electricity from power plants to substations.
Distribution	Delivery of electricity from substations to consumers at lower voltages.
Renewable Energy	Energy derived from natural sources that are replenished, such as wind, solar, and hydroelectric
AC/DC	Alternating current / Direct current.
W	Watt, a unit of power.
HV	High voltage.
Amps	Short for "ampere", one of the standard units used to define measurements of electricity.
Ohms (Ω)	A measurement of how well a current can travel through a circuit or a given path.
PV	Photovoltaic. PV materials and devices convert sunlight into electrical energy.
PV System	Solar panels.





Key areas of power engineering



TRANSMISSION & DISTRIBUTION

Help design, maintain, and manage the systems that convert power to the required voltage, then distribute it safely and efficiently to end users.



Engineer the technology and systems that produce power sourced from fossil fuels, nuclear, hydro, geothermal, solar, biofuels, or wind.



Develop, implement, and integrate technologies and storage solutions for real-time monitoring, control, and automation of the power grid to manage demand.



Find new, viable, and sustainable energy sources, and develop new technologies and methods to improve power systems and reduce energy consumption or waste.



Develop and implement policies that promote efficient and sustainable energy practices, and ensure compliance to standards and codes to maintain safety and reliability in power systems.



Provide technical expertise and manage projects, from energy management systems to cyber security of grid tech, and design new infrastructure to support technology advances.



Where power engineers work

Before you delve any deeper into the world of power engineering, let's start by looking at where power professionals often work.

This is important because if you become a power engineer, then you'll be working in these kinds of environments, and it needs to suit you and how you want to live your life.

POWER ENGINEERS ARE NEEDED EVERYWHERE

Since power is in demand by everyone in today's world, you'll find power engineers in the middle of the city through to remote communities in the far reaches of Australia.

Power engineers are in demand globally, so your skills could suit openings available wherever you want to go.

COLLABORATION IS KEY

Due to the complexity and scale of most projects handled, many power engineers work collaboratively or in teams, allowing them to combine their diverse expertise and skills.

This allows for more complex problem-solving and ensures comprehensive coverage of all important aspects of a project.

WORK ENVIRONMENTS CAN VARY

Power engineers typically work in a variety of settings, from offices for design and planning tasks to industrial sites for hands-on work and system monitoring.

They also spend time in the field, conducting site inspections, overseeing installations, and performing maintenance.





Work-life balance for power engineers

Have you thought about what life will be like if/when you go into this field?

Finding a balance between work and the rest of your life is important, so spend some time thinking about what your career as a power professional could look like.

EXPECT AVERAGE WORKING HOURS

Power engineers work around 44 hours a week on average, which is pretty standard.

Depending on your role you may need to work on weekends or holidays sometimes, and if there's fieldwork or a project deadline coming up you might be expected to work overtime.



Power engineers work on average 44 hours per week

We expect strong future growth and demand in jobs



91% of power engineers work in full-time

JOBS ARE PLENTIFUL

Many power engineering jobs have predicted strong growth going forward into the future, so you can expect that there will always be jobs available.

FULL-TIME WORK IS COMMON

94% of power engineers work full-time, so parttime and casual positions are rare.

Depending on your role you might be working typical business hours, or you might do shift work - people need power all the time, so shift work is also in demand.



Key tasks of power engineers

Power engineers can be tasked with a broad variety of projects, so depending on the field you choose to work in your key tasks may vary quite a lot.

Even within a specific area the projects you'll be working on may be incredibly varied and change over time, so the tasks you perform could often change too.

PROJECT-BASED WORK

Most power engineering roles are project-based, meaning that you are likely to be working on long, complex projects. You could be working on the same project for a few days, months, or even years.

You could be calculating loads, creating detailed specifications, diagnosing and trouble shooting faults, conducting field work, or carrying out maintenance.

PEOPLE-FACING

You will be dealing with people on a regular basis, including your clients, colleagues, other professionals, stakeholders, investors, and even members of the community.

COMMON TASKS

Some common tasks you can expect include:

- Conducting system design and analysis
- Managing and consulting on projects
- Performing system maintenance
- Ensuring compliance and safety
- Writing technical documentation and policies
- Engaging in innovation and research
- Interacting with customers and stakeholders



Parts of these roles may become automated, but human skills will always be needed.



Roles may be both projectbased and operational, combining project-based work with ongoing duties.



You'll interact with others regularly, and be expected to work with tools and technology.



Power engineering skillsets

Power engineers require specific skill sets to help them solve complex problems, complete crucial projects safely, and work effectively in teams. You won't need to have all these attributes right now, but it would be good if you have some of them already and are willing to work towards the others.



ANALYTICAL THINKING

You'll need to analyse complex systems, interpret technical data, identify issues, and devise solutions.



ATTENTION TO DETAIL

You'll need to meticulously plan, design, and review your work to ensure it's safe and reliable.



Knowledge of electrical engineering principles and proficiency with relevant tools and technologies is key.



Great written and verbal communication is vital for teamwork and explaining complex technical concepts.



Use critical thinking, innovation, and the application of engineering principles to solve problems.



You'll need to be updating your skills constantly to keep up with industry changes and technological advancements.



People in the power industry work in Clusters

In the following sections you'll find reference to six Clusters - these groups help us think and talk differently about work. Each section will align with one of the six Clusters, helping you to understand how power engineers work in similar ways but within different roles. This way of thinking could make it easier to understand the different types of work that power engineers do.

Guardians



Guardians protect our mental and physical wellbeing. They help us care for our health, and guard against illness and injury. They also seek solutions to health issues.

Coordinators

Coordinators are the people who plan, prepare, and administer our events, systems and economy. They play a vital role in making sure everything runs smoothly.

Makers



Makers create and maintain the places where we live and work. They grow crops, build homes, repair vehicles, and keep the power on.

Informers

Informers advise, teach, and guide so we can manage our legal, financial, and social responsibilities, and participate in society.

Innovators



Innovators design, engineer, and manufacturer things we use in all areas of our lives, from the clothes we wear, to the food we eat, the homes we live in and the roads we drive on.

Linkers

Linkers help us find, choose, secure, and use things. They can help us with products and physical items, or with the services and support we need.



PATHWAYS TO POWER ENGINEERING

Innovators in power engineering

All engineering roles sit within the Innovators cluster, and as a power engineer you'll develop and advance the infrastructure that delivers electricity from generation sites to end-users, ensuring efficient, reliable, and safe transmission.

You'll probably be focusing on research and development projects that improve network efficiency and reliability and ensure sustainability.

You could find yourself designing new infrastructure, figuring out how to integrate renewable energy to the grid, or modelling and simulating transmission systems to predict performance and identify potential issues.

Power engineering Innovator roles could suit you if you are passionate about cutting-edge technology, enjoy problem-solving, and can think outside the box.



Roles for Innovators

TRANSMISSION & DISTRIBUTION DESIGN ENGINEER

As an Innovator in this job you'd need to have a big-picture outlook. You could be designing highvoltage transmission or distribution lines and substations, or working on ways to ensure systems run efficiently, are reliable, and surpass regulatory standards.

Your tasks could include creating designs and blueprints for transmission networks, developing components and materials used in transmission systems, and designing software tools to simulate and model transmission systems to predict performance and identify potential issues.

TRANSMISSION & DISTRIBUTION TECHNOLOGY INNOVATOR

Innovators in this role are at the forefront of technological advancements, applying them to the transmission and distribution sector.

You could be conducting research and development into new materials, technologies, or methods in power transmission, leading projects that implement innovative technologies in existing transmission infrastructure, and identifying inefficiencies in current systems, proposing and testing new solutions.

What could this look like? Meet Pep...

Pep is a Senior Design Engineer working in the customer solutions team. She also leads a team of design engineers.

She started her career as a utility electrician after completing an electrical apprenticeship, before going on to work in transmission

substations as a maintenance technician. Later, she upskilled with a Bachelor of Engineering (Honours) in Electrical Power and Renewable Energy while working full-time.

Pep's day to day role involves providing distribution network design solutions to connect customers to the grid. Her skillsets include distribution networks, overhead line design, earthing, substation design, and understanding various standards to influence solutions, as well as customer and stakeholder engagement.





PATHWAYS TO POWER ENGINEERING

Makers in power engineering

Power engineers who work as Makers play a crucial role in ensuring that power systems are designed, implemented, and maintained to meet the demands of our society.

In these roles you'd be focusing on creating robust and scalable power systems that can adapt to evolving energy needs and ensure uninterrupted service.

Projects might vary from control and maintenance to working on ways to optimise power system efficiency and cost-effectiveness without compromising safety and reliability.



Roles for Makers

LINEWORKER

As a Maker in this job, you'd be spending much of your time outside, working on underground and overhead power lines to ensure they work properly, and are safe and up to date.

Lineworkers construct and maintain the electric transmission and distribution power lines and other facilities that deliver electrical energy to industrial, commercial, and residential facilities.

You could be installing or servicing these systems, or carrying out emergency repairs to electrical lines and transformers in the event of disruptions like storms or fires.

POWER SYSTEMS ENGINEER

Power Systems Engineers specialise in creating efficient power generation, transmission, and distribution networks.

Makers in this job could be responsible for developing and installing technology integration and carrying out maintenance schedules.

They could also be in charge of performing monitoring and diagnosing of issues, then fixing them to prevent downtime or reduced capacity within the networks.

What could this look like? Meet Sanah...

Sanah is a Senior Electrical Engineer with a Bachelor's degree in Electrical Engineering and a Master's degree in Telematics.

After 12 years of project management as Electrical Distribution Field Supervisor in the oil and gas industry, Sanah moved to Australia, where she began working at Aurecon as a HP Electrical Engineer.

Sanah did further studies in power systems and electrical specification, while working as an independent certifier for a wind farm. She's now been promoted to a Senior Electrical Engineer where she works as a Field Engineer - a varied role that includes working with HP primary design, commissioning and factory acceptance testing on site.



PATHWAYS TO POWER ENGINEERING

Guardians in power engineering

We rely on power to light our homes, cook our food, drive industry, and to transport people and goods. But electricity can be dangerous to work with, which is why Guardians play such an important role within the power industry.

You could work as a Safety Engineer, and look for ways to mitigate risk and operate safely, or as an occupational health and safety officer and work directly with other employees.

You might be working on identifying and mitigating risks associated with electrical systems, or ensuring that operations adhere to industry standards and legal requirements.

You could also work within addressing broader safety concerns, including the impact of power systems on both employees and the surrounding community.



Roles for Guardians

SAFETY ENGINEER

Safety engineers in the power industry are responsible for ensuring that all aspects of power generation, transmission, and distribution adhere to strict safety standards.

You'd be designing safety protocols, conducting risk assessments, and implementing measures to prevent accidents and minimise hazards for workers, the public, and the environment.

You could also be investigating incidents and developing strategies to prevent or reduce future risks.

HEALTH AND SAFETY MANAGER

Health and safety managers oversee safety programs and initiatives within power generation, transmission, and distribution facilities.

You might be responsible for creating and enforcing safety policies and procedures, conducting training sessions for employees, and ensuring compliance with industrial and occupational health and safety regulations.

What could this look like? Meet Abby...

Abby is a Field Support Engineer currently working for Energy Queensland after completing their 3-year graduate program, which allowed her to undertake rotations in different fields.

Abby's day to day role involves providing phone support to field staff to aid them in resolving faults, attending site alongside field crews to investigate and aid in repairing faults.

Abby also performs remote investigations into ongoing faults and writes documentation that supports crews in their work. Her role's focus is working to improve anything possible to ensure that field staff are better supported.





PATHWAYS TO POWER ENGINEERING

Linkers in power engineering

Linkers ensure that the technical and operational aspects of power transmission align with the needs and expectations of all parties involved.

From stakeholder coordination, to providing consumer support and services, to product management and overseeing technical support, Linkers working in the power industry are responsible for bringing everyone together.

Power engineering Linker careers could suit you if you are skilled at communication, enjoy coordinating projects, and excel at connecting technical solutions with stakeholder needs.



Roles for Linkers

COMMUNITY LIAISON

Power projects often include an element of community involvement, and these Linkers help ensure the community impacted by the work can have their voice heard.

Community Liaisons also keep the local community informed of the progress of the project, and may work with advertising or public relations consultants, speak on local radio, and appear in local community forums.

Some also work with young people and schools, sharing information about their work and encouraging young people to consider careers in power engineering.

What could this look like? Meet Dilini....

Dilini is a Senior Network Connections Engineer at Transgrid, specialising in large-scale renewable generation projects such as wind and solar farms.

With a background in power systems, she uses her skills to provide sustainable electricity generation and decarbonisation for the future.

Dilini recommends building a deep knowledge of the basics and being a continuous learner to keep up with technological advances in this industry.



In this role, you'll work directly with utility companies, industrial clients, and other end-users to provide tailored solutions for their power transmission needs.

Acting as a bridge between technical teams and others, you could be conducting site visits, or translating client needs to technical requirements.

You'll also collaborate with engineering teams to develop and implement customised power transmission solutions, and provide technical support and guidance throughout the project lifecycle.



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PATHWAYS TO POWER ENGINEERING

Informers in power engineering

We need Informers in the power industry to bridge the technical and non-technical aspects of power transmission, ensuring projects are legally sound, financially viable, and socially responsible.

The roles are often multi-faceted involving advising and consulting on projects and plans, teaching or training colleagues and non-engineers, and managing other responsibilities from finance to corporate social responsibilities.

In informer roles within power engineering you might be giving technical advice to clients, stakeholders, and regulatory bodies, ensuring projects and daily activities meet regulations and industry standards, or educating others on best practices and new technologies.



Roles for Informers

WORKFORCE TRAINER

This job could be great for informers who want to focus on educating and training others. You might be working with engineers, technicians, and other stakeholders within the power transmission sector.

You could be developing curriculum and materials, and / or delivering workshops, seminars and training programs that build skills, update knowledge, and reinforce safety practices of the people working in the power industry.

POWER TRANSMISSION CONSULTANT

Consultants provides expert advice and guidance on the planning, development, and optimisation of power transmission systems.

They work with utility companies, government agencies, and private sector clients to ensure that transmission projects are efficient, reliable, and compliant with regulations.

What could this look like? Meet Katarina...

Katarina is a Ratings Engineer at Ausgrid who has harnessed her passion for maths, physics, and design and now applies it to the rea world to determine load capacity.

She wasn't sure what she wanted to do after high school, but began an electrical engineering degree with a cadetship during her holidays and loved it.

After graduating, Katarina took a year out to try teaching outdoors education, but ultimately returned to the power industry, where she worked in maintenance and replacement planning, then control and protection, before beginning her current role.





Coordinators in power engineering

Coordinators working in power engineering play a vital role in the planning, preparation, and administration of power systems, ensuring everything runs smoothly and efficiently 24/7.

This could include plans to get things back on track after an event like a storm or flood, or emergencies like a fire or explosion.

In these roles you'd be focusing on creating robust and scalable power systems that can adapt to evolving energy needs and ensure uninterrupted service.

This ranges from control and maintenance, to working on ways to optimise power system efficiency and costeffectiveness without compromising safety and reliability.

Power engineering coordination and planning roles could suit you if you excel at strategic thinking, project management, and systems optimisation.



Roles for Coordinators

OPERATIONS MANAGER

Operations Managers oversee the daily operation and maintenance of power systems, ensuring they run smoothly and efficiently.

You could be monitoring the performance of power systems to detect and resolve issues promptly, and preparing for updates and future projects.

People in this role might also be charged with coordinating maintenance schedules, implementing strategies designed to optimise system performance, or managing operational teams during a normal day or a crisis situation.

POWER SYSTEMS PLANNER

In this role you'd focus on the long-term planning and development aspects of electrical power systems and transmission.

You could be forecasting future energy demands, designing power grid expansions, and ensuring the integration of renewable energy sources.

You'd also need to be across resource allocation for projects and ensure compliance with industry standards and regulatory requirements.

What could this look like? Meet Liana..

Liana is a Project Delivery Coordinator originally in the major customers group, where they were responsible for connecting renewable generators to transmission lines and into the grid.

Liana now works in the Major Projects team, which will enable Queensland to realise their net zero targets by strengthening the transmission backbone throughout the state.

After gaining a certificate in Electrotechnology and Sustainability, Liana went on to study an Electrical and Mechanical Engineering degree and entered the power industry in full time employment through the API Vacation placement program.



Study pathways to power engineering





Your study options

If you're thinking about embarking on a career in power engineering, you need to know that you have a couple of options.

You can launch straight into work with an apprenticeship or traineeship, or you could head off to university to gain a Bachelor of Engineering, and both pathways have positives.

WHAT'S THE DIFFERENCE?

The path you choose really depends on what you prefer and your circumstances.

To become a fully qualified Power Systems Engineer you'll need a four-year university degree. This will take you about the same amount of time as an apprenticeship, but (unless you get a cadetship or scholarship) you may not be able to actually start work in the industry until you graduate.

With an apprenticeship, you'll be able to start work (and earn an income) straight away, and you won't need to qualify for university to apply, but you will need to go to university eventually if you want to become a Power Engineer.

WHERE TO NEXT?



If you are thinking about an entry level role, then read about apprenticeships and vocational options in the next section.



If you're keen to start studying, skip the next bit and move onto the section about university degrees.



Become a Power Systems Technician or Linesworker

There are Powerline Worker or Electrical Apprenticeships to choose from. In these 4-year pathways you could specialise in different fields such as high voltage plant and equipment, communications and controls, or transmission live power lines. If you start out on this path you could choose to upskill later on and progress to more advanced roles.

STEP ONE - FIND AN APPRENTICESHIP

Apprenticeships are generally offered by power and resources companies, so check with the ones near you to see when their applications are open.

They often have minimum age requirements, and may ask you to finish school and/or complete senior maths. Physical fitness and upper body strength is required for lineswork positions, and you may also need your driver's license and a certification that says you're safe to work on a construction site.

STEP TWO - COMPLETE YOUR APPRENTICESHIP

Completing your 4-year apprenticeship plus an industry placement (usually around 3 months), could qualify you to work in some areas of Power Engineering. You may have to complete another qualification before you can apply for roles in more technical or dangerous fields, so we recommend being thorough in your research and asking lots of questions before committing to your apprenticeship.

STEP THREE - START WORK

Once your apprenticeship is complete, you could be a Substation Trade Technician, Easement Maintenance Officer, or Transmission Live Linesperson.

From here, you could choose to upskill to work in more complex areas of power engineering, such as working with high voltage equipment, or in communications and controls.

Remember, your qualifications and work experience could count as credit towards a Bachelor degree if you decide you'd like to pursue more professional roles and become a registered power systems engineer later on.



Become a Power Systems Engineer

If you are keen to head to uni straight out of school, or are keen to begin your career at a professional level, enrolling in a degree is the option you'll need to take. You can choose the area of study that you're most passionate about, which could open up even more opportunities in related careers after you've graduated.

STEP ONE - ENROL IN A DEGREE

There are no specific "power engineering" undergraduate degrees, so search for a Bachelor of Engineering, then find one that suits you and offers specialisations or majors in Electrical Engineering or Renewable Energy.

All Bachelor of Engineering courses are Honours degrees and take a minimum of 4 years of full-time study to complete.

To apply you'll most likely need an ATAR, and they often ask you to have completed certain subjects including maths and science.

Note: If you miss out on an engineering degree, you can apply for a related degree, then apply for a postgraduate Power Engineering qualification later on.

You can find course providers and more info about undergraduate courses on <u>Course Seeker</u>.

STEP TWO - APPLY FOR REGISTRATION

Once you finish your degree and have completed any required engineering work experience, you can apply for <u>registration in your</u> <u>state or territory</u>. To work in power engineering overseas, you may need to undertake additional training, licensing, or registration.

In many cases your skills could be useful in more than one industry, so there are opportunities to move and grow if you don't love the first industry you're working in.

Further into your career, you could consider upskilling in other areas, or enhancing your qualifications with a Master's degree or PhD studies in fields that interest you the most.



PATHWAYS TO POWER ENGINEERING

Looking for more information?

There are lots of places to find more information about careers in power engineering. Here are a few places to start your search in Australia:



The Australian Power Institute (API) represents major Australian power companies whose vision is strengthening the number of people who have the skills, diversity, values, mindset and capabilities that are needed to support the electricity systems of Australian communities, and we've been doing it since 2004!

We are strategic and collaborative in our approach: supporting collective and coordinated activities across the whole lifecycle of the power sector workforce - from school students to executives.







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