ENERGY EDUCATION

Mauri mahi, mauri ora

ENERGY NEWS FROM THE REGION, COUNTRY AND WORLD | MARCH 2023

WITT Te Pūkenga is a key sponsor of the 2023 Offshore Renewable Energy Forum.

It is the third annual event focussing on offshore renewable energy. It hosts a number of international speakers who bring their expertise to help the development of the offshore renewable energy industry in Taranaki.

The first forum in 2020 introduced the concept of offshore wind, and the second forum introduced the key players (wind, wave, tidal, storage), and covered global perspectives and future opportunities (Power to X) for the industry.

The upcoming forum is focused on understanding what barriers remain to commercialising offshore technologies, and how these can be overcome, as well as ensuring the greatest possible benefit for community, local supply chains and service providers.

The December 2021 Offshore Future Energy Forum was well attended

BlueFloat Energy · Elemental Group · Parkwind · WITT · Te Pūkenga · Taranaki Offshore Partnership · RPS

New Zealand nziht School of Engineering, Energy and Infrastructure

Victoria University of Wellington Te Herenga Waka

UC University of Canterbury Te Whare Wānanga o Waitaha Christchurch New Zealand

Energy Education

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A Centre of Excellence in Energy & Engineering will:

- Support the growth of excellent vocational education with a focus on teaching, learning and research.
- Support the development and sharing of high-quality curriculum and programme design.
- Be a consortium with expert representation from industry, the wider sector, and a range of other areas, for example iwi and vocational education representatives.
- Have a national focus.
- Be hosted by a regional campus of Te Pūkenga.
- Address issues and opportunities with a significant strategic impact, ideally with wide-reaching benefits across the sector.
- Solve real problems and grasp viable opportunities.

Preparing for the future

Recently we have seen the devastation that a natural disaster can have on our regions and communities in Aotearoa. At this time our thoughts go out to the all the people that have been affected by this national disaster.

As 2023 ramps up so to does the demand for education and training. International student numbers studying with WITT Te Pūkenga is currently totalling 171 students. We envisage this will increase as we move into the year and new applications receive study visa approvals. New Zealand is still a desirable place for international students to study and as the country looks to the future these students will add culture to our learning environments and become part of our communities.

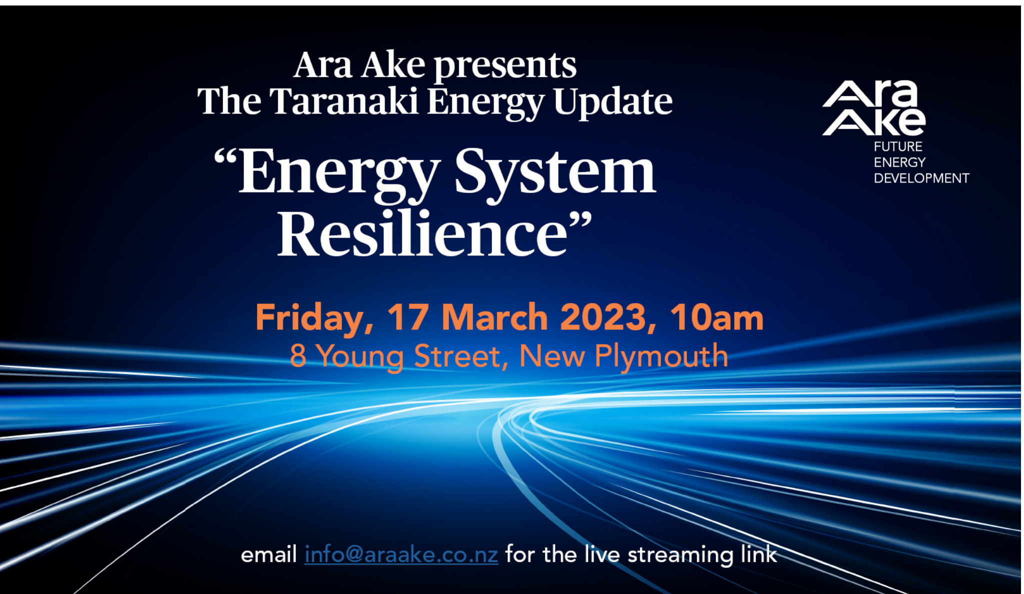
In 2023 WITT Te Pūkenga continue to offer the only NZQA approved Solar Microcredential training in New Zealand. These courses continue to be popular with industry throughout New Zealand and have attracted up to 70 learners from backgrounds as electricians, engineers, sales engineers and third year apprentices since September 2022. In 2023 we expect to see numbers increase dramatically as does the demand for solar energy installations. Full details of the solar course on offer can be found at the end of this edition of Energy Education.

In February WITT Te Pūkenga celebrated the success of their 2021 and 2022 graduates at the annual graduation ceremony. This event is where all the hard mahi of ākonga (students), kamahi (staff) and whānau come together. The class of 2021 was made up of 1157 graduates and the class of 2022 had 986 graduates who have gained certificates through to degree qualifications across a wide range of study programmes.

2023 is another exciting year for WIT Te Pūkenga as we look to collaborate through community of practices and make learning available wider throughout Aotearoa with the sharing of resources. This model helps maintain delivery in the regions and supports local learners to achieve great things for themselves and their whānau while staying connected to their community.

If your organisation has a need for training either existing or new, we would welcome this conversation. We have a range of part-time, full-time, block course and short courses available to suit your needs and we are always keen to hear of new ideas.

Kyle Hall
Director – New Zealand School – Engineering, Energy & Infrastructure, NZIHT



WITT is part of Te Pūkenga - New Zealand Institute of Skills and Technology, together with all the other polytechnics in Aotearoa New Zealand. As from 2023, all WITT learners will be enrolled with Te Pūkenga.

Apply Now

From degrees, diplomas and certificates to a wide range of part-time options, there's a programme to suit everyone, no matter what stage of your career journey you're at.

We can help you find the programme that is right for you, find jobs while you're studying and help you to be ready when your studies are done. Meet with the WITT Te Pūkenga Career Advisor to find the right study option or pathway for you, or chat through options if you're considering a new career.

Contact Nikki:

0800 WITT NZ (0800 948 869)
Phone - (06) 757 3100

Renewable energy courses to meet industry needs

Last year Anna McMullen was employed by WITT Te Pūkenga as part of a joint partnership that was established between the engineering departments at WITT and the University of Canterbury (UC), with an emphasis on course delivery in the area of renewable energy.

Anna spent 2022 undertaking a feasibility study for a renewable energy course to be taught through the University of Canterbury, but offered locally from WITT Te Pūkenga in Taranaki. The purpose of this was to ensure that the local workforce is equipped to meet the changing needs of industry, given the current transition and growth of renewable energy within the region.

It is essential that there is a strong link between specific industry needs, and new tertiary education in renewable energy. Therefore, Anna undertook meetings with industry experts from multiple energy and engineering related companies within the Taranaki region. She gained feedback on a range of questions to determine what a new course should look like in terms of course content, timeframe and pre-requisites, in order to be most beneficial to local industry.

It was positive to see that there was a lot of support for this proposal. Anna found the following to be key content that industry would like to see in a new tertiary level course:

- The big picture of New Zealand's renewable energy transition
- Commercial viability of renewable energy projects
- Stakeholder engagement, including with local iwi
- Technical content including solar and offshore wind
- Smart electrical grids, energy storage and Power to X

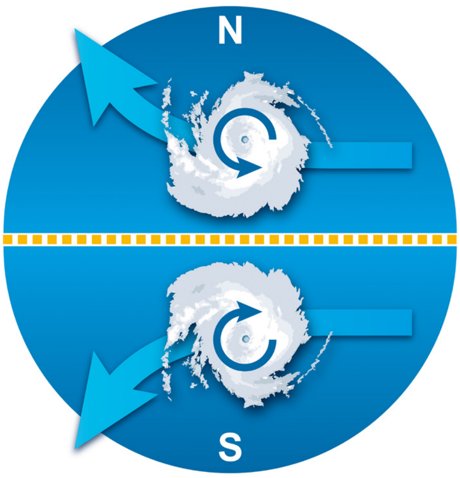
Anna is working with UC to progress this research throughout 2023, with the aim of establishing more specifics around what new tertiary education in renewable energy in Taranaki will look like in the future.

Anna McMullen
Joint appointment in the engineering department between WITT Te Pūkenga and the University of Canterbury

What is a Cyclone?

Tropical cyclones are compact, circular storms, generally some 320 km in diameter, whose winds swirl around a central region of low atmospheric pressure.

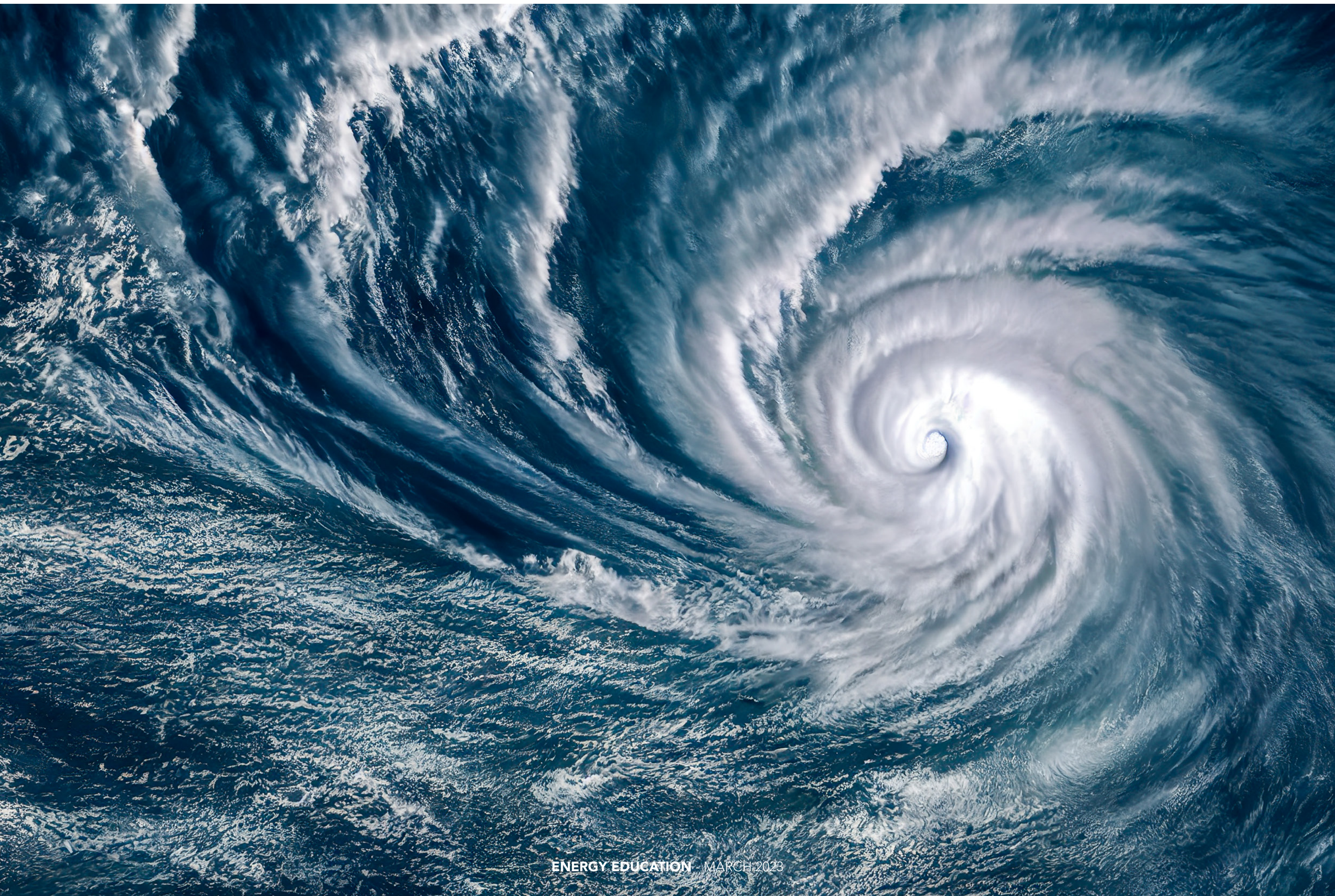
The winds are driven by this low-pressure core and by the rotation of Earth, which deflects the path of the wind through a phenomenon known as the Coriolis force. As a result, tropical cyclones rotate in a counterclockwise direction in the Northern Hemisphere and in a clockwise direction in the Southern Hemisphere.



A tropical cyclone, also called typhoon or hurricane, originates over warm tropical oceans and is characterised by low atmospheric pressure, high winds, and heavy rain. Drawing energy from the sea surface and maintaining its strength as long as it remains over warm water, a tropical cyclone generates winds that exceed 120 km per hour. In extreme cases winds may exceed 240 km per hour, and gusts may surpass 320 km per hour. Accompanying these strong winds are torrential rains and a devastating phenomenon known as the storm surge, an elevation of the sea surface that can reach 6m above normal levels. Such a combination of high winds and water makes cyclones a serious hazard for coastal areas in tropical and subtropical areas of the world. Every year during the late summer months (July–September in the Northern Hemisphere and January–March in the Southern Hemisphere), cyclones strike regions as far apart as the Gulf Coast of North America, northwestern Australia, and eastern India and Bangladesh. And now New Zealand.

Tropical cyclones are known by various names in different parts of the world. In the North Atlantic Ocean and the eastern North Pacific they are called hurricanes, and in the western North Pacific around the Philippines, Japan, and China the storms are referred to as typhoons. In the western South Pacific and Indian Ocean they are variously referred to as severe tropical cyclones, tropical cyclones, or simply cyclones. All these different names refer to the same type of storm.

Source: www.britannica.com/science/tropical-cyclone



Why the Southern Hemisphere is 24% stormier than the North

This article was in the December 2022 issue of Energy Education and is repeated in this issue.

The southern hemisphere is a very stormy place. The winds at different degrees of latitude are described as the "roaring forties", "furious fifties" and "screaming sixties". Ocean wave heights can reach an astounding 24 metres.

For a long time, most weather observations on Earth were taken on land. This gave scientists a clear picture of storms in the northern hemisphere. However, for the southern hemisphere, which is around 20% land, it was not until the advent of satellite-based observations in the late 1970s that we obtained a clear picture of storms there.

Thanks to decades of observations since the beginning of the satellite era, we know the southern hemisphere is about 24% stormier than the northern hemisphere.

Because the Earth is a sphere, it does not receive solar radiation from the sun evenly across its surface. Most energy is received and absorbed at the equator, where the sun's rays hit the surface more directly. In comparison, less energy is received at the poles, where the rays strike at a steep angle.

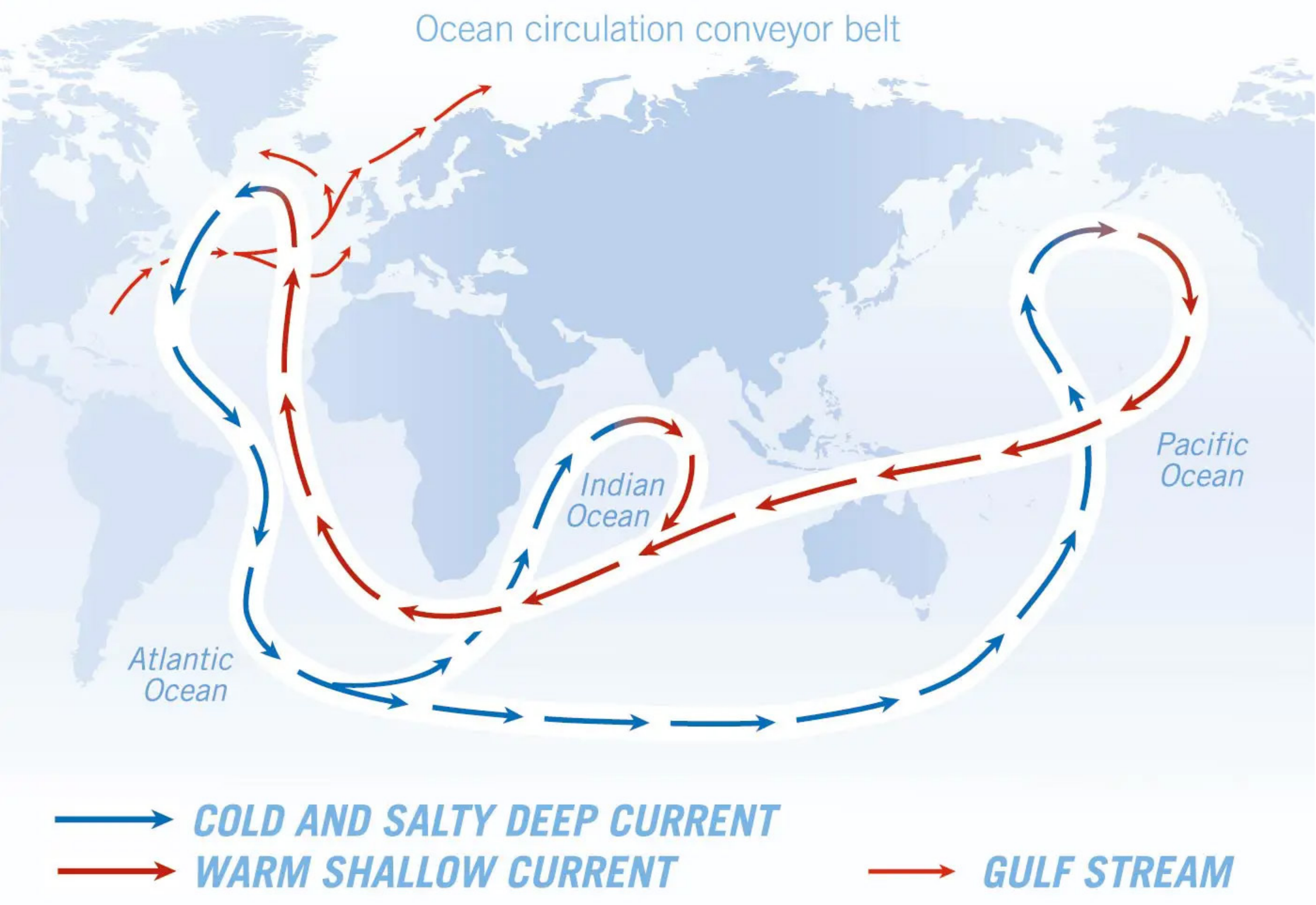
Decades of research show storms derive their strength from this energy difference. Our observational analysis suggests the different strength of storminess in the south versus the north is likely related to two different factors.

First, the transport of energy by the ocean, which is often described as a "conveyor belt". Water sinks near the Arctic, travels along the bottom of the ocean, rises up around Antarctica and flows back north along the equator – bringing energy with it. The net effect is that energy is moved away from Antarctica and toward the Arctic. This leaves a larger energy contrast between the equator and the pole in the south than in the north, which contributes to a stormier southern hemisphere.

The second factor is the large mountains in the northern hemisphere, which suppress storms. Air flow over large mountain ranges create stationary highs and lows that leave less energy available for storms.

Source : Excerpts from guest post by Prof Tiffany Shaw (University of Chicago) on Carbon Brief

https://www.carbonbrief.org/guest-post-why-the-southern-hemisphere-is-stormier-than-the-northern/



Building energy system resilience

In two separate events, the highest recorded rainfall to effect Auckland, and the biggest storm to effect the North Island have occurred in less than 20 days of each other.

A recent report prepared for the National Renewable Energy Laboratory (NREL) partially funded by the U.S. Department of Energy (DOE) says:

> "extreme weather events, natural disasters, and cyber incursions have brought the vulnerability of the electric system into sharp focus. These events have demonstrated that planning for long-duration power interruptions caused by high-impact, low-probability events will require new approaches to power system resilience above and beyond previous hardening efforts."

The rapid growth and declining costs of distributed energy resources (DERs) such as microgrids, solar photovoltaics, and batteries have introduced new technology options for energy resilience.

What is a DER?

DER is the acronym for 'Distributed Energy Resource.' It is different to the current predominant model of the energy system where large power plants are fueled by coal, hydro or gas, to generate electricity that is then distributed via a centralised grid. New Zealand will always have this as the backbone to our electricity system, but when an outage occurs at a significant point in the grid, the outage will effect every electricity consumer beyond that point.

A distributed energy resource (DER), is a decentralised energy system that if planned well, can offer energy supply to communities through smaller local generation and distribution microgrids. Generation that relies on locally accessible energy such as sunlight and wind is part of developing resiliency for that community.

Energy system vulnerability needs significant discussion and strategic planning, in order to build resiliency, especially in the context of increasing force and frequency of adverse weather events.

Resilience planning

Planning for resiliency has always been important for communities, and even more so as weather events are more forceful and frequent.

A case in point is the West Coast of the South Island, which has suffered increasing frequency of adverse weather events. The West Coast poses a logistical challenge for fuel resilience and communication lines in any emergency event with sparse settlement over the region's 650km length.

The National Emergency Management Agency (NEMA) is funding the development of a 'fuel resiliency project' for the West Coast.

Can DER's contribute to building resiliency?

In storm events, the contribution to resiliency by such a local system will depend on the strategic location of generation equipment and supporting infrastructure. Solar panels on house roofs when houses are often the most vulnerable buildings in a storm, may not add to resilience. Such has been the case in Auckland and the upper North Island recently.

The practice of integrating resilient DERs into resilience planning is still at an early stage.

The NREL report goes on to say:

> "Although it is clear that DERs can offer resilience benefits (for critical infrastructure and critical facilities), it is unclear how to determine the value of those benefits. Identifying appropriate methodologies to calculate the value of resilience will be an important step toward ensuring that resilient DERs are considered alongside alternatives and integrated into future energy infrastructure and investment planning efforts."

EVs gaining momentum in the New Zealand market

Transport makes up 21% of the country's carbon footprint, and most of that comes from the light vehicle fleet – cars, vans and utes. In 2019, light vehicles were responsible for almost 11MtCO2e emissions.

With governments worldwide setting stricter fuel efficiency standards, vehicle manufacturers offering more electric and hybrid models, and some swearing off fossil-fueled vehicles for good, the tide is turning.

In New Zealand, the Climate Change Commission has recommended phasing out imports of fossil-fueled cars by no later than 2035, and the new Clean Car Discount will incentivise accelerated adoption of EVs.

By the end of this decade more than 50% of monthly vehicle sales in New Zealand need to be electric in order to meet our emissions reductions targets. This requires a jump from about 6000 electric vehicles (bought in 2020) to annual sales of 150,000 electric vehicles (NZTA).

Reducing Demand

Decarbonising transport won't just be about EVs — it will be about reducing our car use overall, with some shift to public transport or active transport like cycling and walking, and more flexible ways of working, so we're not all commuting every day.

- If every New Zealand household switched their car for a climate-friendly mode of transport for two short trips a week (two kilometre average), every week, we could save around 100,000 tonnes of carbon dioxide emissions each year.
- If one in five commuters switch the car for active transport (biking or walking), or even work at home one day a week, we could avoid 84,000 tonnes of carbon emissions each year.

EVs have never been more popular

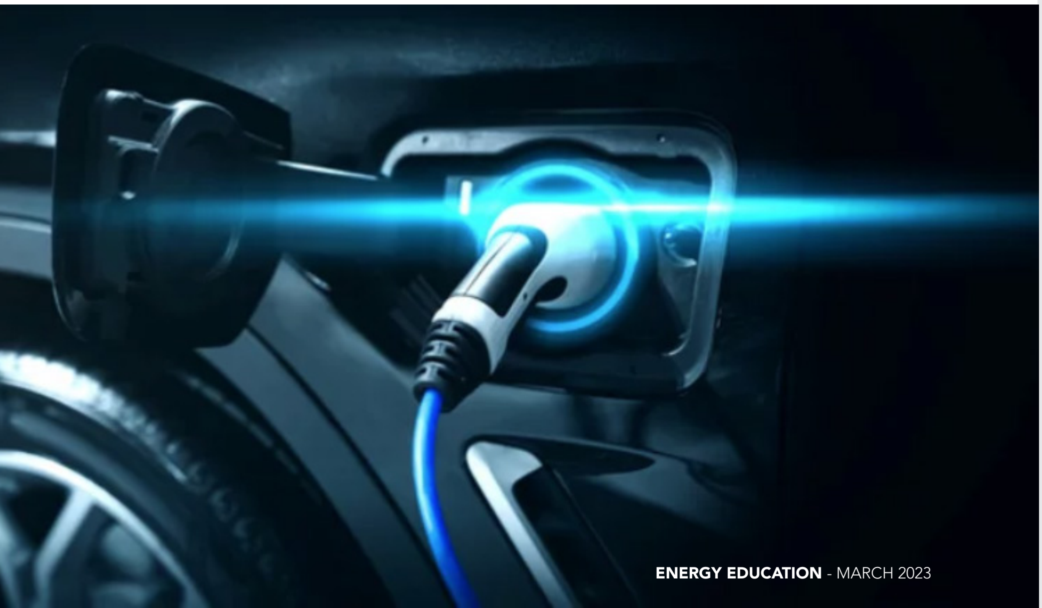
Worldwide, EV sales rose 41% in 2020, despite general car sales being down 16% due to the Covid-19 pandemic.

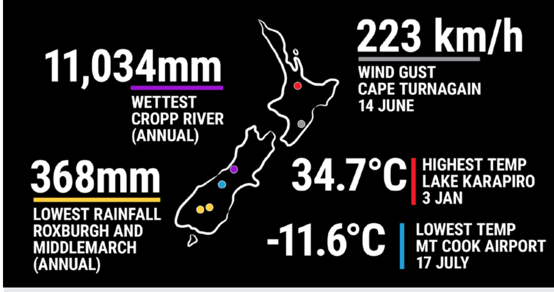
Eighteen of the world's top 20 vehicle manufacturers have stated plans to increase the range of EV models available, and increase their production.

How much better for the environment are EVs?

An EV used in Aotearoa emits about 60% fewer emissions over its full life cycle than an equivalent petrol vehicle. This is the case even when accounting for emissions from raw material extraction, manufacture, and shipping. This figure will improve as Aotearoa phases out fossil fuels in electricity generation and as global efforts decrease emissions from EV supply chains." — Climate Change Commission

Source: EECA





NIWA's 2022 Annual Climate Summary

It's official - last year was once again Aotearoa's warmest on record, knocking 2021 off the top spot.

Highlights:

- The nationwide average temperature was 13.76°C, +1.15°C above the 1981-2010 annual average and surpassing 2021 by +0.20°C.
- The top four warmest years on record have all occurred since 2016.
- No months were below average in temperature, with November being the most unusually warm.
- The nationwide rainfall anomaly was 110%.
- La Niña was one of the primary drivers of last year's weather patterns.
- Sea surface temperatures near New Zealand also had a big impact, being above or well above average every month and resulting in a marine heatwave for most of the year
- The highest air temperature was 34.7°C at Lake Karapiro on 3 January and the lowest was -11.6°C at Mt Cook Airport on 17 July.
- Taranaki experienced New Zealand's highest annual sunshine total with 2659 hours recorded at New Plymouth.
- The wettest location was Cropp River (West Coast, 975 metres above sea level) with 11034 mm rainfall.
- Of the six main centres in 2022, Tauranga was the wettest, Dunedin was the driest and coolest, Auckland was the warmest, Hamilton was the sunniest, and Wellington was the least sunny.

Source: https://niwa.co.nz/news/niwas-2022-annual-climate-summary-is-now-out

Myth-Busting about EV's lifecycle emissions

Myth-busting: saying or showing that something generally thought to be true is not, in fact, true, or is different from how it is usually described:

Lower emissions, even with some coal-powered electricity.

Even if thermal (coal) electricity generation increases during dry periods, as it did in New Zealand in early winter 2021, EVs will still have a lower on-the-road carbon footprint, as renewable generation still makes up around 80% of supply, while petrol and diesel are always 100% non-renewable. And while there is some coal-powered electricity now, there won't be for long, whereas new petrol cars will be in the fleet for 15-20 years.

EVs still have a lower carbon footprint

A recent IEA analysis shows that from a lifecycle perspective (which includes emissions related to vehicle manufacturing, use and end-of-life) EVs today provide lifecycle GHG emissions reductions of around 20-30% relative to conventional ICE vehicles on a global average.

These benefits are more pronounced in countries where the power generation mix is rapidly decarbonising, such as the European Union, where BEV lifecycle emissions are around 45-55% lower.

Source: EECA

Growing an Energy Centre of Vocational

Taranaki is experiencing the emergence of alternative energy industries and usages that have the potential to create a range of new career pathways that WITT Te Pūkenga is preparing to support.

WITT Te Pūkenga is positively connected to many industries which will lead the transition, enabling teaching to maintain a level of relevancy and responsiveness to those industry needs, which many other academic and vocational institutions will struggle to have.

Some of the areas that are anticipated to emerge include electric vehicles, hydrogen fuel technology, renewable generation technologies (hydro, wind, solar, geothermal, wave, tidal etc.).

WITT Te Pūkenga is supporting the energy industry by developing a Centre of Excellence in Energy and Engineering to provide work-ready graduates who are skilled in the latest technologies.

Strategic collaborations

Collaborations between Victoria University, Canterbury University and Ara Ake, the national new energy develop centre, creates strong relationships to ensure WITT Te Pūkenga is connected to other leading organisations in the energy field.

A Centre of Excellence must:

- Support the growth of excellent vocational education with a focus on teaching, learning and research.
- Support the development and sharing of high-quality curriculum and programme design.
- Be a consortium with expert representation from industry, the wider sector, and a range of other areas, for example iwi and vocational education representatives.
- Have a national focus.
- Be hosted by a regional campus of Te Pūkenga.
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- Solve real problems and grasp viable opportunities.

Hiringa Energy - consortium partners

New Plymouth company, Hiringa Energy are consortium partners to develop hydrogen fuelled aircraft.

In 2022, Air New Zealand signed a strategic alliance agreement with Hiringa Energy to explore green hydrogen infrastructure for its zero emissions aircraft programme.

The national airline has also joined forces with some of the world's leading aircraft developers to make zero-emission flights a reality through its 'Mission Next Generation Aircraft' accelerator programme.

The aviation companies include Cranfield Aerospace, VoltAero, Beta, and Eviation. Air New Zealand says it will work with the aircraft innovators to have its first zero emissions flight — either cargo or passenger — in the sky from 2026 and begin replacing its Q300 domestic fleet.

Added to that group is Universal Hydrogen, Embraer and Heart Aerospace, which Air New Zealand Chief Sustainability Officer Kiri Hannifin says "will broaden our knowledge of the technologies being developed for potential future aircraft which is critical to addressing the climate crisis.

"Through our partnerships with Airbus and ATR, we've been able to deepen our understanding of the impact green hydrogen and battery hybrid aircraft may have on our network, operations and infrastructure, as well as the opportunities and challenges of flying low and zero emissions aircraft in New Zealand."

Hannifin says "this isn't about selecting a new aircraft. It's about growing our collective understanding to advance a new era of travel. These partners were selected because they are taking action now to progress decarbonising the aviation industry," says Ms Hannifin.

Through a combination of electric, green hydrogen, and hybrid aircraft, these partners will work alongside Air New Zealand over the coming years to focus on developing the technology and associated infrastructure required to make flying these aircraft in New Zealand a reality.

Christchurch Airport has been selected by aerospace company Airbus and Fortescue Future Industries as a launchpad for developing commercial flight powered by "green hydrogen".

Last October Christchurch and Hamburg Airports entered a partnership to develop hydrogen infrastructure for aviation. The Hamburg-Finkenwerder Airport is also home to Airbus's ongoing research into hydrogen-powered jet engines and fuel cells.

Air New Zealand's long-term partners are developing green hydrogen and battery-hybrid aircraft with between 30 and 200 seats.

Robinson Research Institute

Air New Zealand has also teamed up with Victoria University of Wellington's Robinson Research Institute to help the airline evaluate and validate aircraft propulsion technology as concepts develop and mature.

The research institution is a world-leader in developing power electronics and superconducting machines and is currently working on their application to the aviation industry.

Robinson Research Institute, an arm of Victoria University in Wellington, says

Below: Andrew Clennett, CE of Hiringa Energy based in New Plymouth, (second from right) with consortium members, including Minister of Energy & Resources, Hon Dr Megan Woods

Continued from previous page

they are perfectly placed to support Air New Zealand on their mission to decarbonise flight, and are excited to continue working together through this long-term partnership. Their team is world leading in superconducting technologies, and are at the bleeding edge of understanding what it takes to make large electric aircraft a sustainable reality, so are able to provide that expert advice that will help Air New Zealand make the right technical decisions along its path to zero emissions.

Robinson Research Institute has a long-standing tradition of partnering with industries to solve real-world problems. They work closely with Wellington UniVentures at Victoria University of Wellington, to realise these partnerships. Of course, being proudly New Zealand-based, it's particularly rewarding for them to support New Zealand's flag carrier on what is ultimately, a goal of huge national significance" says Professor Rod Badcock, Deputy Director at Paihau—Robinson Research Institute.

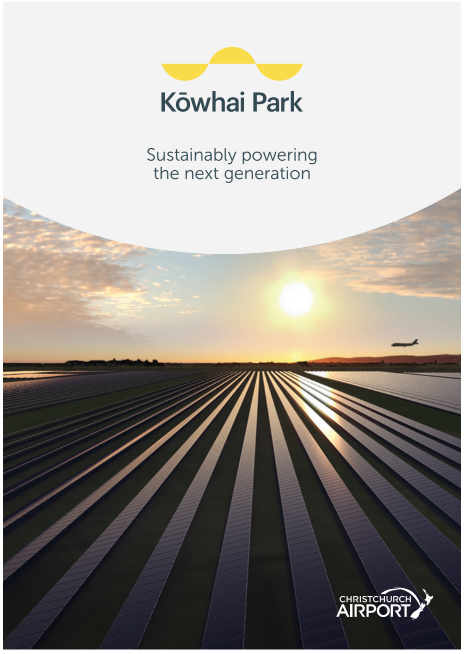
Sustainable Aviation Fuel for long-haul flights

While zero emissions aircraft technology will help decarbonise the airline's domestic network over the period to 2050, Sustainable Aviation Fuel (SAF) is critical in the near term, particularly for the long-haul fleet.

SAF is a 'drop in' fuel which when combined with jet fuel can power the airline's current aircraft. This can reduce emissions for long haul travel and domestic flights while the airline continues to operate conventional aircraft. The inputs and processes used to make SAF result in lower lifecycle emissions than fossil jet, with the opportunity to generate significant CO2 savings.

Airbus

"Air New Zealand and Airbus share common goals on the journey towards the decarbonisation of the aviation sector. Under our existing agreement, we have already determined that New Zealand offers an ideal test environment to develop the ecosystems necessary to support hydrogen-powered aircraft operations. The next phase will go into more detail on potential aircraft design and performance that would meet Air New Zealand's requirements, building upon the long-standing partnership we have together," said Karine Guenan, Airbus Head of Zero Emission Ecosystem.



Kōwhai Park is a platform for generating green energy at scale. Ideally located next to Transpower and Orion's network, this energy can be delivered straight to potential customers to help them decarbonise. Christchurch Airport is currently investigating the opportunity to generate green hydrogen onsite in the future. There will be demand for this energy from both existing businesses and future industries, including green data centres and vertical farming.

A joint programme between WITT Te Pūkenga and Victoria University unlocks an exciting future

WITT - Te Pūkenga is pleased to be partnering with Te Herenga Waka, Victoria University Wellington (VUW) to create opportunities for rangatahi to stay in Taranaki and study then pathway to an exciting degree programme at Victoria University.

Study the first year of your engineering degree at WITT Te Pūkenga, then pathway to Victoria University.

- **Joint BEng (Hons) Programme**
- **Joint BSc Programme**

Scholarships

WITT - Te Pūkenga has scholarships available to study full-time engineering in New Plymouth, either at diploma or degree level and welcomes enquiries regarding these.

If a student has a preference to focus on computer software, engineering and associated fields, then WITT - Te Pūkenga can now help you on that journey and better prepare you for life at university.

These scholarships are proudly sponsored by Ara Ake and GNS.

GNS SCIENCE
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Future Energy Development

Big opportunities through studying at WITT

Ballance Process Operator Melanie Megaw has just bought her first house at 25 years of age, thanks in part to her step up into an operator role in the energy industry three years ago.

Initially, Melanie capitalised on her interest in science and began her career in the laboratory at Ballance Kapuni. She became interested in what changes influenced the results she saw in the lab, so she spent time learning from operators on the plant about the process and their responsibilities. This led her back to the classroom to complete the process operator training programme at WITT Te Pūkenga in 2019.

"I enjoyed the course, the trainer was really good and I enjoyed learning with a team that had the same goal. I'd definitely recommend the course to others. If you're in the industry and want greater career progression, or are new to it, energy is a great industry and they really care about their people," says Melanie.

Melanie's first role as an operator took her north to Whangarei where she worked for Refining NZ after having done a work placement there as part of the course. Changes at Refining NZ's operation brought Melanie back home and back to Ballance, but this time in an operator role.

"The job is diverse, with plenty to learn and do every day, so I love it. I enjoy working as a team and would recommend the training and the opportunity to others – it's got the potential to be life-changing."

Melanie is confident that her skills are transferable to other roles.

"The energy industry is changing a lot in a positive way, the skills I learn now will be beneficial long into the future. Energy will always be needed."

The next intake for the Certificate in Energy Process Operations starts on 20 March 2023 (successful applicants are required to attend a three day health and safety course at WITT -Te Pūkenga from 15 to 17 March).

Click [here] to access further information on the Process Operator programme

Low-emissions sources are set to cover almost all the growth in global electricity demand in the next three years

Renewables are set to dominate the growth of the world's electricity supply over the next three years as together with nuclear power they meet the vast majority of the increase in global demand through to 2025, making significant rises in the power sector's carbon emissions unlikely, according to a new IEA report.

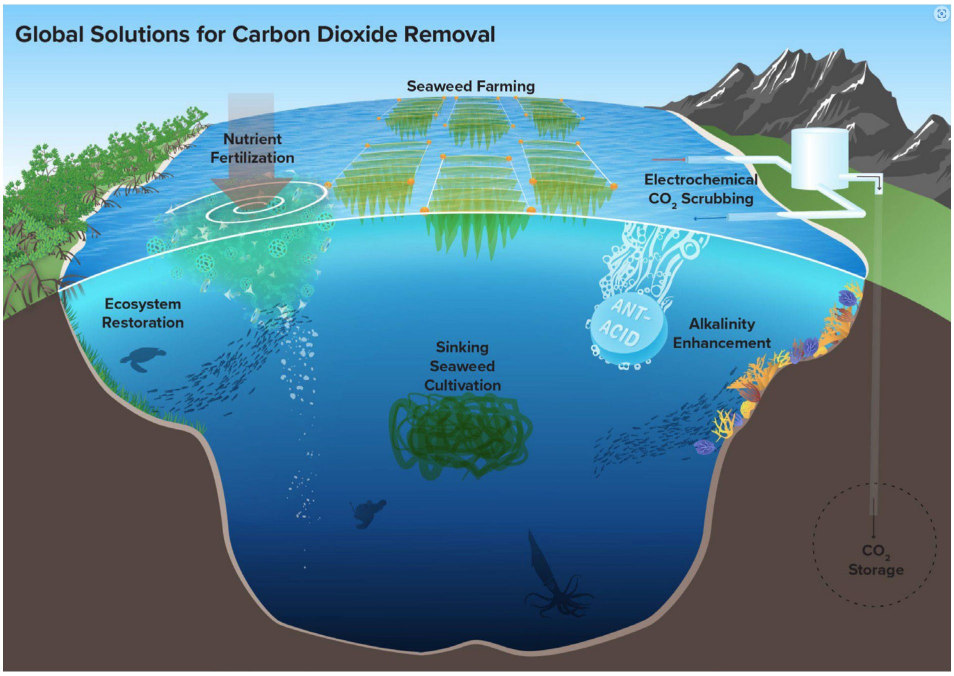
After slowing slightly last year to 2% amid the turmoil of the global energy crisis and exceptional weather conditions in some regions, the growth in world electricity demand is expected to accelerate to an average of 3% over the next three years, the IEA's Electricity Market Report 2023 finds. Emerging and developing economies in Asia are the driving forces behind this faster pace, which is a step up from average growth of 2.4% during the years before the pandemic.

More than 70% of the increase in global electricity demand over the next three years is expected to come from China, India and Southeast Asia.

However, considerable uncertainties remain over trends in China as its economy emerges from strict Covid restrictions. China's share of global electricity consumption is currently forecast to rise to a new record of one-third by 2025, up from one-quarter in 2015. At the same time, advanced economies are seeking to expand electricity use to displace fossil fuels in sectors such as transport, heating and industry.

Source: iea.com

Carbon Dioxide Removal (CDR) ... To Clear the Air, Look Beneath the Waves



Participants at the 26th United Nations Climate Change Conference (better known as COP26) late last year in Glasgow reiterated humanity needs to accelerate change in the coming decades to limit global warming to 1.5°C (or even to the 2°C as agreed up in the Paris Agreement). Meeting this goal by 2050, the formidable deadline agreed upon across environmental sectors to prevent dooming the planet, will require more than electric cars and trucks. In addition to minimising emissions at the source, humanity needs to remove the atmospheric carbon that has collected over the centuries since the Industrial Revolution.

Carbon dioxide removal (CDR) can improve the atmosphere through natural and man-made processes. This differs from other techniques, like carbon capture and sequestration, which aim to collect carbon near the source, before it enters atmosphere.

A newer phenomenon is ocean CDR—researching and developing technology to aid and expedite the ocean's natural carbon sink processes, remove significant amounts of carbon from the atmosphere and make the 1.5°C goal more attainable.

According to the National Academy of Sciences, Engineering and Medicine (NASEM), there are currently six main ocean CDR techniques:

1. Seaweed farming to increase green space that needs CO2 to grow
2. Nutrient fertilisation to enhance phytoplankton growth and uptake of CO2
3. Ecosystem restoration to move carbon dioxide through the food chain and into the ocean via fecal matter and organic matter
4. Artificial upwelling and downwelling to bring nutrient rich water to the surface and increase marine plant productivity
5. Alkalinity enhancement to raise the pH of seawater and increase its ability to absorb CO2
6. Electrochemical CO2 removal to be buried in underground reservoirs.

Not every technique is being pursued to the same extent, and experts throughout the field agree more research is needed to understand the full impacts and potential consequences of these processes. So, where does ocean CDR currently stand?

Dr. Ken Buesseler, senior scientist in marine chemistry and geochemistry, plus a Woods Hole Oceanographic Institution and NASEM committee member, points out these six tactics are just a subset of options, moreover no approach can stand alone. Buesseler specialises in the measurement of radioactive elements in the ocean that track carbon as it's carried from the surface to deep sea by "marine snow," or the organic debris left behind by phytoplankton and other organisms in the food chain. This is a "biological carbon pump," carrying CO2 deep into the ocean where it's stored for a thousand years or more.

Source: worldenergynews.com

WITT RENEWABLE ENERGY COURSES

Stand Alone Power Systems: Design and Installation

Stand Alone Power Systems (SAPS) can be a viable option for many applications, from a remote monitoring station to an off-grid household right up to village electrification.

For the reliable, long-term supply of power to off-grid users, electrical workers involved with these systems fully understand the operating theory and safety requirements in order to design and install safe and effective systems, as well as adequately manage customer expectations.

This course builds upon the basic knowledge provided in Grid-Connected Photovoltaic Systems and expands upon that in Grid-Connected Battery Systems.

Course structure

The delivery of this course is designed for busy tradespeople who do not have the time to attend lengthy face-to-face courses. The online component is fully flexible to allow students to complete the theory in their own time.

- Pre-course learning: Online self-directed learning at your own pace, with tutor support (100 hours).
- Three day course at the WITT Te Pūkenga Infrastructure Park, New Plymouth (24 hours).
- Post-course assignment (16 hours).

With successful completion of the course, the applicant achieves the following micro-credential: Stand Alone Power Systems: Design and Installation (20 credits).

At the end of the course participants will have the following knowledge

- Assess a site's suitability for a stand alone power system and calculate an estimated energy yield at each month of the year for the client.
- Assess a client's energy consumption, create a load versus renewable energy resource profile and estimate renewable energy percentage versus fuel generator energy [percentage.
- Determine best battery technology for a given scenario based on a variety of factors.
- Determine best mix of energy resources for a given site.
- Select appropriate components and assess their suitability.
- Design and install a stand-alone power system.
- Commission and fault-find stand-alone power systems.
- Optimise stand-alone power systems.
- Stand-alone power systems: design and installation.

Topics include

- Commonly used off-grid battery chemistries and their characteristics.
- Battery charging, PWM regulators and MPPT charge controllers.
- Battery inverters, inverter/chargers, hardware differences between hybrid inverters and specifically designed off-grid capable inverters.
- AC and DC coupled battery inverter architectures.
- Cable sizing, fault level calculations and selection of protective devices.
- Balance of system components.
- Site suitability and load assessment.
- System design and yield calculations.
- Backup generators.
- Integration of multiple energy sources.
- Wind and micro-hydro generation (introductory info only).
- Applicable regulations, standards – in particular AS/NZS5033, AS/NZS4509.1 and AS/NZS4509.2, various battery standards including a look at the new AS/NZS5139 (not yet cited in Regs) and examples of lines company connection requirements in New Zealand.
- Installation, testing, commissioning and fault-finding of stand-alone power systems.
- Hazards associated with batteries and stand-alone power systems.
- Energy consumption assessment, detailed load profiling an optimisation strategies.
- Multiple scenarios where stand-alone power systems can be of use:
  - Remote monitoring and control.
  - Baches and tiny houses.
  - Off-grid homes.
  - Off-grid workshops and industry.
  - Remote village electrification.

Who should attend?

- Electricians
- Electrical Engineers
- Electrical Inspectors

N.B. Completion of Grid-Connected PV Systems: Design and Installation is a prerequisite for this course. Completion of grid-connected battery systems is highly recommended.

All applicants must be registered electrical workers and hold a current practicing licence.

Led by Tim Francis

Tim is the trainer appointed to deliver the PV training courses at WITT Te Pūkenga, NZIHT - New Zealand School of Engineering, Energy & Infrastructure, supported by SEANZ.

Tim Francis is the Principal and Director of Southern Solar & Automation. He has a 26-year background as an electrician, initially specialising in industrial control systems and then spending the last 15 years in the Renewable Energy field as a designer/installer of both grid-connected and stand-alone PV and storage systems. Prior to moving to New Zealand in 2019, he was also engaged as a trainer in both subjects at both TAFE NSW and GSES Australia. He has advanced diplomas in Electrical Engineering (Control) and Renewable Energy and held CEC Accreditation as a designer and installer for both grid-connected PV and stand-alone power systems with both micro-hydro and small wind endorsements.

WITT RENEWABLE ENERGY COURSES

Grid-Connected Battery Storage Systems: Design and Installation

Grid-Connected Battery Storage Systems, particularly those integrated with Grid-Connected Photovoltaic Systems, provide many valuable options to home and business owners. However it is essential that electrical workers involved with these systems fully understand the operating theory and safety requirements in order to design and install safe and effective systems, as well as adequately manage customer expectations.

This is a recommended prerequisite course for those wanting to install complete stand-alone (off-grid) systems and builds upon the basic knowledge provided in grid-connected photovoltaic systems.

Course structure

The delivery of this course is designed for busy tradespeople who do not have the time to attend lengthy face-to-face courses. The online component is fully flexible to allow students to complete the theory in their own time.

- Pre-course learning: Online self-directed learning at your own pace, with tutor support (100 hours).
- Three day course at the WITT Te Pūkenga Infrastructure Park, New Plymouth (24 hours).
- Post-course assignment (16 hours). With successful completion of the course, the applicant achieves the following NZQA framework registered micro-credential: Grid-Connected Battery Storage Systems: Design and Installation (10 credits).

At the end of the course participants will have the knowledge to:

- Assess a site's suitability for a grid-connected battery storage system and calculate an estimated energy yield for the client.
- Assess a client's energy consumption, create a load versus PV profile and recommend options to improve self-consumption of PV energy.
- Determine best battery technology for a given scenario based on a variety of factors.
- Select appropriate components and assess their suitability.
- Design and Install a grid-connected battery storage system.
- Commission and fault-find grid-connected battery storage systems.
- Optimise grid-connected battery storage systems for non-typical usages.

Topics include

- Commonly used battery chemistries and their characteristics.
- Battery charging.
- Multi-mode (hybrid) battery inverters.
- AC and DC coupled battery inverter architectures.
- Cable sizing, fault level calculations and selection of protective devices.
- Balance of system components.
- Site suitability and load assessment.
- System design and yield calculations
- Applicable regulations, standards – in particular AS/NZS5033, AS/NZS4777.1, various battery standards including a look at the new AS/NZS5139 (not yet cited in Regs) and examples of lines company connection requirements in New Zealand.
- Installation, testing, commissioning and fault-finding of grid-connected battery storage systems
- Hazards associated with batteries and grid-connected battery storage systems.
- Energy consumption assessment, detailed load profiling and optimisation strategies.
- Multiple scenarios where grid-connected battery storage systems can be of use for:
  - Maximising self-consumption of renewable energy.
  - Short-medium duration backup power.
  - Load shifting.
  - Tariff optimisation.
  - Grid support.
  - Avoidance of need to upgrade mains for some high-power loads.
  - Single to three-phase conversion.

Who should attend?

- Electricians.
- Electrical Engineers.
- Electrical Inspectors.

N.B. Completion of Grid-Connected PV Systems: Design and Installation is a prerequisite for this course.

All applicants must be registered electrical workers and hold a current practicing license.

DATES & LOCATIONS FOR COURSES

All courses held at the NZIHT/ WITT Te Pūkenga Infrastructure Park
New Plymouth

STAND ALONE POWER SYSTEMS: DESIGN & INSTALLATION

Domestic fees: $1,200*
International fees: $3,500
Courses run subject to numbers

GRID CONNECTED STORAGE SYSTEMS: DESIGN & INSTALLATION

Domestic fees $600*
International fees $1,750
Courses run subject to numbers

* Applicants must supply a verified copy of either their NZ Passport or NZ Birth Certificate

For further information please contact the Programme Manager:

Jan Kivell
06 759 7065 ext 3708
jan@nziht.co.nz

Study options include:

Bachelor of Engineering Technology
(Mechanical/Civil, Level 7)

The Bachelor of Engineering Technology (BEngTech) is a three-year engineering degree, where students develop the capability to analyse and implement solutions to real-life, practical situations. It teaches students to understand and apply engineering science knowledge and provides a pathway into engineering, construction and related manufacturing industries. Students choose to major in civil or mechanical engineering. Graduates meet an industry demand for people who can actively apply engineering knowledge and integrate that knowledge into high level practical situations.

Job prospects for civil engineers
www.careers.govt.nz/jobs-database

Earn $60K-$70K a year
Engineering technicians/draughtspeople with one to four years' experience usually earn $50K-$70K per year. Senior civil engineers usually earn $120K-$180K per year.

Good job opportunities
Chances of getting a job as a civil engineer are good due to a shortage of workers.

Enrolment	info@witt.ac.nz
Fees	$7,312 (one year fulltime)
	$914 (per paper)

NZ Certificate in Infrastructure Works
(Level 2 and 3)

The purpose of this qualification is to provide the infrastructure industry with people who have relevant knowledge and skills that can be applied to a range of infrastructure works processes. It is the cornerstone qualification for those graduates wanting to move into an infrastructure career pathway. Graduates of this qualification are able to carry out infrastructure works operations safely and to a quality standard in a variety of infrastructure work contexts. This programme can be studied part-time while you work and full time.

Enrolment	info@witt.ac.nz
Fees	Fees free

Graduate Diploma in Engineering
(Highways, Level 7)

This programme is designed to give those that have engineering qualifications a chance to gain technical knowledge in highway engineering and general knowledge of applied management. The goal is to provide the technical and management skills to function at middle management level.

Enrolment	info@witt.ac.nz
Fees	$6,970 (one year fulltime)
	$871 (per paper)

NZ Diploma in Engineering
(Mechanical/Civil, Level 6)

This internationally recognised diploma gives students the knowledge and skills required of an engineering technician. You'll learn to apply theoretical and technical knowledge to practical situations and demonstrate the necessary strategies to work safely and effectively with contractors, communities, clients and authorities. Pathways include progressing to Bachelor of Engineering Technology.

Job prospects for engineering technicians
www.careers.govt.nz/jobs-database

Earn $50K-$70K a year
Engineering technicians/draughtspeople with one to four years' experience usually earn $50K-$70K per year.

Good job opportunities
Chances of getting a job as an engineering technician/draughtsperson are good due to a shortage of workers.

Enrolment	info@witt.ac.nz
Fees	$7,256

Introduction to Engineering Maths
(Level 3)

Build your mathematic skills and knowledge in an engineering context. This training scheme provides a pathway for students to meet the entry criteria for the NZ Diploma in Engineering.

Enrolment	info@witt.ac.nz
Fees	Fees free

WITT's extensive range of qualifications includes more than 60 options with study pathways that include postgraduate study and bachelor's degrees through to diplomas, certificates and micro-credentials that can be completed part-time or full-time.

Click here for further information