ENERGY EDUCATION

Mauri mahi, mauri ora

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

EVOLOCITY 2023

Teams, start your motors!

A very enthusiastic group of students, teachers and parents met on Sunday 19 March at WITT Te Pūkenga, to launch EVolocity 2023. An initial design activity using cardboard cut into panel-like shapes had everyone thinking about the real design work coming up which will include welding steel chassis, designing steering mechanisms and fitting electronic devices, batteries and motors to their electric vehicles.

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.

Getting moving!

The teams first activity was to build a mock-up of their chosen cart designs! The teams developed a design they would like to work on and discussed different ideas on how they might build it, noting that their design on the day didn't have to be their final design, but it was important to learn the process they would be using.

Computer Aided Design

Students learn CAD design skills and also cover the basics of designing parts for 3D printers. Students bring their own devices and a design to draw up in CAD that can be 3D printed.

What is EVolocity?

A nationwide, inter-school electric vehicle building competition.

What do you do in it?

Design, build, and race an electric vehicle!

Sponsored by Ara Ake,
Partnering with
WITT Te Pūkenga

Ara Ake
Future Energy Development

EVOLOCITY

WITT Te Pūkenga partners to build a better renewable future.

WITT Te Pūkenga was a key sponsor of the recent Offshore Renewable Energy Forum 2023, held in New Plymouth in early March.

Over 200 people attended the conference (in-person and online) which had international representation as well as a wealth of experienced speakers from Aotearoa New Zealand.

The Offshore Renewable Energy Forum 2023 was the third annual event focused on the development of the offshore energy industry. The first forum in 2021 introduced the concept of offshore wind, and the second forum introduced the key players (wind, wave, tidal, storage) and future opportunities for the industry. The 2023 forum focused on understanding what barriers remain and how these can be overcome, as well as ensuring the greatest possible benefit for local supply chains and service providers.

Te Aorangi Dillon - Tumu Whakarae / CEO of Te Korowai o Ngāruahine Trust brought an informative session on how iwi plan to participate, encouraging early conversations and relationship building would be beneficial for everyone.

Electrical Tutor position at WITT

WITT Te Pūkenga is a tertiary education organisation based in Taranaki. We pride ourselves on our student success and quality learning environments. We're looking for an experienced electrician to teach within our trade training programmes.

This is a full-time permanent position working at our Bell Street campus.

If you can tick the following boxes we'd love to hear from you:

- A full EWRB Registered Electrician
- Domestic and Industrial experience
- Passionate in teaching and motivating future electricians
- Supervisory experience
- Understanding the management of health and safety
- Good knowledge of industry-related regulations and standards
- Ability to complete and verify quality control and assurance activities to ensure students can deliver a quality result
- Demonstrated ability to communicate effectively with a diverse group of people

Previous academic experience would be an advantage but it is not required. We will fully support you if you don't have any prior teaching experience.

For the key responsibilities of the role, please view the role description.

We we can offer:

We're committed to the development of our people, providing excellent professional development opportunities, teacher coaching, a supportive work environment and wellness benefits. You'll also get the chance to make a difference in people's lives through education.

New to the Taranaki region?

People say they love living in Taranaki because it's a place where you can live a truly balanced lifestyle. From the natural landscape and coastline to the thriving arts, culture and food scene, Taranaki is a great place to call home.

Want to know more?

If this opportunity sounds like you, please apply via Seek. Applications for this position close on 21 April 2023.

What people said about the forum

General feedback

"I had a fantastic time and the energy in the room was great. Very professional and I really loved that you brought in Māori leaders from the region.

I really enjoyed the skills development conversations panel and that you brought in presenters from a variety of industry types and professions all working towards similar goals.

Well done to all involved in coordination and organizing the event. Thanks so much again."

Useful connections

"I met two additional offshore wind developers looking to do business in the region."

"I met the local Iwi representatives and discussed how we can improve outcomes for Māori in the region."

"Very valuable opportunity to make new connections, and re-engage other connections."

"The beauty of these forums is the concentration of industry professionals."

Things we'll look to focus more on for future events:

"Offshore renewable energy is an NZ-Inc opportunity (with Taranaki as the lead region) and this forum could be taking the opportunity to position national focus and discussions."

"Having a University/secondary student programme - incorporating students in a separate space to provide some information about the energy sector then integrate them into the conference would be great."

Lake Onslow pumped hydro and its alternatives

It has grown from a $4 billion project to a nearly $16 billion project and it's received mixed reaction from the wider energy sector.

Why is that? Essentially, it is putting all the eggs in one big basket, and that basket is located in the bottom of the South Island, a long way from the population centres which will need the power.

On 31 March, the Government released a cabinet paper where the Minister of Energy and Resources recommended two proposals for the advancement of the NZ Battery Project.

- "Work on the option of a pumped hydro scheme at Lake Onslow (the Lake Onslow option) should progress to Phase 2a which will involve further technical design and development, policy work and decision-making. The purpose of the next phase of the project will be to prepare detailed designs and undertake policy work to further inform as to the potential operating models of such a scheme and its impact on the market.
- Further work should be done on two other options: a portfolio of other technologies (the portfolio option) that could address the dry year problem; and, subject to iwi engagement, further preliminary investigation of a potential North Island pumped hydro location at Upper Moawhango.

The first proposal is a continuation of the main focus of the project as initiated by the Minister of Energy and Resources at its inception.

Part a of the second proposal (the portfolio option) is more in keeping with the broad sentiment of the energy sector as a whole, which has also been part of the work stream of the NZ Battery Project from its inception.

The portfolio option includes alternative technologies, made up of combustion of biomass, new geothermal plant used flexibly, and interruptible hydrogen electrolysis.

The Portfolio option would retain better option value and could support staging of investment. The three technologies each operate slightly differently, so contribute to managing the dry year in different ways.

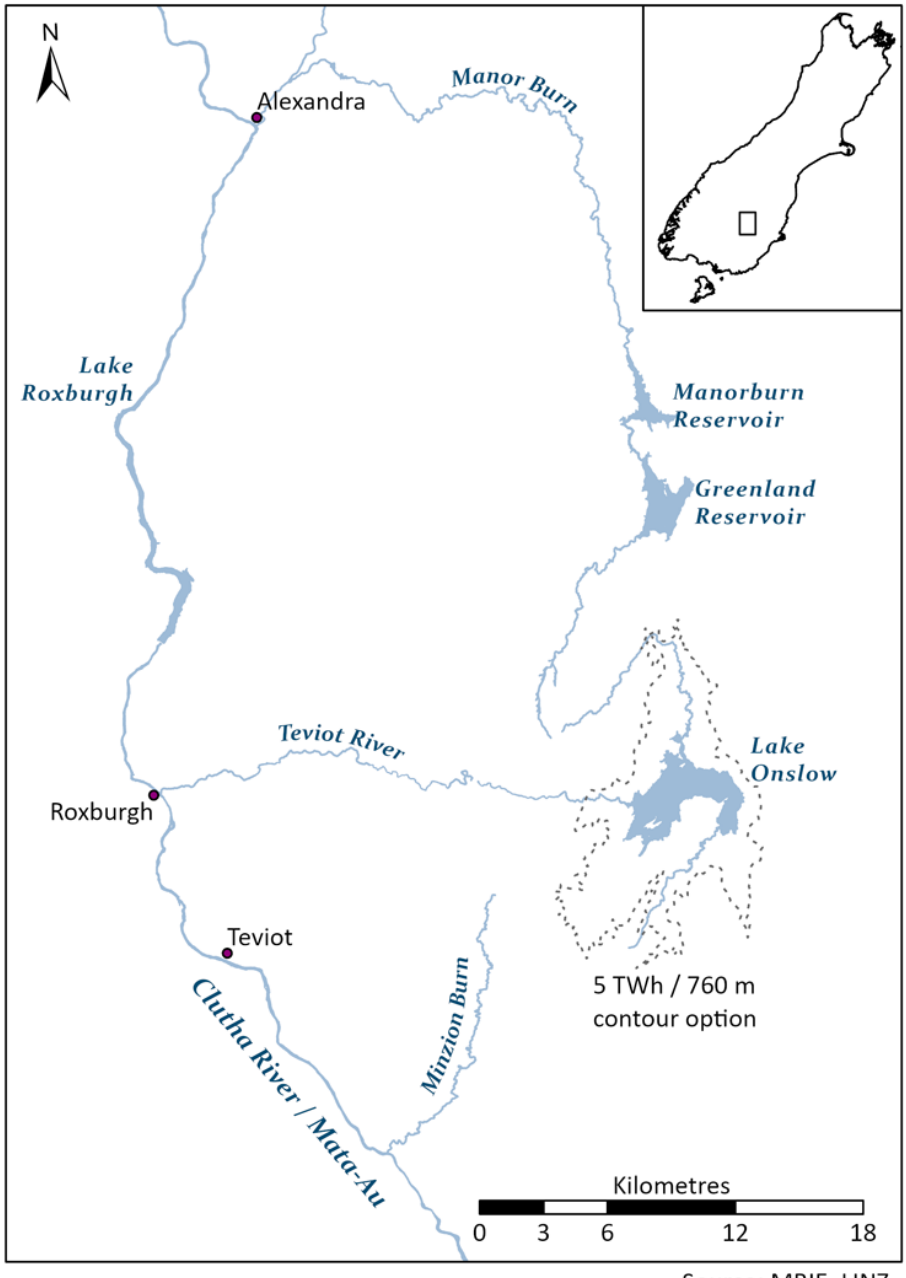
But what is pumped hydro storage?

As New Zealand transitions away from fossil fuels and increasingly relies on hydro, wind and solar, the dry year problem may expand to become a dry, calm and cloudy problem.

Pumped hydro is a solution to cover these times where intermittent energy supply is limited by low rainfall, low wind and cloud covered days.

Pumped hydro technology involves transferring water between two reservoirs at different heights. Water flows from one reservoir to the other through tunnels, passing through a power station.

When electricity demand is low or when surplus power is available, electricity is used to pump water from the lower reservoir to fill the upper reservoir. When water stored in the upper reservoir is released, it flows down the tunnels to drive turbines that generate



Source: MBIE, LINZ

hydro-electricity. Water in the upper reservoir effectively acts as a 'battery', as it can be released to generate electricity when it's needed during times of high demand or during dry years.

Facts and figures

The pumped hydro scheme at Lake Onslow is expected to provide between 3 and 8.5TWh, depending on the size of the enlarged lake. It is estimated to have a construction and commissioning time frame of between seven and nine years.

A large construction workforce would be required. It is currently estimated that up to 2,500 people would be required over the construction period, with a peak of about 1,320 workers at any one time.

This would include specialist plant operators, construction workers, site and supervising engineers, trade people, drivers and administrative staff.

These figures will be further refined, should the Lake Onslow option progress to the detailed business case. The NZ Battery Project will also investigate the needs of a large and temporary workforce and the likely impacts this will have on the community.

Services pumped hydro can provide

- Dry year storage — storing energy that can be converted to electricity during a dry year event. The NZ Battery Project was established to investigate the ability of pumped hydro to address New Zealand's dry year problem.
- Intermittency back up — hydro lakes can increase or decrease their output to offset the variation in wind or solar generation, but this capacity is limited. Pumped hydro could provide a form of back-up to ensure electricity supply and demand is met when generation from solar, wind and existing hydro are not enough.
- Fast response reserve — pumped hydro can potentially provide immediate power when there is a sudden energy shortfall in the electricity market.

Early estimated costs

Based on Phase 1 investigations, the estimated cost of the Lake Onslow pumped hydro scheme is about $15.7 billion.

The earlier stated estimate of $4 billion was developed by the Interim Climate Change Commission prior to the NZ Battery Project being set up. This figure was updated from a high-level desktop estimate in 2006.

There has been considerable design and geotechnical work completed since then, and the revised total figure includes assessment of the all-in costs for the scheme, including escalation, contingency, supporting works such as road and bridge construction and land acquisition.

The figure of $15.7 billion is the expected cost of the reference case (capable of storing about 5TWh), and remains an estimate as work on this option is continuing.

The estimate is based on an industry standard that gives 50% confidence that the final cost will be the stated value or less, in accordance with industry best practice for this stage of development. This includes risk-based contingency and escalation. The certainty of costs and schedule estimates will increase as further work is done.

Only the most immediate transmission costs are included in this figure. Early estimates for necessary transmission upgrades to support a pumped hydro scheme operating at Lake Onslow would cost an estimated $615m. This estimate is also based on the industry standard practice of a 50% confidence rating that the final cost will be this value or less, which is appropriate for this stage of the project. This includes risk-based contingency and escalation.

Not all transmission upgrade costs would be attributable and payable by the NZ Battery Project, as other loads and generators would benefit from these upgrades.

Funding and financing

If this option continues to advance to the later stage of Phase 2, the funding and financing models will be determined as part of the final investment decision.

Next steps

Minister Megan Woods recommends undertaking more work over the June quarter on both the Lake Onslow and portfolio options, with a Cabinet report to follow in July.

"Progressing the portfolio option will involve optimising the mix of technologies, and delivery models," the cabinet paper says.

"Next steps on the Lake Onslow option will involve more detailed geotechnical work, engineering design, investigations into delivery models, and environmental and sociocultural risk assessments."

The North Island pumped hydro option will also be investigated.

"Should it go ahead, further work on the Upper Moawhango option would involve, subject to iwi engagement, economic assessment and further work with the New Zealand Defence Force to understand land-use ramifications."

Source: MBIE, Energy News

Aotearoa New Zealand's changing climate is the most significant challenge to our hydro energy supply.

In New Zealand, between 80-95% of electricity is generated by renewable sources.

The majority is produced by hydro dams. Most dams are in the South Island and their electricity is transmitted to the North Island via large cables (called the High-Voltage Direct Current or HVDC).

According to the Electricity Authority, the additional water used in dams (hydro storage) is refilled by both rain and snow, with snow having a particularly strong seasonal impact on storage. Hydro lake levels typically drop during autumn and winter, as hydro generation runs hard, and rain falls as snow on the slopes of the Southern Alps. Then snow-melt flows into the hydro lakes in spring and summer.

In winter, historically there tends to be a larger volume of snow than rain, which reduces inflows into the South Island hydro-lakes (particularly the largest storage lake – Pukaki) when electricity demand is at its highest.

Snow typically accumulates at elevations above 1,000 metres. The snow then melts in late spring, filling the lakes over summer when demand is usually lower.

Because there is a wide variation of snow-melt (ranging from between 20-70%), generators need to manage lake levels in autumn to ensure there is enough stored water for the winter. When all hydro reservoirs are full, the stored energy amounts to approximately five weeks of electricity generation over winter which equates to approximately 14,000 GWh. This makes managing hydro storage critical to the electricity sector.

The outlook for summer 22/23 was for La Niña conditions, similar to the previous two summers. During La Niña, New Zealand tends to experience warm and wet conditions in the North and dry conditions in the South.

In November 2022 NIWA forecast that "New Zealand's risk for ex-tropical cyclone activity is normal-to-elevated through April. These systems can cause flooding rainfall, strong winds, and coastal hazards."

NIWA's forecasting was accurate with ex-tropical Cyclone Hale, and Cyclone Gabrielle bringing tremendous flooding, winds and coastal erosion.

Glacier change

The most recent glacier ice volume estimates for New Zealand come from Macara and Willsman (2021), who estimate that glacier volume between 1978 and 2020 decreased from 53.3 km3 to 34.6 km3 (a loss of 35%).

Using state-of-the-art remote sensing data from satellites, Hugonnet et al. reported in 2021 on a record thinning rate of 1.52 ± 0.50 m per year in 2015–2019 for glaciers in the Southern Alps, which is a nearly seven-fold increase compared to 2000–2004.

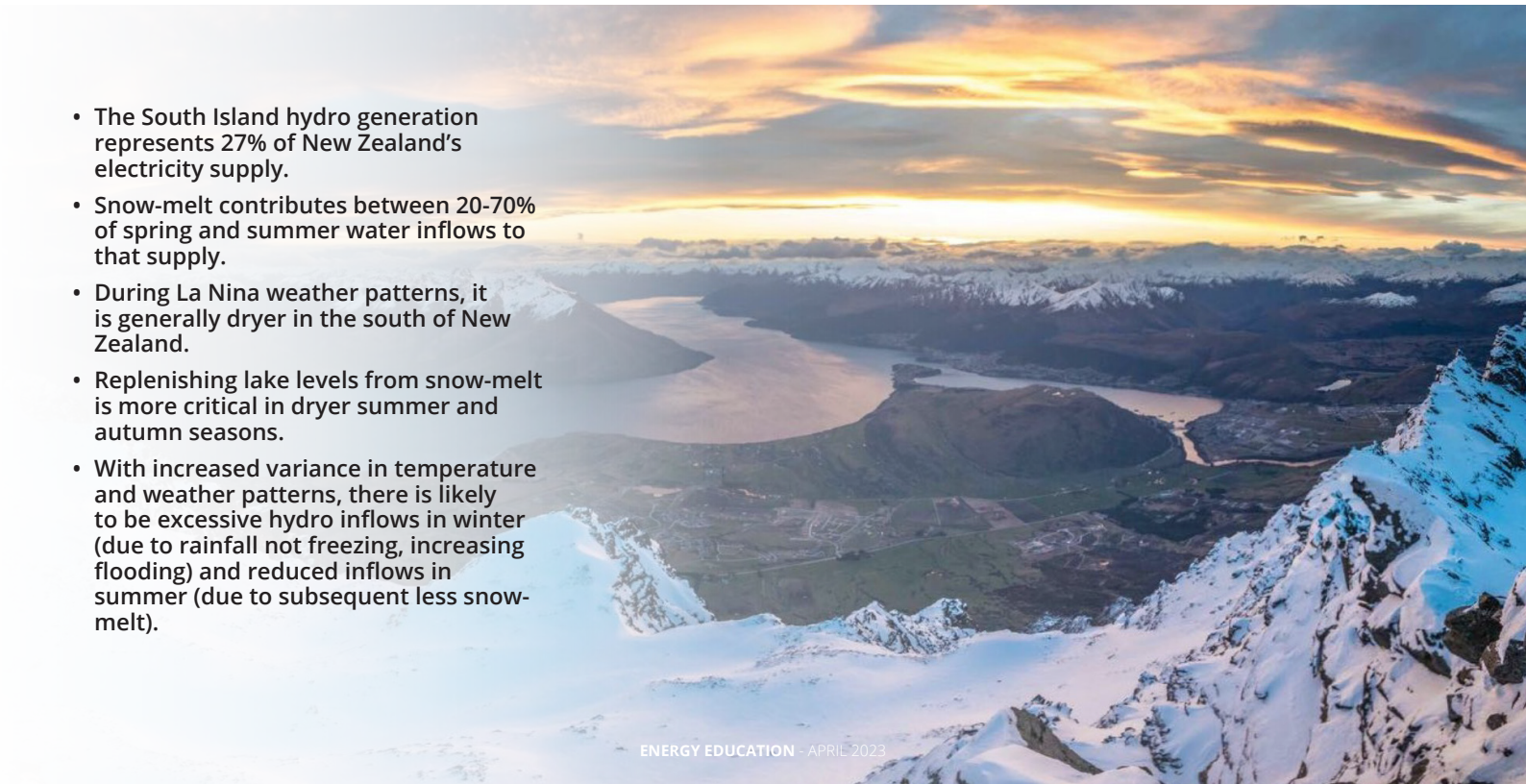
It is stated in the United Nation's AR6 report that snow cover and depth have decreased and are projected to decrease further in New Zealand. The basis of this statement comes from the estimate of snow days reported by the Ministry for the Environment (2018), which is calculated by counting precipitation days where mean air temperature is below the freezing point.

Seven of the past nine years have been among New Zealand's warmest on record. Glacier melt has seen a seven-fold increase in the last 20 years (2015-19 compared to 2000-04)

Heating from warm air and increased long wave radiation from atmospheric moisture and low clouds are responsible for driving extreme melt events.

(Gillett and Cullen, 2011; Conway and Cullen, 2016).

- **The South Island hydro generation represents 27% of New Zealand's electricity supply.**
- **Snow-melt contributes between 20-70% of spring and summer water inflows to that supply.**
- **During La Nina weather patterns, it is generally dryer in the south of New Zealand.**
- **Replenishing lake levels from snow-melt is more critical in dryer summer and autumn seasons.**
- **With increased variance in temperature and weather patterns, there is likely to be excessive hydro inflows in winter (due to rainfall not freezing, increasing flooding) and reduced inflows in summer (due to subsequent less snow-melt).**



Coal capacity climbing worldwide

Increase comes despite vows to slash fossil fuel use

Coal is the biggest source of planet-warming gases in the atmosphere.

The capacity to burn coal for power went up in 2022 despite global promises to phase down the fuel that's the biggest source of planet-warming gases in the atmosphere.

The coal fleet grew by 19.5 gigawatts last year, enough to light up around 15 million homes, with nearly all newly commissioned coal projects in China, according to a report by Global Energy Monitor, an organization that tracks a variety of energy projects around the globe. That 1 percent increase comes at a time when the world needs to retire its coal fleet four and a half times faster to meet climate goals, the report said. In 2021, countries around the world promised to phase down the use of coal to help achieve the goal to limit warming to 1.5 degrees Celsius.

"The more new coal projects come online, the steeper the cuts and commitments need to be in the future," said Flora Champenois, the report's lead author and the project manager for GEM's Global Coal Plant Tracker.

New coal plants were added in 14 countries and eight countries announced new coal projects. China, India, Indonesia, Turkey, and Zimbabwe were the only countries that both added new coal plants and announced new projects. China accounted for 92 percent of all new coal project announcements.

With nearly 2,500 plants around the world, coal accounts for about a third of the total amount of energy installation globally.

Other fossil fuels, nuclear energy, and renewable energy make up the rest.

China added 26.8 gigawatts and India added about 3.5 gigawatts of new coal power capacity to their electricity grids. China also gave clearance for nearly 100 gigawatts of new coal power projects with construction likely to begin this year.

But "the long term trajectory is still towards clean energy," said Shantanu Srivastava, an energy analyst with the Institute for Energy Economics and Financial Analysis who is based in New Delhi. Srivastava said the pandemic and the war in Ukraine temporarily drove some nations toward fossil fuels.

In Europe, where the Russian invasion of Ukraine meant a scramble for alternative energy sources and droughts stifled hydropower, the continent only saw a very minor increase in coal use.

Others went the other way. There were significant shutdowns in the United States, where 13.5 gigawatts of coal power was retired. It's one of 17 countries that closed up plants in the past year.

To meet climate goals set in the 2015 Paris Agreement, coal plants in rich countries need to be retired by 2030 and coal plants in developing countries need to be shut down by 2040, according to the International Energy Agency. That means around 117 gigawatts of coal needs to be retired every year, but only 26 gigawatts was retired in 2022.

"At this rate, the transition away from existing and new coal isn't happening fast enough to avoid climate chaos," said Champenois.

Source: The Boston Globe7 Apr 2023

Genesis Energy look to replace coal with biomass at the Huntly Power Station

Genesis Energy has successfully completed a biomass burn trial as it looks at alternative fuel options for Huntly Power Station.

The objective of the week-long trial was to prove the technical viability of operating a Rankine unit solely on biomass. That was achieved with a Rankine running only on biomass for several hours. It followed significant research and work over the past year to identify the most suitable type of biomass to use, securing a supply of it from offshore, understanding the adjustments needed to operate the Rankine and putting in place robust health and safety guidelines.

International experts involved in converting coal-fuelled power stations to biomass assisted the Genesis team.

Interim Chief Executive, Tracey Hickman, said the trial is important for Genesis and the country given Huntly was built to provide vital back-up to New Zealand's highly renewable electricity generation.

"We see Huntly's back-up role continuing for some time and it's important we explore more sustainable and cost-effective alternatives to coal, especially if we're able to adapt existing plant that can be used to 2035 and extended to 2040. It makes sense for the country in terms of reducing emissions, security of supply and financially," Hickman said.

"Eventually, new technology or an over-supply of new renewable generation might be able to provide security of supply, but that is some time away and not yet certain."

Biomass is increasingly being used offshore as an alternative to coal. It can deliver a similar amount of energy and can be stored outside. Genesis will analyse the findings from the trial over coming months, including the critical issue of exploring the viability of a local and sustainable supply chain.

There is currently no local source of the type of pellets needed for Huntly and Genesis will talk with businesses in a similar position that might provide the scale to support a reliable local supply chain.

"The trial has provided an opportunity to show other businesses what we've done, what we've learnt and to hear from international experts experienced in helping businesses move from coal to biomass," Hickman said.

Source: Genesis Energy

The Huntly Power Station is the largest thermal power station in New Zealand and is located in the town of Huntly in the Waikato. It is operated by Genesis Energy Limited, a publicly listed company (currently 51% owned by the NZ Government). [1] The station has five operational generating units – three 250 MW coal-and-gas-fired steam turbine units, a 50 MW gas peaking plant, and a 403 MW combined cycle gas turbine plant. The station also plays an important role in voltage support for the Northland, Auckland and Waikato region.

Growing an Energy Centre of Vocational Excellence

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.
- Address issues and opportunities with a significant strategic impact, ideally with wide-reaching benefits across the sector.
- Solve real problems and grasp viable opportunities.

What are biomass pellets?

The advantage of using biomass in the form of a pellet is its energy density. This refers to the amount of energy that can be stored in a given amount of a material.

On their own the wood and residues like wood chips and sawdust that make up biomass do not have a high energy density. A kilogram of wood, for example, stores little energy, compared to fuels like coal or diesel. However, by compressing forest industry residues into a pellet, biomass becomes significantly more energy dense. Wood pellets can also have very low moisture content, giving them a high combustion efficiency – an important feature in power generation.

The wood is chipped, screened for quality, heated to reduce its moisture content to below 12% and then converted into a fine powder. This is then pressed through a grate at high pressure to form the solid, short, dense biomass pellet.

Biomass pellets can be used to generate power in a similar way to coal, allowing existing coal power stations. A conveyor system takes pellets from storage through to pulverising mills, where they are crushed into a fine powder that is then blown into the power station's boiler.

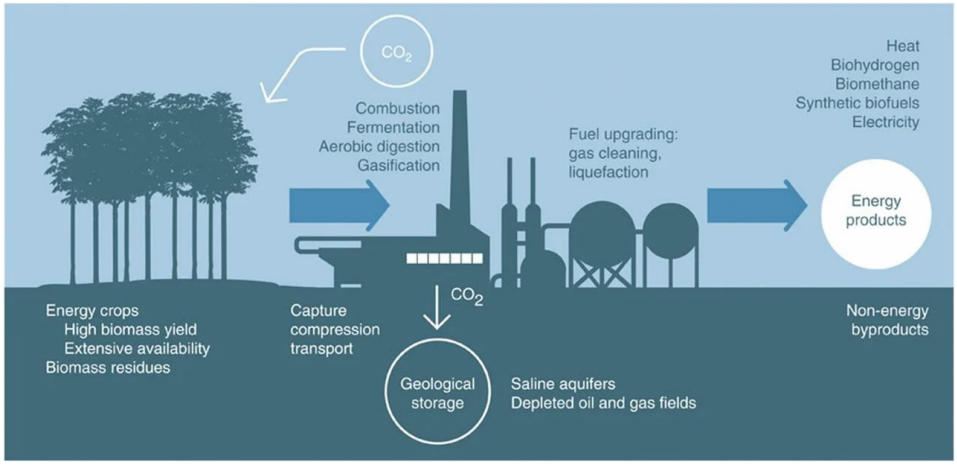
Bioenergy with carbon capture and storage (BECCS)

The concept of BECCS is growing biomass for energy purposes. As it grows, the biomass absorbs atmospheric CO_2 through photosynthesis. The biomass is then processed into a fuel form, often pellets. As the fuel combusts, the carbon it is made of forms biogenic CO_2. Biogenic CO_2 is typically counted as a net-zero emission in most Greenhouse Gas accounting schemes.

The New Zealand Government's publication 'Measuring Emissions: A Guide for Organisations', states that "The carbon dioxide emitted from the combustion of biofuels and biomass (including wood) is biogenic, meaning it equates to the carbon dioxide absorbed by the feedstock during its lifespan. This means we treat the carbon dioxide portion of the combustion emissions of biofuels as carbon neutral."

The IPCC states that "Bioenergy has significant potential to mitigate GHGs if resources are sustainably developed, and efficient technologies are applied. Certain current systems and key future options including perennial crops, forest products and biomass residues and wastes, and advanced conversion technologies, can deliver significant GHG mitigation performance - an 80 to 90% reduction compared to the fossil energy baseline."

Source: Ara Ake report on Carbon Dioxide Removal



First blended fuel (Diesel-Hydrogen) truck in Australasia

Australasia's first dual fuel (diesel-hydrogen) truck is up and running in Invercargill.

The project is led by the HW Richardson Group's Gareth Wishart (left) and his team at HWR Hydrogen.

HW Richardson Group has been working to develop dual-fuel hydrogen prototypes for the last year and as part of George Begg Festival — they commissioned their first dual-fuel truck — with another 10 diesel trucks to be converted over the next couple of months. HWR chief executive Antony Jones said, "We are really excited. It is just an amazing day to see something that we committed to 14 months ago, here, now — making a big difference in heavy vehicles emissions."

Source : https://www.hwr.co.nz/about-hwr

WITT is part of Te Pūkenga - New Zealand Institute of Skills and Technology, together with all the other polytechnics in Aotearoa New Zealand. All WITT learners are enrolled with Te Pūkenga.

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 TE PŪ AO

Ara Ake Future Energy Development

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.

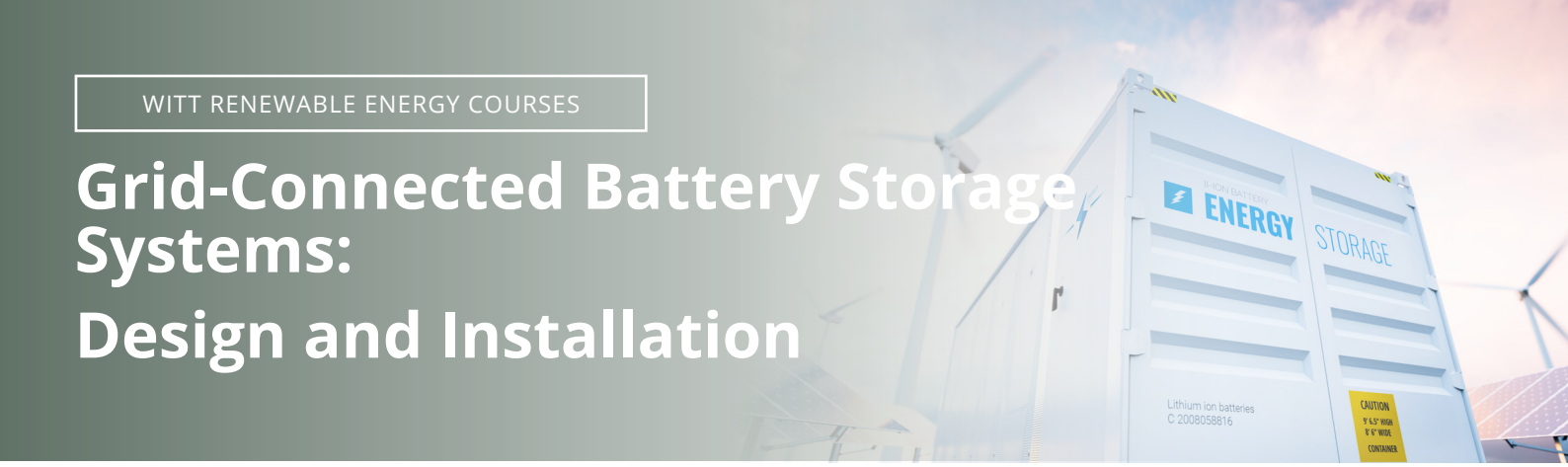
Led by Tim Francis

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 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 engineering and connect your career to energy, structures, manufacturing, buildings, machinery, roads, products and more.

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 full-time)
$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