

ENERGY EDUCATION

Mauri mahi, mauri ora

ENERGY NEWS FROM THE REGION, COUNTRY AND WORLD | FEBRUARY 2022

WITT NEWS

Studying Engineering at WITT

"Taking the EE2E [Engineering education-to-employment] course in my last year at high school truly reinforced that I wanted to study engineering.

I chose to study the Bachelor of Engineering Technology (Civil), as I have always loved to problem solve and take on new challenges. I hope in the future to develop my creative side of Civil Engineering, by planning out designs to build structures!

I have been enjoying my time at WITT so far, as all the tutors and students are super friendly and have already given me so much support! I look forward to graduating after three years and working in the Taranaki engineering industry, to hopefully give back within the community."



Nikita Greiner, Civil Engineering

WITT offers diplomas and degrees in Engineering at their New Plymouth campus in Taranaki.

Currently on offer is the New Zealand Diploma in Engineering – Mechanical or Civil, which pathway very nicely into the Bachelor of Engineering Technology – Mechanical or Civil. Students can study in part time or fulltime format and WITT can assess prior knowledge and/or experience to advise which will be the best path forward. You can also choose to enter the diploma or degree directly.

Solar Energy Course in 2022.

The first renewable energy course being delivered will be 'Grid Connected PV Systems – Design and Install.' We are currently awaiting the delivery of resources to commence this training. Contact us for more information and we will add you to registration list for the first course. **For enquiries call 0800 948 869.**



ENERGY EDUCATION

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AgriPV opportunities for Aotearoa New Zealand

Sustainable Energy Systems, Victoria University of Wellington



New Zealand is seeing an increased uptake of solar photovoltaic (PV) systems at various scales, and the potential of niche PV applications is receiving more attention.

In regions with a productive agricultural sector, for example, the land value tends to be higher, or in some regions the land holds intrinsic cultural value. This land value makes the development of conventional, ground-mounted solar installations more complicated, even when a good solar resource is available.

AgriPV, or agrivoltaic, systems are subsequently receiving much attention globally as a potentially viable alternative to conventional installations, both at large, utility-scale, or for on-farm and community energy provision. Conceptually it means the combination of agricultural production with energy generation from solar PV over the same land area, with potential benefits for both economic activities.

Grazing has little risk to the installed solar infrastructure.

Global experience shows that various crop and pastoral production practices can be tailored for dual land usage and can, indeed, benefit from agriPV systems. For appropriate horticulture crop – berries, potatoes, tomatoes, lettuce, carrots, broccoli, and others – the potential benefits of agriPV are the creation of cooler conditions during the day and warmer conditions at night, thereby reducing heat stress and frost damage, and increasing soil moisture levels in dry periods due to the micrometeorology under the panels. For pastoral production the appropriateness of

agriPV is abundantly clear.

Grazing has little risk to the installed solar infrastructure, with many benefits from a farming perspective; for example, increased health and wellbeing of the animals due to protection from the elements, less water consumption of the animals, and access to pasture during dry conditions.

A further consideration is the impact of climate change on the agriculture sector, and the required adaptation. The impacts may accentuate the benefits of agriPV systems going forward, and its appropriateness for different crop and pastoral production.

Advancements in PV technology also means more suitable energy generation configurations. Special monocrystalline solar panels, with different levels of transparency, may be suitable depending on the targeted crop. Using specialised materials means that the panels can be customised to absorb certain wave lengths of the spectrum, passing the appropriate light through to the crops. This can be advantageous in the case where certain crops see an efficiency increase under certain light wavelengths. Efficiency rates of such specially designed panels are reported to be in line with standard modules, and offer additional benefits, such as less irrigation requirements. Cost is currently an issue, but for larger projects, and with wider adoption, prices are expected to reduce drastically.

Bifacial PV's

Bifacial PV panels, which are PV modules that can produce power from both the front and back of the

module, are also becoming standard for many agriPV applications.

Bifacial PV modules have a greater power density per unit when compared to monofacial PV modules and also have the advantage of reduced sensitivity to temperature change. The concept of vertically mounting the bifacial PV modules for agriPV applications has been compared to traditional fixed tilt monofacial PV modules with comparable energy output – in low density PV arrays. This has the advantage of minimum land coverage and the potential to mount panels closer to the ground, and between higher plant growth, such as fruit trees or grape vines.

Another route is to use tracking more effectively to improve the efficiency of electricity generation, and specialised trackers have been developed that are tailored for agriPV systems. The required increase in spacing between PV modules, to minimise shading of the modules, also means light penetration for crop production below the panels.

Regardless of the chosen PV technology configuration, optimisation techniques are required to maximise yields – of electricity and, especially, crop production. The optimisation of agriPV systems, however, will require more information about the behaviours of crops, and animals, with different PV technology configurations in various climatic conditions.

New Zealand researchers and industry are collaborating to investigate the opportunities with a number of test and demonstration sites envisaged across the country.

Interested stakeholders are welcome to reach out to [Alan Brent](#) at [Victoria University of Wellington](#).



Professor Alan Brent - Professor of Sustainable Energy Systems School of Engineering and Computer Science

Zero Emission Flight

Tackling the hydrogen challenge



Airbus have the ambition to develop the world's first zero-emission commercial aircraft by 2035. Airbus say hydrogen propulsion will help them deliver on this ambition. Their ZEROe concept aircraft enables them to explore a variety of configurations and hydrogen technologies that will shape the development of future zero-emission aircraft.

Hydrogen is critical to Airbus' aim of developing the world's first zero-emission commercial aircraft by 2035. This will require an innovative approach to fuel storage. Airbus is now designing cutting-edge liquid hydrogen tanks to facilitate a new era of sustainable aviation.

Hydrogen is one of the most promising technologies to reduce aviation's climate impact. When generated from renewable energy sources, it emits zero CO₂. Significantly, it delivers approximately three times the energy per unit mass of conventional jet fuel and more than 100 times that of lithium-ion batteries. This makes it well suited to powering aircraft.

However, storing hydrogen on-board an aircraft poses several challenges. Hydrogen may provide more energy by mass than kerosene fuel, but it delivers less energy by volume. At normal atmospheric pressure and ambient temperature, you would need approximately 3,000 litres of gaseous hydrogen to achieve the same amount of energy as one litre of kerosene fuel.

Clearly this is not feasible for aviation. One alternative would be to pressurise the hydrogen at 700 bars – an approach used in the automotive sector. In our example, this would slash the 3,000 litres to just six.

This may represent a huge improvement, but weight and volume are critical for aircraft. To go further still, we can dial down the temperature to -253°C. That's when hydrogen transforms itself from a gas to a liquid, increasing its energy density even more. Returning to our example, four litres of liquid hydrogen would be the equivalent of one litre of standard jet fuel.

<https://www.airbus.com/en/innovation/zero-emission>

Technology advancements key to reducing aviation emissions

International Energy Agency

Global air passenger numbers tripled in just over 20 years, until the Covid-19 crisis resulted in an unprecedented collapse in global air travel. Air traffic contracted more than 75% between April and May 2020, and global passenger volumes were nearly two-thirds lower in 2020 than in 2019.

After increasing rapidly over the past two decades, CO₂ emissions from aviation fell by one-third from the 2019 level in the wake of the pandemic to just over 600 Mt in 2020 – the lowest level since 1997. Despite this unprecedented collapse, passenger numbers and cargo volumes are set to rise in the coming decades. In the past, energy intensity reductions have been insufficient to counterbalance such activity growth.

In the last 60 years, the fleetwide carbon intensity of commercial passenger aircraft has dropped more than 70% per available seat-km. Continuous engine and airframe improvements have made today's new aircraft ~85% more efficient than the early jet planes that entered into service in the 1960s, and ~20% more efficient than the models they are replacing.

However, a range of operational, technical and behavioural solutions will be required to cut emissions from 2025 onwards, to reduce them to just over 780 MtCO₂ by 2030 and around 470 MtCO₂ by 2040 in line with the Net Zero Emissions pathway.

<https://www.iea.org/reports/aviation>

Air New Zealand and the NZ Government ask industry to propose a plan to bring Sustainable Aviation Fuel to market

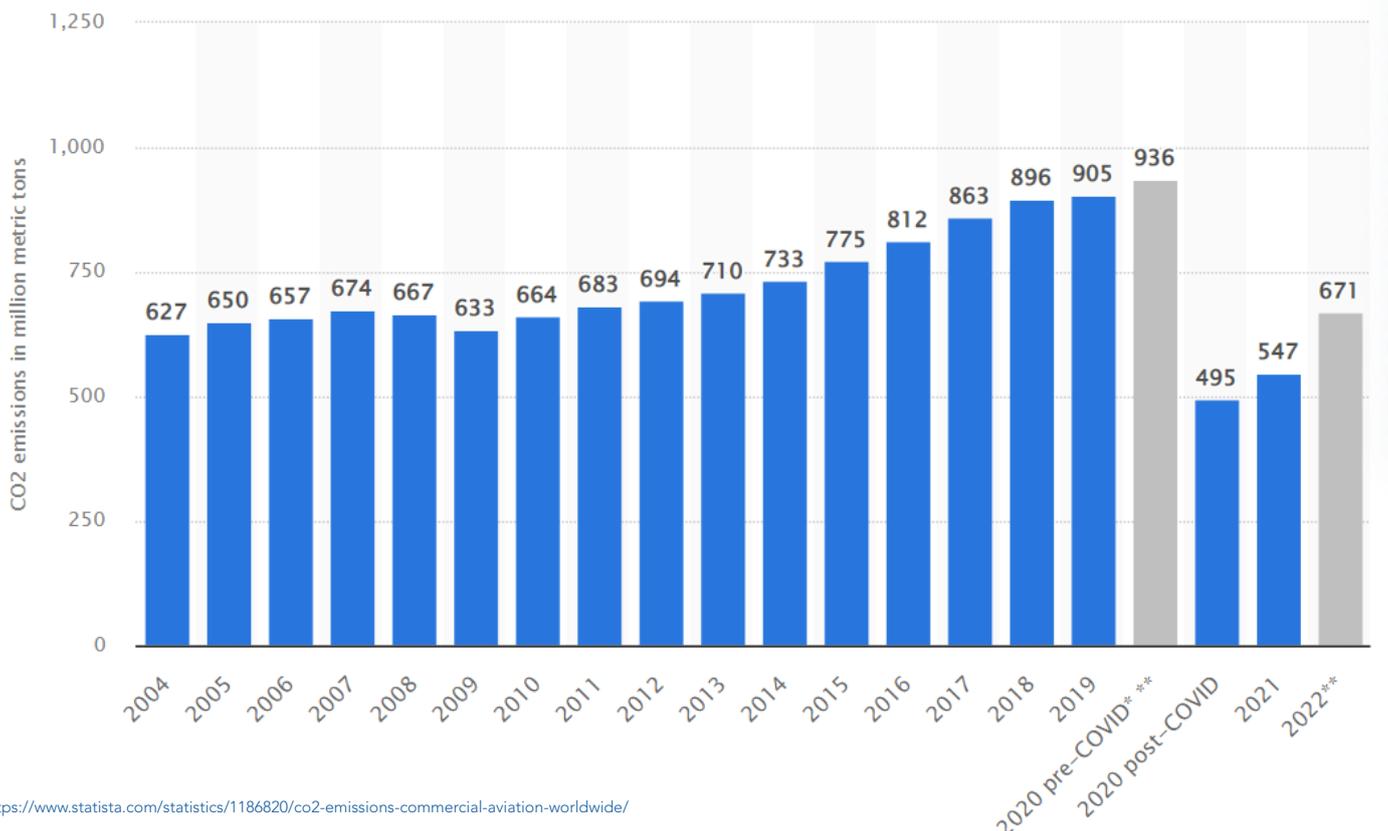
Air New Zealand and MBIE have signed a Memorandum of Understanding to run a closed Request for Proposal (RFP) process that invites leaders in innovation to demonstrate the feasibility of operating a SAF plant at a commercial scale in New Zealand.

SAF is a fuel made from waste materials such as used cooking oils, landfill waste, or forestry and agricultural residues. It has the potential to reduce carbon emissions by more than 80 percent compared with traditional jet fuel. However, there is a shortage - currently less than 1% of aviation fuel supplied in the world is SAF.

The New Zealand Government currently owns 52% of Air New Zealand ordinary shares.

Carbon dioxide emissions from Aviation

From 2004 to 2022 in million metric tonnes



<https://www.statista.com/statistics/1186820/co2-emissions-commercial-aviation-worldwide/>

Lanzatech utilising waste CO₂ to produce sustainable aviation fuel

Two of aviation's biggest names recently unveiled what they believed to be a "landmark step" towards the future of the industry with the development of a commercial yet sustainable fuel when Virgin Atlantic, in collaboration with Boeing, flew a 747 from Orlando to London Gatwick – powered by a tank of LanzaTech 'advanced' jet fuel.

The special propellant was created by Lanza Tech using recycled waste gases produced as a by-product of industrial processes — such as the those found in steel manufacturing – to make ethanol. This ethanol can then be used for a range of low carbon products, including jet fuel. The innovative alcohol-to-jet process used to make the fuel was developed in collaboration with Pacific Northwest National Lab and the US Department of Energy.

Sir Richard Branson, founder of Virgin Group said: "Long haul travel is more important than ever for connecting people around the world and it's our responsibility to ensure we're doing that in the most sustainable way possible. Working with LanzaTech will enable us to greatly reduce our



Sir Richard Branson, founder of Virgin Group

carbon emissions and at the same time, help support UK industry."

Branson went on to say: "That's why we're excited to showcase this fuel on its first commercial flight as we have plans for the world's first full-scale jet fuel plant using this amazing new technology. The LanzaTech process is important because this fuel takes waste, carbon-rich gases from industrial factories and gives them a second life – so that new fossil fuels don't have to be taken out of the ground. This flight is a

huge step forward in making this new technology a mainstream reality."

Jennifer Holmgren, CEO at LanzaTech commented: "Today, with our carbon smart partner, Virgin Atlantic, we have shown that recycling waste carbon emissions into jet fuel is not impossible, that waste carbon needs to be thought of as an opportunity, not a liability, that carbon can be reused over and over again.

<https://www.traveldaily.com/virgin-and-boeing-join-forces-with-lanzatech-to-create-the-carbon-future-we-need/>

All Nippon Airways (ANA) Boeing 777-300ER powered by LanzaTech biofuel

All Nippon Airways (ANA), Japan's largest 5-Star airline for seven consecutive years, recently received its latest passenger aircraft from the United States (US) via a delivery flight that was conducted using a blend of jet fuel and sustainable aviation fuel (SAF).

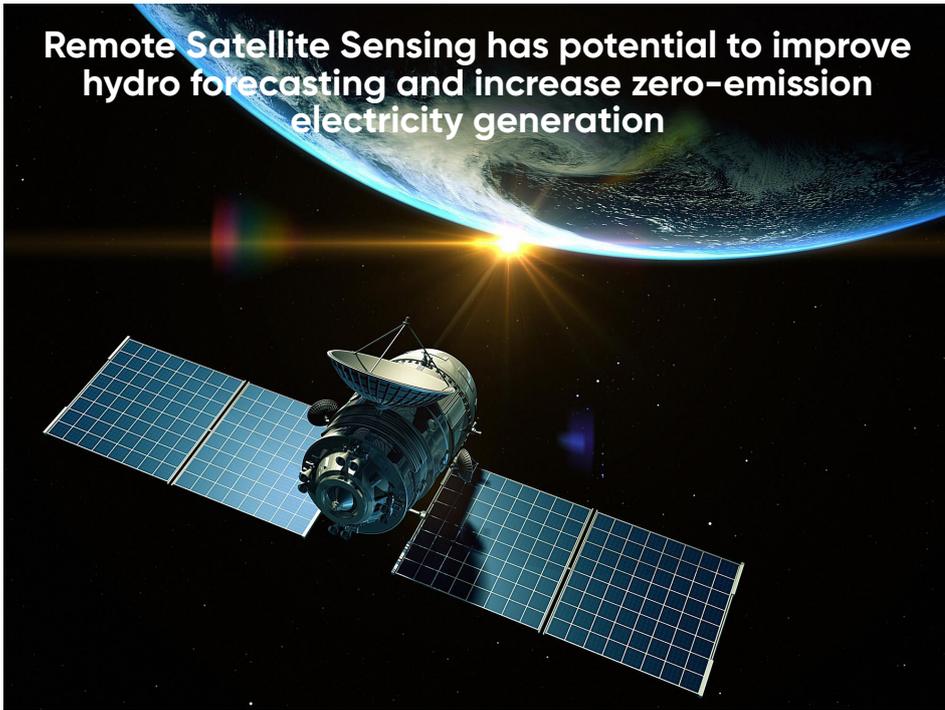
The brand new Boeing 777-300ER was flown from Boeing's facility in Everett, Washington to Japan, utilizing SAF made from LanzaTech's waste gas derived ethanol.

Who are Lanzatech?

Lanzatech were founded in 2005 with NZ angel investment money and NZ government grants, and established pilot plant at the Glenbrook Steel Mill south of Auckland, where it took waste carbon from places like the gases from steel mill chimneys and converted it into fuels and green chemicals.

They are now headquartered in Chicago, where LanzaTech continues to turn waste gas from steel mills into ethanol and other high value fuels and chemicals.

LanzaTech's carbon recycling technology is like retrofitting a brewery onto an emission source like a steel mill or a landfill site, but instead of using sugars and yeast to make beer, pollution is converted by bacteria to fuels and chemicals! Imagine a day when your plane is powered by recycled GHG emissions, when your shampoo bottle started life as emissions from a steel mill. LanzaTech say this future is possible today using their technology.



Remote Satellite Sensing has potential to improve hydro forecasting and increase zero-emission electricity generation

Ara Ake (the national new energy development centre) has partnered with South Island hydro generators and international start-up, WeGaw, to do a collaborative research project in New Zealand which may increase the generation capacity of those generator.

South Island hydro generators Contact Energy, Meridian Energy and Genesis Energy have agreed to be involved in a collaborative research project, with the aim of improving water management and forecasting in their South Island snow-fed catchments.

This opportunity has been made possible through Ara Ake's partnership with Switzerland-based WeGaw, a start-up company that uses artificial intelligence and machine

learning to build highly predictive models from snow and water data acquired through satellite remote sensing.

Ara Ake Chief Executive, Dr. Cristiano Marantes, is looking forward to seeing WeGaw's technology being implemented in a New Zealand setting.

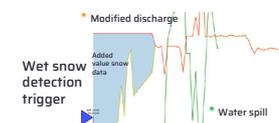
"Connecting our national electricity generators with WeGaw's AI technology is an exciting opportunity for generators to add value to their forecasting and ultimately play a role in the nation's low-emissions future".

WeGaw say their forecasting can create an up to 10% energy production increase with an up to 30% reduction of water spill. For seasonal water forecast, their technology enables a reduction in error by 20 to 40% says Wegaw.

Some benefits of the Wegaw system of forecasting

Short term discharge detection

Using Wegaw SCE and snow wetness monitoring, we can help hydropower companies improve **time to snow melt-based discharge detection up to 4 days** before, depending on catchment area, dam location and basin slopes.

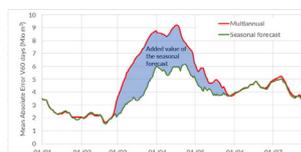


10% Energy increase
30% Water Spill reduction

With this early snow detection technique based on wet snow monitoring we help improve 10% energy production per season.

Seasonal Forecast error reduction

Snow Water Equivalent measurement improvement through Wegaw Snow Depth product. Reducing the error by 20% - 40% compared to multiannual average water discharge.



30% Error Reduction
5% price improvement

By using SD information for SWE-based discharge adjustment, we help reduce the relative forecasting error by up to 40%.

Energy Innovation Fund Navigator

Ara Ake
Future Energy Development

Click [here](#) to access Ara Ake's Energy Innovation Fund Navigator

www.araake.co.nz

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The official website of the New Zealand Government

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Kaitiaki Takekiriaki

MARKETS - EVIDENCE AND INSIGHTS BRANCH

ENERGY IN NEW ZEALAND

21

2020 CALENDAR YEAR
Comprehensive information on and analysis of New Zealand's energy supply, demand and prices



Europeans want more renewable energy.

An immense 88% of people said they wanted renewable energy to be a larger share of European GDP. Almost half of Europeans believe climate change is the next global challenge, while 88% think renewable energy should be a larger part of the economy. A poll, commissioned by the European Parliament and Commission jointly, asked 26,530 people across all 27 EU states about issues, from citizenship to renewable energy.

<https://www.openaccessgovernment.org/europeans-renewable-energy/128309/>

US Researchers develop stable sodium battery technology

Funded by the U.S National Science Foundation, scientists have developed a more environmentally and socially conscious substance for batteries. By replacing the lithium and cobalt in lithium-ion batteries, researchers at the University of Texas at Austin have created a stable battery that recharges as fast as a traditional lithium-ion battery. This technology has the potential for a higher energy output than current battery technologies. In order to work, the ions in batteries must travel between the negative charge anode and positive charge cathode while generating electricity. In previously used sodium-based batteries, the anodes can develop something known as dendrites. Lithium dendrites are formed when extra lithium ions accumulate on the anode surface and cannot be absorbed into the anode in time. They can cause short circuits and lead to catastrophic failures and even fires or explosions. This new sodium-based technology resists dendrite growth and recharges as fast as a lithium-ion battery.

<https://www.openaccessgovernment.org/sodium-based-batteries/127248/>

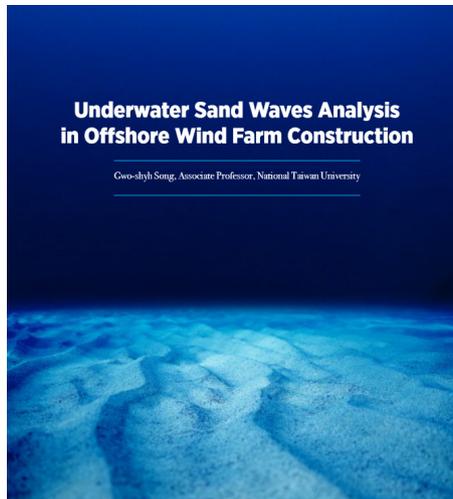
Study finds plant-based jet fuel could reduce emissions by 68%

According to a US-based study, a non-edible crop can create plant-based jet fuel that can significantly reduce the carbon footprint of flying. The study, published in GCB Bioenergy, finds that sustainable aviation fuel (SAF) can be created

from *Brassica carinata* – a crop. Puneet Dwivedi, associate professor in the Warnell School of Forestry and Natural Resources, said: “If we can secure feedstock supply and provide suitable economic incentives along the supply chain, we could potentially produce *carinata*-based SAF in the southern United States. *Carinata*-based SAF could help reduce the carbon footprint of the aviation sector while creating economic opportunities and improving the flow of ecosystem services across the southern region. In September, President Joe Biden proposed a sustainable fuel tax credit as part of the Sustainable Aviation Fuel Grand Challenge, which brings federal agencies together to scale up the production of SAF nationwide. President Biden set the goal of a 20% drop in aviation emissions by 2030 and achieving a fully zero-carbon aviation sector by 2050.

<https://www.openaccessgovernment.org/plant-based-jet-fuel/122559/>

Underwater sand waves analysis in offshore wind farm construction (Taiwan)



Underwater Sand Waves Analysis in Offshore Wind Farm Construction

Geo-shyh Song, Associate Professor, National Taiwan University

When wind farms are creating their infrastructures offshore, they need a route in which to lay their cables. This enables necessary energy to be transported back to the mainland, amongst other essential uses. Scientists have to first map the ocean floor, to understand where to put cables that will not challenge local biodiversity or be impacted by the sand wave migration of the seafloor. The team used a multi-beam sonar method, to carry out an in-situ investigation of the area. The resultant bathymetry data was

correlated with earlier survey results. The researchers here found several fascinating differences about how the seafloor moves, both to the South and North of their wind farm. Some of these waves move as fast as 30cm per day, creating an interesting situation in the South. The data they extracted is highly useful for any institution considering working with offshore energy. They explored a water depth of less than 50 metres in order to map the migration of sand waves.

<https://www.openaccessgovernment.org/sand-waves-analysis/83820/>

Piloting green shipping corridors: Australia-Japan and Asia-Europe

The shipping industry is diverse, disaggregated and part of the logistical chain of 80% of global trade. So reducing its emissions (3% of the global total) will be complex. One way to cut through this complexity is to create a limited number of green shipping corridors between major port hubs, to pilot solutions. This can shrink the challenge of coordination between fuel infrastructure, vessels, firms and national policies down to a manageable size while still retaining the scale necessary to create an impact.

<https://energypost.eu/piloting-green-shipping-corridors-australia-japan-and-asia-europe/>

Critical Raw Materials for the energy transition:

A ramp up of the supply of critical raw materials (CRMs) is essential for the world's energy transition. Wind and solar, batteries, digitalisation, transport and hydrogen cannot meet their targets without it. The EU defines 30 minerals as critical. To give one example, the global deficits in lithium supplies could surge more than 60-fold to 950,000 tons by 2030. Europe represented just 5% of global mining in 2020 and is the only region in the world with a declining mining industry. Europe's dependence on imports makes it vulnerable to economic and geopolitical shocks and rivalries. At present, China provides 98% of the EU's supply of rare earth elements (REEs) and around 62% for all its defined 30 CRMs.

<https://energypost.eu/critical-raw-materials-for-the-energy-transition-europe-must-start-mining-again/>

Juggling fuel affordability and fuel security

New Zealand's refinery closes and shifts to become an import only terminal

"The conversion of the Marsden Point oil refinery into an imported fuel storage facility is being strongly backed by Refining NZ's independent directors as a way to turn around its financial fortunes, cut carbon emissions, and return to dividends sooner."

The future of the refinery has been under review since early last year, as the pandemic exacerbated its problems with falling refining margins and an oversupply of fuel in the Asia-Pacific region."

<https://www.rnz.co.nz/news/business/446217/refining-nz-directors-unanimously-back-marsden-point-conversion>

However a report by Wellington consultants Hale and Twomey say this is not without risks. They note that "Refining NZ operates the only fuels refinery in New Zealand and supplies 65-70% of the country's fuel demand for the main petroleum products (petrol, jet fuel and diesel). It is currently under severe financial pressure due to low refining margins and there is a risk that refining may no longer be viable."

<https://www.mbie.govt.nz/dmsdocument/15260-refining-nz-impact-of-conversion-to-fuels-terminal>

The Hale and Twomey reported 12 significant risks. Here are three which the Radio NZ report highlighted:

- A reduction in fuel inventories (expected to be 25-30%) that is

likely to impact New Zealand's supply security;

- No ability in New Zealand to correct product that are not up to standard.
- Loss of ability to process New Zealand crude in a major supply emergency (global geopolitical meltdown or pandemic where New Zealand might be isolated for a time).

The refinery has played a significant role in the supply of fuel into New Zealand, supplying 67% of New Zealand's liquid fuel needs in 2019. As an import terminal it will supply significantly less fuel than it currently does.

The Hale and Twomey report stated "a terminal at Marsden Point would service about 40% of New Zealand's demand - 30-35% for petrol and diesel and 75-80% for jet fuel. Therefore, terminal throughput would be around 55-60% of current refinery output.

That means a significant percentage of current supply will need to be independently supplied from refineries and vessels from Asia, as the Hale and Twomey report notes.

Energy security is an important component of both national security and a stable economy by being less vulnerable to disruptive externalities. While vehicles powered off the grid, be they battery or fuel cell could be considered independent from imported fuels, their percentage of the total fleet is still miniscule. The risk has not yet been abated.

Global risk assessments

Radio NZ reported in June last year that MBIE had received a review of geopolitical risks and natural disasters to the supply chain.

They added that the Ministry of Foreign Affairs and Trade (MFAT) told MBIE there was "quite a significant national security element to having 100 percent reliance on fuel imports."

Percentage of national fuel supplied by Marsden Point Refinery

	2015	2016	2017	2018 ^s	2019
Petrol	62%	64%	59%	61%	62%
Jet Fuel	95%	88%	84%	86%	87%
Diesel	75%	65%	67%	56%	62%
Total	74%	69%	68%	64%	67%

Source:
Hale and Twomey Report "Refining NZ - Impact of conversion to fuels terminal."



Marsden Point refinery, to become a fuel import terminal in April 2022

International Energy Security

Ensuring energy security has been at the centre of the International Energy Agencies mission since its creation in 1974, following the oil crisis in 1973.

Today, the global oil market remains vulnerable to a wide range of risk factors, including natural disasters, major technical accidents, and geopolitical tensions. As oil is expected to remain a major component of global energy demand for the coming decades, particularly for the transportation sector, maintaining the IEA emergency response capability will continue to remain essential.

In accordance with the Agreement on an International Energy Programme (I.E.P.), each IEA country has an obligation to hold emergency oil stocks equivalent to at least 90 days of net oil imports. In case of a severe oil supply disruption, IEA members may decide to release these stocks to the market as part of a collective action.

New Zealand a signatory

New Zealand is a signatory to the International Energy Agencies fuel security obligation of having 90 days supply of fuels onshore or in offshore "tickets" which are arrangements for supply.

As a backstop to New Zealand's onshore supply was access to NZ produced crude. Being unable to refine onshore domestic crude could reduce New Zealand's ability to meet the day IEA obligations.

<https://www.iea.org/areas-of-work/ensuring-energy-security/oil-security>

Governments recalibration

MBIE has released a consultation document in January 2022 addressing this issue.

<https://www.mbie.govt.nz/dmsdocument/18594-consultation-paper-onshore-fuel-stockholding>

They say in their introduction:

"We propose requiring a minimum onshore fuel stockholding level similar to that proposed in Australia, namely 28 days of cover for diesel and its biofuels equivalent, and 24 days of cover for other liquid transport fuels (namely petrol and jet fuel)."

Australia's refineries are also finding their viability being challenged by the competitive production coming out of Asia, and while that is challenging

the model of domestic production for Australia, it seems in order to maintain energy security, the Australian Government is also maintaining some degree of domestic production.

The Australian Government said:

"To support our long-term fuel supplies, the Australian Government has developed a comprehensive fuel security package. The government's long-term fuel security goal is to increase our domestic storage and to hold a sovereign refining capability that meets our needs during an emergency, as well as into the future. We will secure our local industry's capabilities, while keeping fuel prices in Australia among the lowest in the OECD."

<https://www.energy.gov.au/government-priorities/energy-security/australias-fuel-security-package>

Reuters (SYD) reported in May 2021 that the Australian Government "has agreed to pay its last two oil refineries up to A\$2.3 billion (\$1.8 billion) through to 2030 to keep the struggling plants open and protect the country's fuel security."

Context of the NZ document is similar

"This paper is about resilience to more significant disruptions that could, without adequate mitigation, result in a prolonged national fuel shortage that would warrant rationing of available fuel to high priority uses (such as emergency services and food distribution). The primary disruption scenario we have in mind is an event that prevents or significantly delays the delivery of imported fuel into New Zealand for a sustained period."

The NZ document mentions the same need for adequate fuel supply to emergency services and distribution, but in order to support those essential

services, New Zealand is one step removed from the Australian scenario, where NZ's domestic production of liquid fuels is no longer that backstop. Suffice to say in order to maintain energy security at an essential services level, having the same onshore fuel stockholding level as Australia (28 days) may not be as adequate without that onshore production capability.

Wars, pandemics and natural disasters

The consultation paper talks about geopolitical instability, pandemics and global supply chain fragility.

"Since the start of the Covid-19 pandemic, New Zealand, like other countries, has had first-hand experience of international supply chain fragility – including for medicines and other goods for which global supply chains were previously considered robust. While fuel supply has not been at risk to date during the pandemic, it is prudent to consider how resilient we are to some hard-to-predict events, whether extreme weather, a global pandemic, or geopolitical conflicts that could disrupt fuel supplies."

Global energy supply is extremely vulnerable at present, with geopolitical issues in the South China Sea and Eastern Europe (Ukraine), as well as strained supply chain due to the global Covid-19 pandemic.

These combination of factors will no doubt be giving some sleepless nights. Confidence in the market to supply is one thing, disruptive externalities are another.

However, we are heading towards a transport system based on domestic renewable energy resources, which offers a significant opportunity for energy independence as a nation, however timing is everything.



The consultation paper is available [here](#):



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www.careers.govt.nz/jobs-database

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GOOD JOB OPPORTUNITIES

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

STARTS

14 March and 25 July 2022

FEES

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\$885 (per paper domestic)

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OVERVIEW

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

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