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VOLUME 30 ISSUE 2 - JUNE 2022



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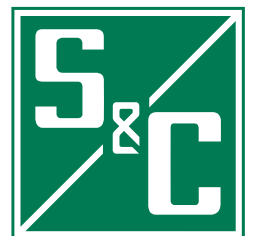
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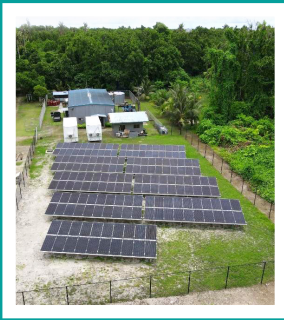


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Pacific Power Association, Suva, Fiji Islands. The PPA is an inter-governmental agency and member of the Council of Pacific Power Association, Suva, Fiji (CROP) established to promote the direct cooperation of the Pacific Island Power Utilities in technical training, exchange of information, sharing of senior management and engineering expertise and other activities of benefit to the members.

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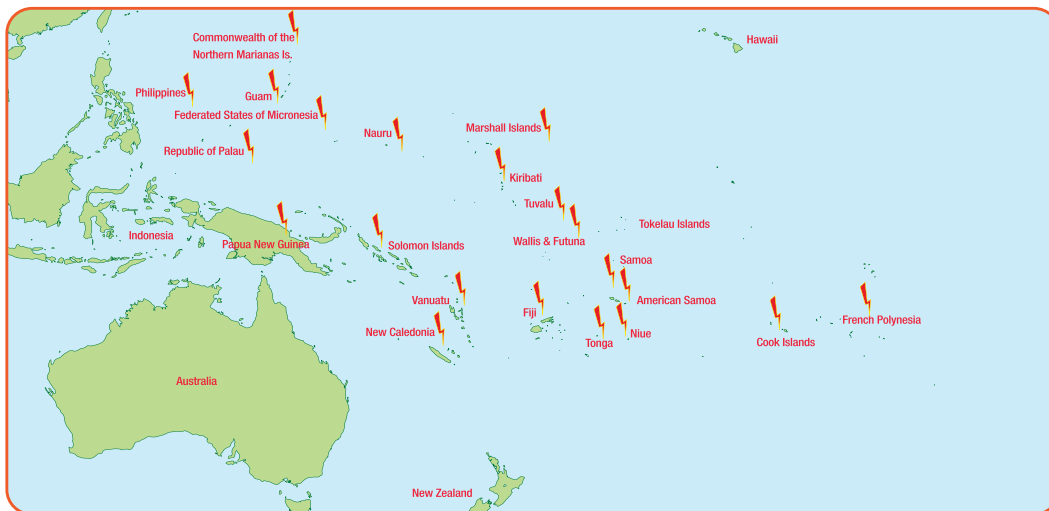
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## Editor's Note

Gordon Chang  
Acting Executive Director

Welcome to All Our Readers and particularly to the new Allied/Affiliate members who are receiving this publication for the first time.

We are well into the year now and I am sure everybody is slowly getting back to work into implementing their respective work programs for the year after the Covid-19 that delayed or stop our work altogether in our respective countries. When we pause a moment to think about this Covid-19 virus time certainly flies and we need to be on top of activities to be able to achieve our goals for this year.

The Pacific Power Association in collaboration with SEIDP, and funded by World Bank will come to an end in February 2023. For all reports such as the recently completed, "Pacific Power Utilities Benchmarking Report 2020". This report benchmarks the performance of 21 Member Utilities in the year 2020. All other reports before 2020 is available in the PPA website along with other workshop reports. It is my hope that the participating utilities utilize the findings of the report to formulate performance improvement programs for their respective utilities to improved utility performance.

For the utilities that did not take part in 2020, I would sincerely hope that you consider taking part in the next round of benchmarking which will soon be started by the PPA Secretariat by requesting data from the participating utilities members.

I sincerely hope that you take the time to read the magazine, as the articles are really enlightening and that you will find it worth your while.

Vinaka Vakalevu.

# Palau Public Utilities Corporations Achievements

Frank Kyota

Chief Executive Officer, Palau Public Utilities Corporation

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The Palau Public Utilities Corporation (PPUC) remains committed in achieving Palau's target of 45% renewable as contemplated under the Nationally Determined Contributions (NDCs) declared in 2015. At nearly 97 – 98% of energy generation deriving from diesel, PPUC consume 02 s approximately 6,000,000 US Gallons of diesel per year. Despite the unanticipated challenges of COVID-19, PPUC continues to engage in efforts to reduce its dependency on fossil fuel and integrate more renewable energy. Presently, PPUC and the RoP is on the verge of launching Palau's first Independent Power Producer (IPP) focused on the Koror – Babeldaob grid to raise our renewable energy generation levels from the current 3% to a minimum of 20%. This partnership between the PPUC and Solar Pacific Energy Corporation (SPEC) aims to construct a 13.2-Megawatt (MW) solar PV facility with a 10.2 MW energy storage system to generate a minimum of 20 Gigawatt hours (gWh) per annum for twenty (20) years with the possibility of an extension of an additional five (5) years.

PPUC has also prepared the Investment Plan or PPUCs Least Cost Generation plan to act as PPUC's 2021-2025 Transmission & Distribution and Generation expansion program in order to meet the ROPs goal of 45% renewable and 30% energy efficiency by 2025. The Program will help develop and optimize a least-cost generation plan with distributed generation resources and grid stability with emphasis on the renewables, energy storage, and mini-grid options.

The Program will further identify the short-term priority capital investment projects urgently needed for the improved reliability of power supply, which will eventually be included in the government and PPUC's investment priorities. To this end, the various stakeholders like the Ministry of Finance, Palau Energy Administration, and other key government and development stakeholders will closely be consulted throughout the implementation of the project's scope.

In parallel to this IPP project for 20% and keeping in mind the larger goal of 45%, PPUC is collaborating with partners, i.e the Japan International Cooperation Agency (JICA) and the Asian Development Bank (ADB), to plan and implement grid upgrade projects to enable the Koror-Babeldaob grid to integrate large renewable energy effectively. This entails the construction of additional transmission lines, installation of grid-forming batteries, upgrading of substations, and much needed capacity building. This will ensure that renewable energy generated is efficiently captured, delivered, and consumed.

PPUC also endeavors to implement projects to improve the resiliency of its island states that operate separately from the main grid by introducing and implementing renewable energy initiatives. One recently concluded successful project, is the installation of 65 Kilowatt (kW) solar PV with 165 kwh of battery storage at the northern island of Kayangel. This project was made possible with kind support of the Ministry of Foreign Affairs and Trade (MFAT) of New Zealand. Currently, Kayangel operates with 40 – 45% renewable energy penetration and has resulted in a reduction of monthly fuel consumption by at least 2,000 US Gallons/month. It should also be noted, that since the commissioning of this facility, fuel deliveries to Kayangel have been reduced from 3 trips/year to now 1 trip/year. Kayangel is the first state in the Republic of Palau to achieve 45% renewable energy electrification.

Additional efforts are being explored for the other islands. For example, PPUC is collaborating with the Government of Korea and the Korea Energy Technology Evaluation and Planning (KETEP) to introduce a similar arrangement for the state of Peleliu. The project had been impacted by covid-19 but with the improving conditions, we target to commence the project in the 3rd quarter of 2022, which will involve the installation of 206 kW of solar PV with 787 kWh battery storage.

PPUC works with partners to engage with projects to reduce electricity expenses of public facilities. As part of the New Zealand funded Kayangel Project, 113 kW solar PV system was installed at the PCC cafeteria to reduce their electricity bill. In a similar effort to promote the use of renewable energy and reduce monthly expenses, PPUC in partnership with MPIO and JICA, will be rehabilitating the solar PV system at the Palau International Airport.

PPUC's efforts also expand into the equally important water sector. At this time, PPUC, working with JICA, is engaged in a technical cooperation project in strengthening PPUC's capacity in non-revenue water (NRW) reduction. The consultant for the project mobilized on March 2022 and continues to work with PPUC in identifying current challenges, develop approaches for reducing NRW, and improve public relation in terms of water conservations. The outcomes to come from this project are 1) preparation of a pipe renewal plan to guide the cyclic replacement of Palau's aged water lines, 2) development of a leak detection manual to increase capacity in leak detection, and 3) improve capacity in water use monitoring and public awareness.

As of November 2021, with the construction of the new Ngerikiil water booster pump, the residents of Ngerikiil have been receiving treated water from the Koror-Airai Water Treatment Plant (KAWTP). In February 18, 2022, the Environmental Quality Protection Board (EQPB) provided certification that the Ngerikiil area water has been improved to meet the RoP safe drinking water quality standards. Prior to the commissioning of this project, the Ngerikiil area had been receiving raw water. The project is made possible via the joint effort of the Government of Palau, the Airai State Government, and PPUC.

In consideration of the impacts of climate change particularly the effects of the dry season and Palau's limited surface water sources, in collaboration with PICRC and PEWA, and funding from the Italy Government, PPUC has contracted out a project for the exploration of new ground water sources. While delayed due to the impacts of Covid, the project is underway and two potential locations have been identified for exploratory drilling and testing in Airai. An exploratory drilling rig has been mobilized and PPUC plans to commence drilling later this year. If this project is successful in identifying suitable ground water sources, then we can proceed to the design of a well-field to provide additional water to be integrated to the water system.

Lastly, despite the multitude of challenges faced under the Koror-Airai Sanitation Project (KASP) including the temporary closure of borders due to Covid, PPUC has successfully completed the construction of the new Malakal sewer treatment plant. Since the 9th of November 2021, the new plant has been in operation and continues to receive and treat wastewater before discharging to the Malakal Bay. The construction of the sewer treatment plant also includes the creation of PPUC's own laboratory to regularly test the quality and effectiveness of the system. The remaining challenges is now to complete the construction of the sewer collection system in Malakal. PPUC is now working with the Ministry of Finance and ADB to secure funding to complete the remaining major sewer pump station near the old CIP office and connect the remaining portions of the Malakal area including the minatobashi bridge crossing.



*Ngerikiil Pump Station*



*Malakal Sewer Treatment*

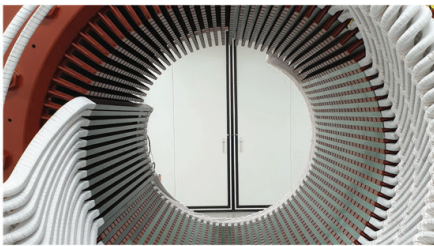


*Kayangal Solar*



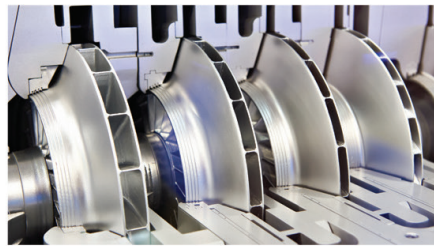
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# Tongan Tsunami: A Catastrophic Hit on Livelihoods & Infrastructure.

Sandip Kumar – Pacific Technical Officer, Global Sustainable Energy

Bruce Clay – General Manager, Clay Energy

The recent disastrous Jan 15 volcanic eruption and subsequent tsunami that battered the nation (Tonga), surrounding island nations and the globe was a major news story for weeks after the disaster with the news channels and social media inundated with photos and videos of the devastation.



*Heavy ash deposits covering solar arrays*

On 20th December 2021, an eruption began on Hunga Tonga–Hunga Ha’apai, an uninhabited volcanic island and submarine volcano of the Tongan archipelago in the southern Pacific Ocean. The volcanic eruption was the largest recorded in thirty years. The eruption reached a very large and powerful climax on 15 January 2022 which generated a powerful tsunami impacting the nearby islands in the Tonga group severely and deposited a significant amount of volcanic ash across the islands. Three people in Tonga were killed by the tsunami, dozens of homes were destroyed and drinking water was tainted.

The Government of Tonga reported that about 84% of the population has been directly affected. Electricity supply was disrupted and the undersea fiber optic cable providing phone and internet connectivity to Tonga extensively damaged resulting in loss of communications.

The World Bank estimates \$90.4 million in losses, which represents 18.5% of Tonga’s GDP (Source: abc news). More than 80% of the country’s people depends on small scale agriculture and fisheries and livestock just for consumption. The World Bank estimated losses to agriculture, forestry and fisheries at \$20.9 million. There were also multimillion-dollar losses to homes, schools, churches, community halls and other non-residential buildings, and infrastructure including roads, bridges and the ruptured undersea cable. The World Bank’s report stated about 600 buildings across Tonga were damaged or destroyed by the tsunami. Three hundred of these buildings were homes, and it is estimated 1,525 people from the Tongatapu and Ha’apai island groups have been displaced. Tonga’s

tourism sector, which represented an estimated 18.5% of GDP in 2019 (prior to international border closures), has been significantly impacted. The industry comprises at least 85 accommodation businesses and 32 land and sea tour operators, with (marketed) accommodation spread across Tongatapu (48 providers), Vava’u (24) Ha’apai (11) and Eua (2), and land/sea tour operators split between Tongatapu (16), Vava’u (14) and Ha’apai (2).



*The aftermath of Tongan Tsunami at Ha’atafu Beach resort*

Tonga’s main communication connection to the rest of the world was restored on 22nd February with the crew aboard cable repair ship Reliance having to replace about 90 kilometers (56 miles) of cable that was damaged by the tsunami. The tsunami caused damage to water supply tanks, pipes, channels as well as to localized infrastructure for water supply. In addition, ashfall impacted rooftop tanks (mostly used in rural areas), and wells. The power network on the coastline sustained damage due to the tsunami. The electrical transmission and distribution network infrastructure was also covered in volcanic ash requiring cleaning before re-energising. Road infrastructure was likely not greatly impacted given the low levels of ashfall; however, some damage to roads and causeways has been seen on Tongatapu and Pangai Ha’apai (including at the Foa causeway).

Generation from Tongatapu’s solar farms was reduced to near zero with up to 15mm of volcanic ash covering solar arrays and plant. Cleaning of the arrays has taken weeks and was a “delicate” process due to the abrasiveness of the ash. There has been reports of some shattered PV modules and roof top solar hot water collectors due to the shockwave from the major volcanic explosion.

The Tongan community have been extremely resilient in their restoration efforts, trying to get back to life as normal as it can be, and as soon as possible. Humanitarian assistance and infrastructure repair is ongoing.

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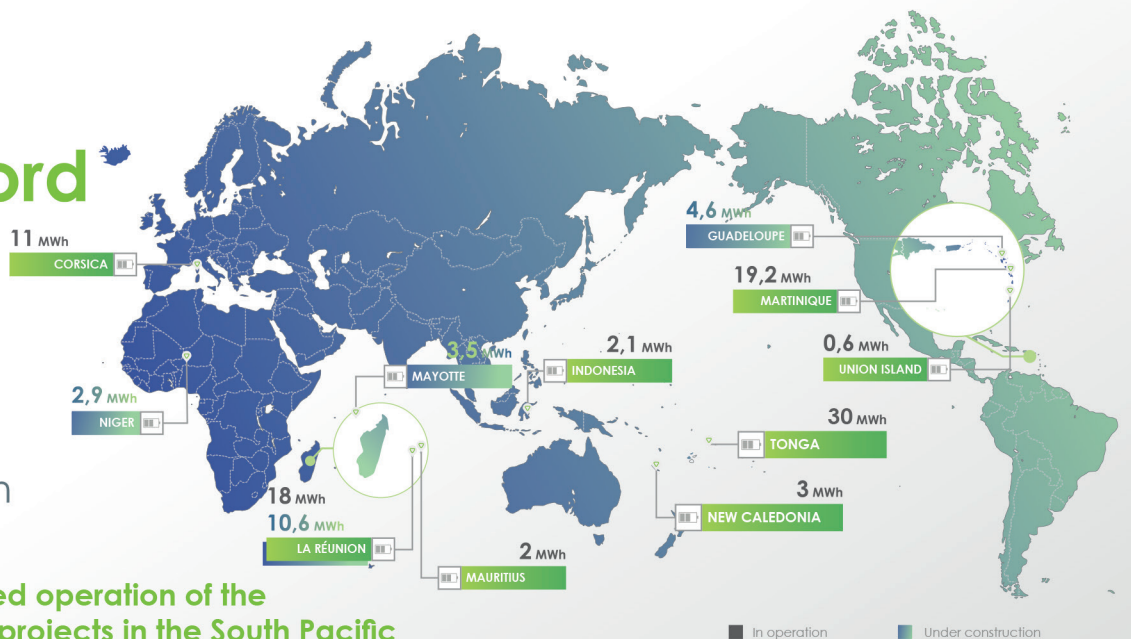
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Under construction



**Akuo successfully started operation of the largest battery storage projects in the South Pacific totaling 30 MWh in Tonga in the end of 2021!**



# Better Crop Yields under Solar Panels, Improving Output from Floating PV & Other Ideas

SEIAPI Newsletter

Imagine Newsletter, February 2022

In the right locations, solar PV panels can boost food production, protect water supplies, increase electricity output and even partly offset the impacts of climate change on ecosystems.



Healthy, larger crops under 345W PV panels  
(Source: [theguardian.com](https://www.theguardian.com) 22 Feb 2022)

In tropical locations with limited rainfall, such as some atolls and other small islands, positioning solar panels above open fields of crops can produce cabbages, aubergines (eggplants) and lettuce that are a third bigger on average, and more nutritious than vegetables grown in control plots with the same amount of water and fertiliser. Maize was also taller and healthier.

Floating solar panels on a lake or reservoir might sound like a poor idea, but recent studies have shown this generates more electricity compared with rooftop or

ground-mounted PV. This is due to the cooling effect of the water beneath the panels, which can boost electricity output by as much as 12.5%.

Floating solar farms on lakes, reservoirs or in coastal waters could also prevent aquatic weeds growing out of control without expensive and harmful herbicides. Due to climate change, tropical lakes are vulnerable to increased or even permanent heatwaves. Smaller lakes may shrink or disappear entirely, along with their wildlife, whereas deeper lakes will face less intense but longer heatwaves. A floating solar farm that reduces wind speed and solar radiation by 10% across an entire lake could offset a decade of climate change induced warming. Designs that shade the lake more than shelter it, by reducing sunlight more than wind, can have the greatest cooling effect. Evaporation falls and the lake water mixes more frequently, which helps oxygenate the deeper water.



Floating solar farm  
(Source: Giles Exley, Lancaster University)



Kagoshima PV, Japan (Source: John Major, Univ of Liverpool)

# Sealing Conduits for Resilient Electrical & Telecom Systems

Sheri Dahlke – Technical Director

Robin Francis – Director Content Marketing and External Relations

Chris Trevis of Polywater and Lindsay Taylor – Group BDM TEN Group Australia

Source Munich RE – [www.munichre.com](http://www.munichre.com)

In 2021 Global losses from extreme weather totalled USD\$280bil (AUD\$388bil), of which USD\$120bil (AUD\$166bil) was insured. A mission-critical system or service is indispensable to a functioning community, the economy, and public safety. If the system or service fails or is disrupted due to power outage or damage, commerce and community life can be severely compromised or completely halted. Electrical grids and communication networks are at risk worldwide. Global demand for electrical power and data bandwidth is growing at an increasing pace. As demand increases, potential damage and risk to infrastructure also increases. In many countries, aging assets and unreliable funding further plague these systems' operational integrity. This paper focuses on how natural disasters compromise mission-critical assets in electrical and communication systems, and how strategies are developed to reduce the risk. Any strategy must begin with collaboration among key stakeholders, such as communities, utilities, and government agencies, and depends on commitments to include system resilience projects in annual operational plans and budgets.

Natural disasters such as hurricanes, cyclones, tsunamis, floods, tornados, and bushfires are examples of extreme weather that wreak havoc on people's lives, homes, and businesses and impose serious consequences on society. Consumers are typically unaware of behind-the-scenes work required to provide reliable power and digital access, but outages bring instant and unwanted focus.



Flooded Water

## Severe weather events are increasing the need to seal out water

Australia is very familiar to severe wet weather events, from very active cyclone and monsoonal zones to floods and storms that can cause weather to dump unseasonable amounts of rain in catchments. In fact, there have been 18 major flooding events in the past 12 years that have caused billions of dollars in damage, this is a rate of 1.5 per year over the 12-year period. Climate change scientists indicate that these events could become more frequent and intense. When combined with our growing population, this puts more people and infrastructure at risk by these weather events.

Examples of key weather events that had an impact on communities were: the Brisbane floods of 2010/11, Townsville floods of 2019 and the 2021 floods of NSW, which resulted in a combined total of \$9.84 Billion Dollars in damage claims. It is safe to say that in the past 12 years each state and territory has recorded a notable event.

Power and communication outages are costly not only due to the loss of the essential utility services during the disaster, which are considered mission critical, but require resources and time to make post disaster repairs. System reliability during floods to support critical infrastructures such as hospitals, police, fire and emergency and agencies like the State Emergency Services (SES) is important to public safety. The investment in systems that reduce risk and exposure and increase the resiliency of the system will be beneficial in both minimising direct cost and indirect cost of floods and storms on utility networks.

"Water events that cause major disruptions uncover systems that have not been properly sealed," said Lindsay Taylor - Group BDM – TEN Australia.

## System hardening for greater resilience and the payoff

The choice of storm hardening methods depends on a variety of factors and requirements. As weather volatility increases its impact on power systems and assets, budg-

eting for measures and products that enhance resilience must be augmented. There is a payoff to consider: the vicious cycle of costly annual repairs, service disruptions, and downtime can be mitigated with research and investment in technologies that reliably protect systems against extreme weather events, especially water events. Ideally, utilities and communities work in partnership to create cost-effective plans that provide optimal asset protection in severe weather events—ultimately safeguarding infrastructure, the economy, and people.

### The Role of Proper Seals in System Hardening Projects

Water penetration causes costly damage that is difficult to repair. Whether a project is new construction or an upgrade, prevention of water penetration is essential. Durable sealing technologies provide powerful duct protection and play a vital role in a comprehensive system hardening program. Implementation of sealing technologies is a site-by-site activity that uses varied applications to achieve the goal: reducing or eliminating water penetration. As the frequency of water events increases, the permanent installation of sealing technologies pays for itself by saving on the cost of vital equipment restoration. The following section on sealant selection outlines a process to help match the appropriate sealant to a specific project providing long-term benefits.

**Table 1. Cost of Power Infrastructure Hardening:**

The cost of hardening power infrastructure depends heavily on the hazard and the infrastructure involved. Miyamoto (2019) estimated this cost for power sector infrastructure for floods, earthquakes, and cyclones, linking the cost of hardening the infrastructure with the change in damage probability.

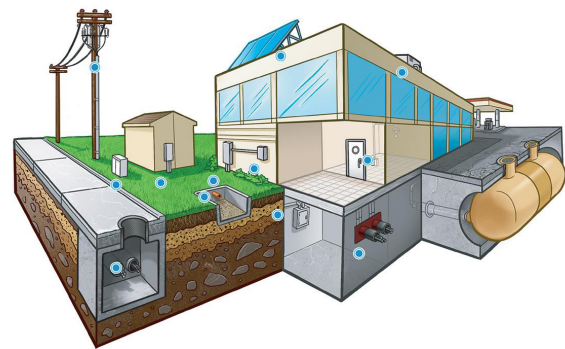
	Earthquakes		Cyclones		Floods	
	Cost Increase	Damage Probability is Reduced by	Cost Increase	Damage Probability is Reduced by	Cost Increase	Damage Probability is Reduced by
Thermal Plants	20%	10	10%	3	2%	Risk Very Low
Nuclear Plants	5%	10			2%	2
Hydropower Plants	20%	2			5%	1.3
Solar Plants	5%	5	15%	2.5		
Wind Farms	5%	1.2	5%	2		
T&D Lines	15%	Residual Risk Very Low	20%	2		

### Determining What Needs Protection

Proper sealing starts with an analysis of the complete project, its function and location, its requirements for success, and other variables. Setting clear objectives is important. Only then can the appropriate sealing technology be identified. What needs protection? Is it mission-critical, or is there system redundancy? What is the asset value? Is it exposed to outdoor elements or below grade? Is the goal to prevent moisture or repel a flood? Is physical asset degradation a concern? Each situation is unique and there is no one solution. Many factors must be considered in these situational analyses.

### Defining The Situation

System hardening poses a variety of situations that require different sealing technologies. For example, cable raceways, wall penetrations, and wall cracks are scenarios that present a variety of materials, geometries, and other factors. It is common for a conduit to pass through the outside wall of a building or enclosure. Such conduits are often underground, so water ingress is problematic.



*Achieve Resiliency by Sealing Vulnerabilities*

A thorough examination of the conditions raises many questions:

- Is the area hard to reach or partially obstructed?
- What materials are to be sealed? Plastic, metal, and cement are the most common materials.
- What is the condition of the conduit and the wall? Is this a new installation or an older existing entry?
- What kind of surface contamination can be detected?
- How much of the conduit is filled with cable, innerduct, or pipe?
- What are the physical dimensions of the space to be sealed? Is the installation horizontal or vertical?
- Are there specific codes or standards that the seal must meet? For example, in some situations, UL recognition may be required.

With so many questions, one gets the impression that seal technology selection is impossibly complex. However, such questions simplify selection. The combination of conditions present in the analysis quickly eliminates sealant candidates and narrows the search. Ensuring that needs are clearly defined allows the tailoring of solutions to meet the specific conditions. There is a solution to most situations. In many cases, water ingress may be evident. In fact, water may be actively flowing into the enclosure or building. Specialty sealing solutions can be installed while the leak is active. What pressure must the seal withstand? Measured as waterhead height, this is a key factor in selecting sealant technology. Under normal conditions, the seal may only need to withstand a few centimetres of waterhead.

During a water event, however, waterhead resistance requirements may rise to as high as 80 feet (25 meters). The requirements of a water event solution will define which sealant technology to use. Planning and careful surface preparation are keys to a successful seal. Existing entries with aging materials pose a challenge. Metal rusts, concrete degrades, and plastic becomes brittle. Oxidation, grime, scum, and oil should be removed prior to seal installation. New installations can present problems if materials were damaged during construction. Always inspect the area surrounding the seal and make repairs if necessary.

### Determining Life Expectancy and Environmental Compatibility

The expected lifetime of a seal depends on numerous requirements and various factors:

- Seals can be engineered as permanent or temporary. Sometimes a seal is needed for a specific time interval. More commonly, the seal is intended to last the lifetime of the material receiving the seal.
- Before cable is run, conduits are often capped as a temporary seal. The cap can be removed at the time of cable pulling, when a more permanent seal is installed.

- Seals can be engineered to meet only the current configuration of the opening and the cables, innerducts, or pipes passing through. Other seals are engineered to be re-enterable, allowing future changes to the configuration.
- Seals must be compatible with the installation environment. The presence of water, salt, corrosive material, or solvents will dictate seal technologies. Additionally, the expected working temperature is important.
- Seal locations subject to vibration or flexing may require a specific seal type.

### Testing To Verify Seal Strength and Integrity

Seals are installed to meet specific requirements. The varied requirements establish a road map to the proper choice of sealing technology.

Critical infrastructure assets are often placed underground for protection from falling trees, lightning strikes, and other weather events. These include transformers and sewage pumping stations. The water column pressures generated in such installations often exceed 6 to 10 feet (2 to 3 meters) and can reach much higher peak pressures. Duct seals must resist these pressures to maintain the functionality of underground power cable installations.

### Blocking Water by Choosing A Reliable Sealing Technology

Flooding causes more economic damage than all other types of weather events. Sealing underground networks from flooding is an effective means of protecting valuable electrical and communication assets. High winds, heavy rainfall, and storm surges generated by hurricanes and cyclones combine to produce large volumes of floodwater that degrade the operational capacity of a system. This is especially true in urban areas where underground networks are susceptible to flooding. Protecting these valuable networks from water penetration is a top priority. Sealing technology protects infrastructure from flooding and comes in many forms. There are advantages and disadvantages among sealant choices, which we explain below:

- Low-cost, mastic putty is an age-old sealant with limited sealing performance. It does not hold water or air pressure.
- It is susceptible to sagging at higher temperatures and deforms when cables are moved.
- Cement/mortar, grout, and Plaster of Paris are also historical sealants. The lack of available water for on-site mixing makes them inconvenient. Their extended reaction or setting times can further complicate installation.
- Pre-engineered mechanical seals perform well. They resist high water head and gas pressure, are easily removed, and help support cables; but they can be challenging in complex cable or high-conduit-fill configurations.

- Two-part, closed cell expanding foam is an excellent choice. High-performance foams readily adapt to varied configurations, remove easily for future access, and offer robust chemical resistance. Foam selection is key, as the chemistry varies.
- Epoxy mortar can be used as a sealant or coating, particularly for cracks and small imperfections. It has strong water and chemical resistance. Epoxies are typically high in viscosity and require trowel application.

### Making Sealant Technologies Work For You

Proper installation is, of course, vital for success when sealing. An important step in any seal deployment is surface preparation. Every seal technology works better if the site is cleaned and free of contaminants. Matching the requirements of the seal to the capabilities of available sealants increases the probability of success.



### Summary

Natural disasters such as hurricanes, cyclones, tsunamis, floods, tornados, and bushfires are examples of extreme weather that wreak havoc on people's lives, homes, and businesses. These severe weather events challenge electrical and telecommunication systems, often resulting in serious adverse consequences to people, property, and economies. In this article, we explored the following:

- How extreme weather necessitates preventative system resilience measures. River flooding and other natural disasters are particularly dangerous and often result in water infiltrating electrical and digital systems;
- Described ways to protect these systems against water ingress with best practices, including the optimal choice of sealant and proper application techniques;
- Provided a road map of the many variables that enhance effective decision making; and
- Outlined the payoff from investing in system resilience, which includes the use of multiple sealing technologies, prevention of costly repairs, service disruption, and downtime in electrical and telecommunication systems.

Article written by Sheri Dahlke, Technical Director; Robin Francis, Director Content Marketing and External Relations; Chris Trevis of Polywater and Lindsay Taylor - Group BDM TEN Group Australia.

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# Network innovation & technology solutions Safety by Design: Encapsulated LV Frame Minimizing Arc Flash *TransNet's way of going beyond BAU*

Goran Stojadinovic  
MCE, MEE, TransNet NZ

## Background

Exposed live parts in LV panels and switchboards present a serious safety risk to operators. Simple daily tasks performed in an LV Frame of a distribution transformer, such as the testing of CTs or insertion of a fuse, can potentially result in electric shock and/or produce an arc flash.

An arc flash is caused by an electric arc that creates a high temperature and moves at high speed (about 100 m/sec):

- It releases huge energy and heat over a very short time and can destroy metal panels and equipment
- It can cause serious injury, even death, to people in the vicinity
- It can cause lasting effects on the operator's health, including burns, physical injury from flying molten metal and other parts, inhalation of hot toxic gases, etc.
- It can also create an arc blast, a pressure wave that can knock the operator unconscious or pin them against equipment.

Therefore, the arc flash presents serious safety and operational risk that every power utility must consider:

- For the safety of its field personnel and maintenance crews
- For the safety of public
- For potential damage to LV panels and other equipment

## The requirements of the New Zealand Health and Safety at Work Act 2015

The duty imposed on a person by or under this Act requires the person:

- To eliminate risks to health and safety, so far as is reasonably practicable; and
- If it is not reasonably practicable to eliminate risks to health and safety, to minimise those risks so far as is reasonably practicable.

There is growing evidence that the arc flash risk could be even greater on LV than on HV because:

- High fault currents involved
- The perception that LV is less dangerous leads to complacency while working on LV
- o According to OSHA – '80% of electrically related accidents and fatalities involving "Qualified Workers" are caused by arc flash/arc blast.' [1]
- o 'The principal injury events associated with electrical hazards are electric shocks and & flash & arc blast. Low-voltage shock injuries result from direct contact of

the victim with electric current...' [2]

- o 'Most of the low-voltage injuries were electrical flash burns (55% of the study population).' [3]

## The most common arc-flash hazard reduction methods

To reduce the risk of an arc flash from LV equipment, most power utilities have adopted some of the following conventional procedures and methods:

- Use the special clothing and PPE and/or avoid the hazard area (if possible)
- Install arc-resistant equipment
- Add the LV current-limiting devices
- Install protective relays that detect an arc flash and reduce fault clearing time

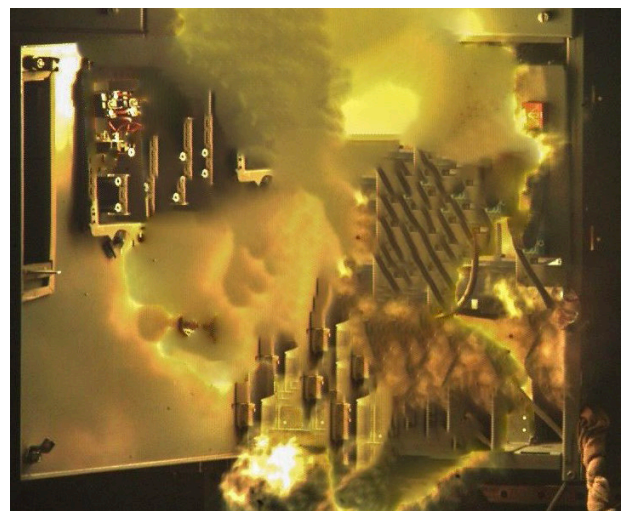
However, the above methods:

- Do not eliminate the arc flash or electric shock – they just reduce it
- Do not prevent the destruction caused by the arc but only minimize the effects of an explosion.
- Some of the above methods can be quite costly for LV

Furthermore, none of the above methods prevents the incident in the first place.

None of them goes to the root cause of the problem, e.g.:

- There are still exposed live parts
- There are still short clearances phase-to-phase and phase-to-earthed components
- There is a need for field crews to work on LV panels while equipment is still energized





**Solution: An innovative Encapsulated LV Frame with the Safety-by-Design approach**

The way the LV cabinets (enclosures), panels (LV Frames), and other distribution equipment are designed plays an important role in minimizing arc flash hazards. By simply changing the design, the arc flash incidents can be drastically reduced or eliminated.

That's why in this innovation the Safety-by-Design concept has been adopted as one of key principles, as follows:

- A design that makes the equipment safe not only during the installation but also for the future maintenance and even when equipment is worked on while energized
- A design that prevents or minimizes the future occurrence of safety hazards

*"Prevention is the best medicine",  
in other words,  
"Prevention is better than cure".*

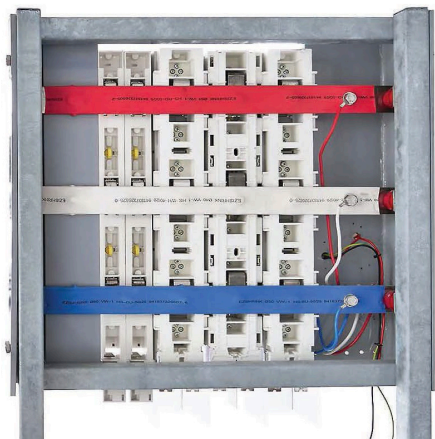
**Encapsulated LV Frame puts safety first (Rear view)**

Encapsulated LV Frame



*The rear of the new TransNet LV frame completely protects workers removing and replacing transformers*

Traditional LV Frame



*Traditional bus protection still leaves exposed live parts*

**Encapsulated LV Frame (Front view)**



**Design and Development of Encapsulated LV Frame**

- Developed originally three years ago for a network company and its contracting team
- Many improvements and fine-tuning have been made since
- Can be mounted either in a transformer cabinet or as a distribution board on a wall in a kiosk
- The Encapsulated LV Frame is the first to have a fully-enclosed busbar system:
  - o It prevents accidental contact with live parts, and
  - o It drastically reduces or even eliminates the likelihood of an arc flash occurring
- A new design of a busbar system drastically reduces the likelihood of an arc flash:
  - o By increasing the clearances
  - o By eliminating unnecessary exposure to busbars
  - o No need to use heat-shrink on individual bars
  - o LV frame is fully covered with the plastic enclosure to prevent access to the busbars other than through designated access points on the front panel

This safety-by-design concept minimises the risk of electric shock or arc flash when adding circuits or working close to live feeders. The design allows the incomer to remain safely live and continuously feed the phases not being worked on.

## Implementation

- If you are going to install a new vertical disconnect you no longer have to remove a panel to uncover the bus. The new frame reduces the area of the exposed bus to a minimal 60 mm square protected by a removable touch-safe cover.
- This design also increases safety during transformer maintenance and generator connection/disconnection
- The Encapsulated LV Frame design allows a transformer to be safely removed and replaced when a fault occurs, whether it is:
  - o bolted to a pad in a transformer, or
  - o installed freestanding on optional Unistrut legs
- This can be achieved with minimal time and effort:
  - o There are generator ports on the front of the board to allow generators to be plugged in once the bus is isolated. The generator and the transformer are then synchronised and, once the generator is energised, the transformer can be safely removed and replaced while the generator is supplying power to consumers.
  - o Safety is assured because the entire busbar system at the back of the frame is sealed in the black plastic enclosure to prevent any live contact.

## Flexible configuration, modular design, and customisation

- **Flexible:** Encapsulated LV Frame is a lot more flexible in its design and size to suit different network companies and their requirements.
  - o It can be configured for any number of cables coming out of a transformer as well as their current ratings
- **Modular:** This meant ensuring it was easier to install by making it modular and allowing more vertical disconnects to be added, depending on how many outgoing circuits and phases were required.
- **Adaptable:** Disconnectors can be mounted on the LV Frame to allow either top or bottom-feed. Each unit can be ordered as a base frame for customers to build onto. It can also be pre-wired as a complete solution to customer requirements for each job, ready for all network companies to consider as they upgrade the safety of their transformers.
- **Safe one-man installation:** Encapsulated LV Frame has a good balance between the robustness and its weight to enable safe one-man installation.
  - o It is now light enough for one man to install in the LV end of a 100 kVA to 300 kVA transformer and bolt it

into place

- o It is an ideal solution to retrofit into an existing transformer during an emergency
- o The whole frame can be set up and ready to install at any time and can be converted very quickly to a top or bottom feed on the job without disrupting access for tap changes.

## Versatility

Often additional fittings need to be added in the field while the busbars remain live. This work can now be done safely because there are no busbars behind the panel. This safety-by-design measure eliminates the risk of hitting a live busbar when accessories are being installed.

A grey accessory panel is provided on the right-hand side of the frame for easy installation of optional additional fittings and equipment, as follows:

- Ripple relays, pilot fuses, Ferro-resonance kits, demand metering fuses, CT test blocks, LV monitoring equipment, communication routers, and power points for tools.
- The accessory panel could also be used for generator ports if a customer wants the full use of the standard 6-way panel.

The above fittings and equipment can also pre-installed before the frame is shipped.



## Higher safety standard

Safety is further assured by the higher current rating designed into the busbar system.

- The Encapsulated LV Frame Busbar is rated for up to 800 amps while a typical 300 kVA transformer fully loaded draws about 430 amps.
  - o A significant safety margin is achieved with the slightly thicker busbars.

- o Even if a transformer is running at full load and under a high ambient temperature, the frame will never get close to its maximum thermal rating and overload capacity.
- The Encapsulated LV Frame now offers an unprecedented level of safety as standard, while still enabling a high level of customisation to meet any specification

The company supplies 4, 6, and 8-way LV Frames. It has developed the new encapsulated frame concept as an extension of its successful EP7 3-way pillar.

The new frame is the latest development in a range of LV pits and pillars designed, engineered, and manufactured in New Zealand.

**The key principle and the main driver for the success of all these development is Safety-by-Design!**

### Greatly improved Insulation Coordination

It is one of the key aspects of the Encapsulated LV Frame. The purpose of the LV Insulation Coordination is to ensure:

- Safety of people
- Protection of equipment and reduction of LV dielectric failures
- Continuity of supply (e.g. reliability, to a certain extent)

As per the international standards, the LV Insulation Coordination differentiates between several levels of insulation and categories of protection, with four hierarchically graded requirements according to the equipment type and purpose [4][5][6], as follows:

- 1) **Functional** insulation between conductive parts - vital only for the proper operation of the equipment
- 2) **Basic** insulation of live parts – insulation of hazardous-live-parts that provides basic protection against electric shock e.g. it is touch-safe
- 3) **Reinforced** (double basic) insulation - separates LV circuit from unearthed exposed parts
- 4) **Enclosures** - provide additional protection.

**The Encapsulated LV Frame satisfies three (out of 4) insulation coordination levels, which offers a much higher level of safety for people and protection of equipment in comparison with traditional LV Frames.**

Note: The touch-safe design protects by eliminating finger contact with live parts.

Nonetheless, only authorized personnel with appropriate PPE should work on LV equipment.

### In summary

The Encapsulated LV Frame innovation is the latest Company innovation:

- It is a continuation of the Company's R&D efforts to improve the safety and reliability of LV network and equipment.
- It considers the concept of Safety-by-design.
- Combined with the EP7 link pillar series and TUDS (Total Underground Distribution System), this innovation achieves an unprecedented level of safety for the public and field workers, compared with traditional LV underground networks. [7][8][9]

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### References

1. Electrical Safety in the workplace magazine (11 November 2020) - <https://www.electricalsafetypub.com/features/dont-test-your-luck-when-exposed-to-arc-flash-and-electrical-safety-hazards/>, and Inolect, Consider the Facts: Arc Flash Hazards <https://inolect.com/consider-the-facts-arc-flash-hazards/> <https://www.progarm.com/news/is-the-arc-flash-risk-greater-at-high-or-low-voltage/>
2. Richard B. Campbell, ScD., David A. Dini, P.E., Occupational Injuries From Electrical Shock and Arc Flash Events, NFPA, UL LLC, USA (2015)
3. (Singerman et al., 2008) <https://academic.oup.com/jbcr/article-abstract/29/5/773/4598436?login=false>
4. Insulation Coordination for Equipment within Low-Voltage Systems, IEC 60664-1 (2002)
5. Degreesofprotectionprovidedbyenclosures(IP-Code),IEC60529
6. IETWiringRegulations,BS7671:2018/A1:2020
7. G.Stojadinovic,BuildingTotalUndergroundDistribution-SystemforSmartCities,CEPSI2021:The Energy DigiCon of Asia Pacific
8. TheNewErainPowerdistribution,TransNetNZ, [https://www.transnet.co.nz/site/transnet/files/Brochures-Catalogues/The%20New%20Era%20Cat\\_2017\\_web.pdf](https://www.transnet.co.nz/site/transnet/files/Brochures-Catalogues/The%20New%20Era%20Cat_2017_web.pdf)
9. EP7LinkPillar<https://www.transnet.co.nz/results.html?q=ep7>

# Palau Becomes the First Country to Sign the Moana Pledge Transpacific Agreement

**Bryce Barbier**  
Project Finance Specialist, Mana Pacific

During the recently held 7th Our Ocean Conference hosted by the Republic of Palau in partnership with the United States, President Surangel S. Whipps Jr. announced the Republic of Palau's commitment to generating 100% of its energy from renewable resources by 2032 without increasing costs to consumers. Aligning with this bold commitment, President Whipps signed the Moana Pledge transpacific agreement committing to reaching renewable energy goals while enhancing overall island resiliency through the use of the Solar Impulse Certified™ Moana Pledge framework created by Pacific Power Association members, Mana Pacific.



By signing, Palau became the first of the Pacific Island Countries and Territories to commit to the non-binding Transpacific Compact designed to accelerate renewable energy growth across the region simultaneously through streamlined project development processes and principles.

Upon signing, President Whipps conveyed the value of the initiative: "The Moana pledge is all about bringing people together, bringing resources together, and bringing experts to find the best way to chart a sustainable path that ultimately benefits the people by lowering the cost of energy and protecting our planet." Accompanying the President was Mana Pacific Inc's Co-founder and President, Mr. John Miller, who reflected on the long-standing effort and development that led to the momentous occasion: "By becoming the first country to commit to the Moana Pledge, Palau has taken the first step in a journey of a thousand miles and an example for the rest of the Pacific Islands to follow."

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Ngerulmud, Republic of Palau 96939

*Palau Reaffirms Commitment to Generating 100% Renewable Energy by 2032 as President Whipps Signs the Moana Pledge transpacific agreement*

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###

## Joint PPUC-PCREEE-ISA-INES Training on Renewable Energy Mini-Grids

**Kakau Foliaki**

Programme Deliver Officer/Energy Consultant, Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE)

Palau, 29th November, 2021 - The SPC's PCREEE in collaboration with the Palau Public Utilities Corporation (PPUC), the International Solar Alliance (ISA) and the National Institute of Solar Energy of France (INES) conducted a 3-day training on Renewable Energy Mini-Grids at the Palau Public Utilities Corporation's Conference room, Koror, Palau. The purpose of the training was to strengthen the local technical capacity in Palau to effectively design, install, monitor and maintain renewable energy mini-grid systems. A total of 28 male and female officials from the PPUC, 3G Solar Tech, SOSTSI, PCC, Palau Energy Administration participated in the training programme to enhance their skills in mini-grid systems.

The training is part of the technical assistance that PCREEE offers to its member countries. The content focusses on fundamentals of renewable energy mini-grid, design, installation and monitoring. The training was also to empower PPUC to utilise their local RE expertise to facilitate and lead discussions on mini-grid and to identify areas for further assistance.

The training was opened by Chief Executive Officer of the PPUC, Mr Frank Kyota. *"It is crucial for Palau to meet its national energy target of 45% renewable energy by 2025. As such, exploration of alternative resources to meet our target while reducing carbon footprint is crucial,"* said Mr Kyota. He also acknowledged the support of the PCREEE in providing the platform to allow local energy experts to share experiences and insights on how to improve access to renewable energy and the transition to clean energy in Palau.



*Kakau Foliaki  
Programme Deliver Officer/Energy  
Consultant, Pacific Centre for Renewable  
Energy and Energy Efficiency (PCREEE)*

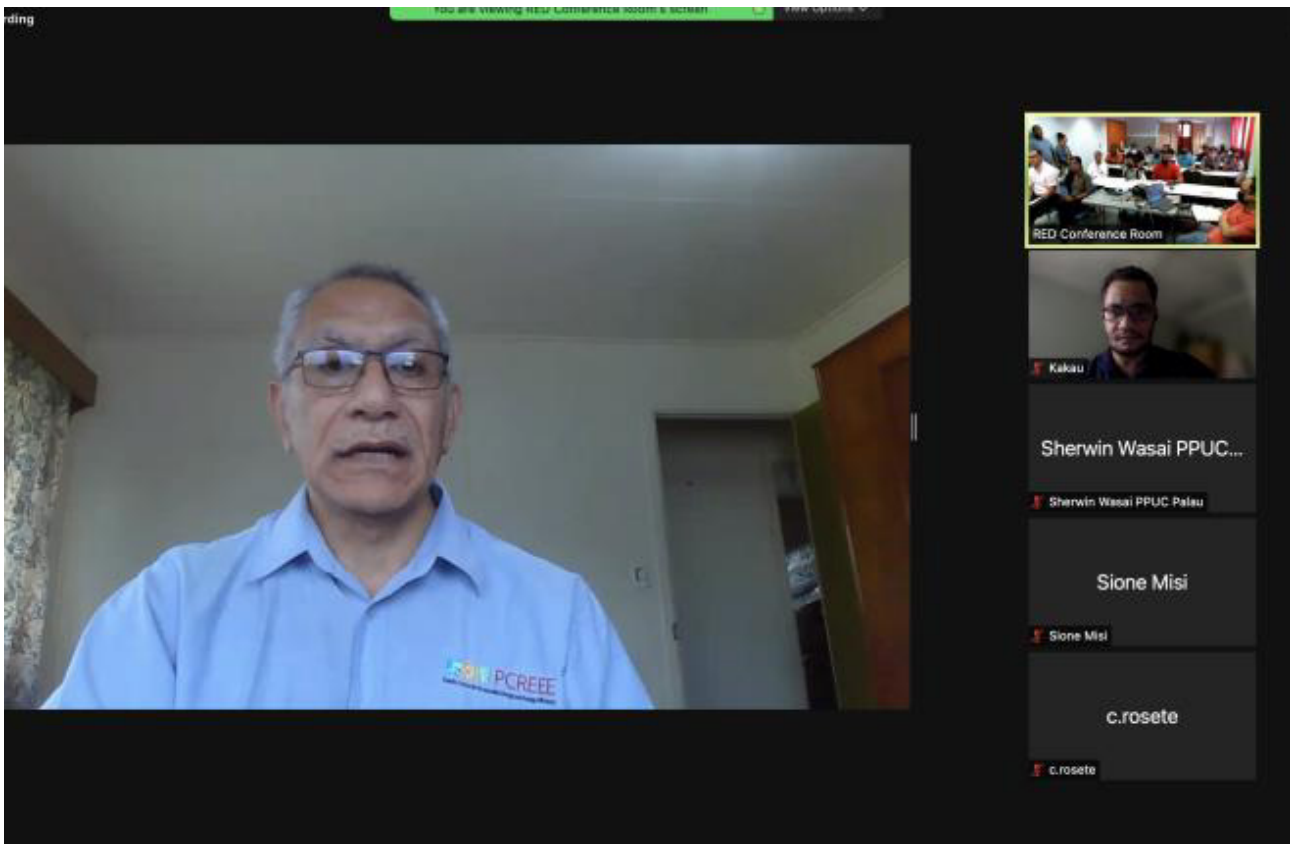


## CURRENTS

Addressing the participants through video message, PCREEE Manager, Mr. Solomon Fifita, said ***“There are increasing number of mini-grid systems installed throughout the Pacific region as governments and power utilities recognize the crucial role of mini-grid systems in unlocking the development opportunities in the remote and rural communities.”*** In supporting Palau with the training, Mr. Fifita highlighted the benefits of the training to enhance design, operation and maintenance of the mini-grid systems so as to be more resilient and to build back stronger from natural disasters and to assist in fighting against the COVID pandemic.

The training was facilitated in country by PPUC Renewable Energy Manager, Mr Kennard Sugiyama. Throughout the 3-day training, key issues and concerns were raised by PPUC technicians, contractors and participants relating to mini-grid systems designs, types of batteries, type of cables, battery disposals, grid fault, lack of certification of PV modules to meet international standards and the affordability of PV and batteries for consumers. Due to covid restrictions, one of the highlights of the training was the inclusion of a virtual site visit to the PPUC project site at Kayangel island, where PPUC showcasing the operations of the PPUC solar mini-grid on the island.

The workshop was concluded with a closing remark from Manager of the PCREEE thanking the participants and PPUC for their support and highlighting that the workshop has been conducted efficiently, in close collaboration with the partners, promoting self-reliance on local expertise and was conducted cost-effectively. The PCREEE looks forward to supporting investments in Palau’s energy sector through a matchmaking platform such as an investment forum to promote investment in renewable energy and energy efficiency.



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## Marshalls Energy Company Fuel Tanker

### Marshalls Energy Company

Marshalls Energy Company (MEC) took a vital step to sustain and expand its petroleum business with the purchase of an approximately 160,000-gallon fuel tanker from Ratson Shipbuilding. The vessel will be the first in MEC's soon-to-be-created shipping division, which aims to expand and diversify the distribution of petroleum products to Ebeye and other neighboring islands.

The BKI Class, 172-foot ship was built in 2020 in Indonesia. It will be modified to meet MEC requirements and to meet open ocean operational use before shipping to Majuro in mid-June 2022. The vessel is anticipated to be in operation by Q3 2022, assuming modification works and delivery are on schedule.

MEC currently provides diesel, liquid petroleum gas (LPG), and lubricants to power utilities, fisheries vessels, and for domestic and commercial marine and land transport, primarily in Majuro and Ebeye. "With the new vessel, MEC intends to supply gasoline to neighboring islands at prices comparable to Majuro, says MEC CEO Jack Chong-Gum." The CEO further added, "MEC does not intend to compete with the private sector; instead it aims to be the main distributor and supplier of petroleum products in the RMI. This is the vision of the utility's founders when they created MEC."

The vessel will also allow MEC to meet its mandate of providing a secure and consistent supply of petroleum products to the neighboring islands, closing the gap for access to affordable and sustainable fuel in these remote areas.

MEC management states: "MEC is committed to providing affordable and secure energy supply to the neighboring islands. The purchase of this vessel not only aligns with MEC's mission to provide reliable and efficient energy to enhance the quality of life for the people of the RMI, but also with the RMI's National Strategic Plan and Energy Policy Framework."

The operation and maintenance of the vessel will be overseen by MEC's shipping division. MEC's expanded business is anticipated to create a dozen of new jobs.

The purchase is part of MEC's long-term strategy to improve the utility's economic viability. MEC CEO said, "the acquisition of this fuel tanker will greatly improve MEC's commercial platform by growing MEC's presence in the RMI and eventually in neighboring countries in the region."



*1 MEC purchased this 172-foot fuel tanker in mid-2021*



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# Tuvalu 100% Renewable Energy Target

Mafalu Lotolua  
General Manager, Tuvalu Electricity Corporation (TEC)

## INTRODUCTION:

Tuvalu is one of the countries that are 100 percent dependent on diesel fuel for its power generation. In 2008 during the World Financial Crisis, the Tuvalu Government set a target of 100 percent renewable energy for its electricity power generation.

In achieving the target of the government of Tuvalu the 10-Year Master Plan was born in 2012. The Plan has two stated goals; (i) to generate electricity with 100% renewable energy by 2020; and (ii) to increase energy efficiency on Funafuti by 30%

The 100% target is guided by the REEE Master Plan, which is directly linked to the Tuvalu National Sustainable Development Plan (Te Kakeega III) and so now called the "Te Kete", the Climate Change Policy (Te Kaniva), and the Tuvalu National Energy Policy 2009.

The Master Plan has identified the most proven and mature technologies for Tuvalu to meet its target and the Implementation Strategies are as follows:

- 60-95% - Solar
- 0-40% - Wind
- 5% - Biodiesel
- 30% - Energy Efficiency

## SOLAR:

In 2015 a major transition took place in the power generation of the seven outer islands of Tuvalu from diesel based power generation to hybrid power system which includes solar PV/battery storage/generator systems were commissioned with total capacity of 1,212kW of solar PV with storage capacity total to 244,020AH, which provide the communities with 24/7 of power supply. A total capacity of 756kW grid-connected solar PV was installed in Funafuti, which 436kW is controlled with SMA Fuel Saver and 320kW uncontrolled – feeding directly into the grid. The European Union (EU) funded the installations in three of the islands and New Zealand Ministry of Foreign Affairs and Trade (NZMFAT) funded the other four.

The percentage of the overall share of renewable was at 29% at that time and in recent times the percentage share of renewable energy has been decreased significantly because from the significant increase of demand and the ageing of the equipment.

On walking the road toward the 100% mark, Tuvalu is not doing it alone, is doing it with the assistance of the

donor community. The World Bank would install 700kWp ground mounted solar PV and 1MW/2MWh and 500kW roof-top solar PV and 1MW/3MWhr by ADB. The ADB also fund additional 224kW solar PV in three of the outer islands. It is anticipated that when the World Bank project is commission the share of renewable will increase to 37% and further increase to 49% once the ADB project is commission.

The Facilitation of the Achievement of Sustainable National Energy Target of Tuvalu (FASNETT), a GEF Funded Project in Tuvalu provides financial assistance for the installation of a 100kWp grid-connected Floating Solar PV (FSPV) demonstration project in Funafuti. The project is under progress and lesson learnt from this demonstration will improve future development of FSPV projects.

With the limited land space Tuvalu is facing, it will not be able to achieve its target. So, the TEC is now moving towards in exploring the use of building rooftops and also floating PV in the lagoon. At present there are solar PVs has been installed in few rooftop in Funafuti and are all working perfectly.



Aerial Photograph of the 77kWp Solar PV Systems at Nukufetau Island



Battery Storage at Outer Islands of Nanumea.

**WIND**

Tuvalu was a participant of the Pacific Power Association Sustainable Energy Industry Development Project (P152652) funded by the World Bank.

The project is to install of the solar and wind measurement stations. The stations were install in Tuvalu early in February 2020. The wind station was removed in June 2021 and the solar station was removed in March 2022. These stations were removed to move to another country. The data for the monitoring is under analysis and it will soon be published.

**ENERGY EFFICIENCY**

Energy Efficiency is also important to avoid additional renewable energy generation. The Energy Efficiency Act has been endorsed by Parliament in April 2016 and this will restrict the importation of five non-efficient appliances into the country, this includes refrigerators and chest freezers, air-conditioning unit, lights and washing machine. There are activities under the energy efficiency portfolio that covers by various donors and are all contributing to the achievement of the 30% as stated in the Master Plan.

The Development Bank of Tuvalu has received additional financing from the FASNETT project for the community to access the funding for the procurement of more energy efficient appliance.

**CONCLUSION**

As power generation become convenient and reliable, increases the need to use more household electrical appliances. The transition to renewable energy in 2015 TEC saved around 80% of its diesel consumption in the outer islands. As time passes, the demand increases and the equipment ages, and the diesel consumption increased.

Walking the road to the 100% mark is not an easy task and there are challenges along the way like, technically by using storage or limit the maximum output of solar/wind generation so the maximum limit is not exceeded under brief periods when there are wind gusts or the shine fully. Also the high level of RE penetration, there are challenges associated with that will raises the potential interconnection and challenges associated with system safety, reliability and imbalance and demand, just to name a few.

The 100 percent renewable energy target was set to be achieved by 2020 and then was extended to 2025. Because of the COVID-19, the delivery of the two large Utility Scale Project that were funded by the World Bank and the Asian Development Bank were delayed thus affect the contribution of increasing the share of renewable energy to the achievement of the 100 percent target. The Government is now working on setting the new date for the achievement of the RE 100 percent target for Tuvalu.

In conclusion, achieving the 100 percent target would be possible if Tuvalu walk together with the donor community. As the saying goes; "If you want to Walk Fast, Walk Alone and if you want to Walk Further, walk Together".

## Expanding Energy Access in the Outer Islands

**Gidion Moofal**  
Customer Service Manager, Yap State Public Service Corporation

In keeping with Yap's Energy Master Plan of 2018 to provide electricity access to all households in Yap by 2025, the Yap State Public Service Corporation, Yap's sole provider of energy, is looking to further its operations in the outer islands with the latest project aimed at servicing the need for sustainable and affordable renewable power generation in the outer islands.

Lamotrek and Ifalik are among Yap's outer islands that remain without publicly accessible electricity. With no current service being provided and relying solely on kerosene and gasoline for energy, the communities and individual households of Lamotrek and Ifalik are burdened with the high cost of generating their own energy.

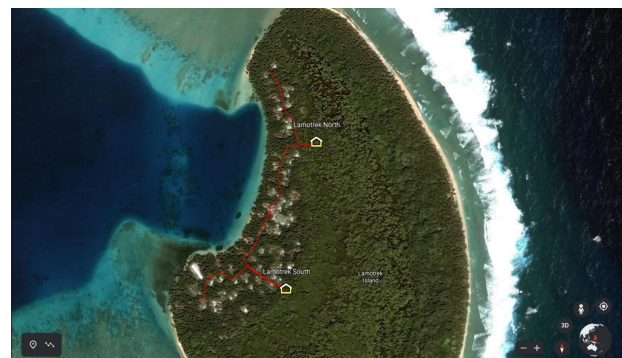
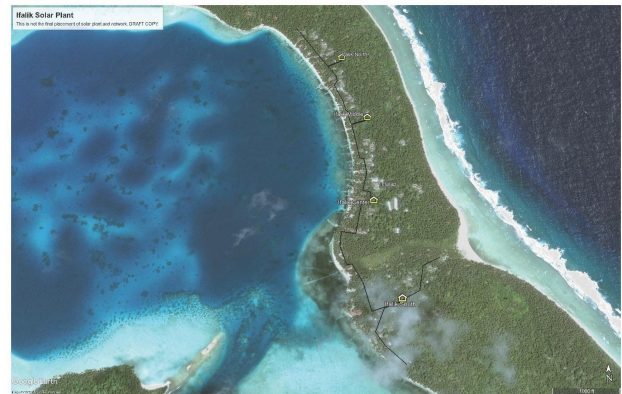
Seeking funds under the USDA's High Energy Costs Program, YSPSC proposes the acquisition and installation of two off-grid PV mini-solar grid systems directly benefiting Lamotrek and Ifalik; providing accessible electricity through the construction of centralized 100% solar mini-grids with battery backup capacity.

Averaged at less than a dollar per kwh, these mini-grid systems would better suit the islands of Lamotrek and Ifalik because of the high number of households concentrated in villages. As outer island populations go, Lamotrek and Ifalik have the benefit of high population density with a total population of 907 individuals; Lamotrek with 329 individuals and Ifalik with 578 individuals according to the 2010 census. The installation of mini-grid systems on these two islands will result in a 100% power accessibility rate.

Lamotrek and Ifalik will, each, be electrified with one PV mini-grid; with Lamotrek's mini-grid comprising of two interconnected PV microgrids and Ifalik's mini-grid comprising of four PV microgrids with the option of connecting two adjacent microgrids or all four microgrids; each microgrid powered by a solar PV plant with BESS. The distribution networks will be installed underground for easy maintenance and to protect against climate risks. Site preparations, construction and installation of the solar power systems will be manually carried out by YSPSC and community members as no earthmoving machinery will be brought in.

A team will be visiting Ifalik and Lamotrek later this year to conduct an assessment of the proposed properties; safeguarding against negatively impacting the environ-

ment, collect information on local conditions and issues, and ensure that nothing is overlooked or misrepresented that can affect the performance and effectiveness of this project.



## Akuo commissions the South Pacific's largest storage project

### Akuo Energy Pacific

Akuo, an independent global renewable energy power producer and developer, and Tonga Power Limited, the Tonga Islands' public grid operator, announce that they commissioned Tonga 1 & 2, the South Pacific's largest battery energy storage system with a total capacity of 29.2 MWh / 16.5 MW.

### A stationary battery service

The two battery storage facilities use Storage GEM®, the innovative modular energy storage container technology developed by the Akuo Group. A total of 8 such containers have thus been deployed on Tongatapu, the Tonga archipelago's main island: three Storage GEM® for Tonga 1 and five for Tonga 2. Because of the global public health crisis, the deployment of these two projects on behalf of Tonga Power Limited, signed in July and November 2019 respectively, was in large part steered remotely, helped by the substantial adaptability of the methods used and the site's organization. The containerized technology, entirely checked on test benches in the factory, easily lent itself to remote deployment.



### A resilient set-up that has already proven itself during the volcanic eruption of January 2022

These two facilities have already had an opportunity to prove their resilience. Indeed, the volcanic eruption of January 15th, which resulted in a tsunami that devastated the archipelago's coastline and cut the country off from the rest of the world, did not affect their ability to function correctly, enabling these facilities to continue operating and help stabilize the grid in the days following the catastrophe.

### Better penetration of renewable energies in the archipelago's energy mix

Previously, the Kingdom of Tonga's renewable energy capacity (3 solar farms and 1 wind farm) totaled 5.6 MW, an electricity mix penetration rate of just 10%. These two

facilities provide direct support to the grid and provide Tonga Power Limited with facilitated steering thanks to the customized EMS (Energy Management System) developed by Akuo. The Tonga 1 facility, with a capacity of 5.3 MWh / 9.3 MW, is designed to improve the grid's stability, while Tonga 2, which has a greater capacity of 23.9 MWh / 7.2 MW, is designed for load-shifting. Together, they meet Tonga's need to strengthen its storage capacity in order to support the increase in the percentage of renewable energy in its electricity mix and are contributing to the islands' goal of increasing the share of renewables to 70% by 2030. They have already allowed Tonga to double its renewable energy capacity, with the connection of 6 MW of solar supported by a private partner. The installation of these facilities was made possible by the "Tonga Renewable Energy Project" program, financed by the Green Climate Fund (56%), the Asian Development Bank (23%), the Tongan government (10%), Tonga Power Limited (6%) and the Australian government (5%).

**Jean Ballandras, CEO of Akuo Asia-Pacific,** commented: *"In 2013, the international renewable energy agency, IRENA, highlighted in its "Pacific Lighthouse" report on the archipelago that Tonga's solar energy production would be unable to cope with peak consumption times without storage solutions being put in place. Akuo decided first and foremost to tackle this issue: Tonga is now capable of installing renewable energy capacities at a much faster rate. We would like to thank the Asian Development Bank and the Green Climate Fund, who have assisted us with this project. This success demonstrates Akuo's ability to hybridize complex multi-energy systems and thus help grid operators with their energy transition".*

#### About Akuo: Entrepreneurs by Nature

Akuo is an independent global renewable energy producer and developer. The company is present across the entire value chain, including project development, financing, construction and operation. As of end 2021, Akuo had invested more than EUR 2.8 billion for a current total capacity of 1.4 GW in operation or under construction and has over 8 GW of projects under development. With more than 450 employees, the Group, headquartered in Paris, France, has a presence in 15 countries around the world. For more information, please visit [www.akuoenergy.com/en](http://www.akuoenergy.com/en)

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# *Welcome!*

## *Welcome to the New Allied Members and Member Re-Joining the Secretariat*

Two new Companies have joined and one has re-joined PPA as Allied Members since our last PPA Magazine.

The new Allied Members are;

**KHAN ADVISORY:** Khan Advisory is based in Queensland, Australia. Their primary activity is consulting and strategic advice.

**CABLES PTE LIMITED:** Cables Pte Limited is based in Suva, Fiji. Their primary activity is manufacturing of power cables for domestic, industrial and commercial purposes.

The re-joined member is:

**GENERATOR RENTAL SERVICES LTD:** Generator Rental Services is based in Auckland, New Zealand. Their primary activity is generator rental and sales and transformer rental.





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