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SEIAPI
Sustainable Energy

Newsletter of the Sustainable Energy Industry Association of the Pacific Islands Issue 1 • March 2022

Tongan Tsunami: A Catastrophic Hit on Livelihoods & Infrastructure.

Article By: Sandip Kumar (GSES) & Bruce Clay (Clay Energy)

Heavy ash deposits covering solar arrays

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.

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.

Balancing Renewable Energy and Conservation

Article By: Peter Johnston (Environmental & Energy Consultants Pty Ltd)

SEIAPI member companies typically design and install RE systems, usually PV, which are financed for PIC governments through grants and/or soft loans, or for private facilities. We tend not to consider much environmental impacts, such as those on habitats, assuming that the governments or financing agencies have adequately considered it and have included mitigation within project designs. However, this can be weak or poorly enforced and monitored. RE and protected areas (PAs) are critical tools to combat biodiversity loss and climate change respectively, and both are required for a sustainable future.

RE facilities can cover a lot of ground area, with overlapping or other uses. Estimates for utility-scale PV systems range from 3.5-10 acres per megawatt, less by siting them at lower-quality locations such as brownfields, abandoned mining land, or existing transportation and transmission corridors or on roofs. Large onshore wind facilities in the US require 30-141 acres per MW but less than 1 acre/MW is disturbed permanently. Estimates of life-cycle emissions for PV systems are 0.07-0.18 lbs of CO_2E/kWh, compared to 0.02-0.04 pounds for wind systems, 0.6-2 lbs for natural gas and far more for oil.

Should SEIAPI members be concerned about environmental impacts of increasing RE installations? Despite ambitious RE development, petroleum as a percentage of PIC commercial energy has not declined significantly in recent decades and is about the same as the world average. RE expansion needs to be accelerated considerably if the region is to achieve, or even approach, decarbonizing goals, but numerous past studies have concluded that RE investment results in significant environmental damage.

Globally, conservationists have called for 30-50% of the earth to be set aside for nature and even if this is not achieved, there could be growing conflict between RE and PAs. However, a recent comprehensive study suggests that, while conflicts do occur, they have been relatively minor and can be kept small in most countries. The study did not include PICs or other island states but suggests that even large RE development and habitat protection can be mutually achieved. However, some RE systems – particularly hydro– are often incompatible with conserving sensitive habitats for plants and wildlife both upstream and downstream and can have negative impacts on nerbyGDP. Decarbonization would also be smoother if it includes measures to

improve energy efficiency and reduce demand.

The study combined a database of PAs with maps of locations where land vertebrates are threatened according to IUCN's red list (https://www.iucnredlist.org/) with WWF's list of ecoregions (https://www.worldwildlife.org/publications/terrestrial-ecoregions-of-the-world). Both current and potential protected areas were assessed based on their ability to protect the most threatened species. About 15% of RE facilities are within PAs. Some PAs have been delisted but the study concluded that this has not been driven by RE development. Wind farms are obviously developed where there are good wind resources. However globally, other considerations (e.g., proximity to road infrastructure) were the biggest factor for PV siting. For most areas where new RE facilities are likely and habitat protection is expected to grow, conflicts are generally unlikely or can easily be avoided. There are some specific conflicts that can be hard to resolve, such as risk to birds and bats from small onshore wind turbines.

For SEIAPI members, it's welcome news that the RE infrastructure needed to meet climate objectives can be developed in a way that does not present a major threat to area-based conservation efforts. However, careful design, regulation and land use zoning is required, and donor agencies are likely to introduce stricter requirements over time. For those interested, recent industry-focused guidelines for mitigating impacts of solar and wind energy projects are freely available including a downloadable spreadsheet (https://portals.iucn.org/library/node/49283).

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

(Adapted from Imagine Newsletter Feb 2022)[1]

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, Kenya
(Source: 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 farm (Source: Giles Exley, Lancaster University)

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.

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

[1] *This is a shortened and edited version of text from articles and images available at:* *https://theconversationuk.createsend1.com/t/ViewEmail/r/6E597D45DC2E43D12540EF23F30FEDED/BA3CF08BFF8C1F1A988EF2DB2A43364C?alternativeLink=False*

Superfly Limited Commissions 38kW Hybrid System for Aola Health Centre

Article By: Gavin Pereira (Superfly Energy Ltd)

Aola is situated 50 kilometers beyond the national grid. The cost of diesel, including the cost of transporting it across flood-plain affected roads meant that a solar-hybrid system is the least cost power solution to ensure sustainable power delivery at the newly constructed Aola Health Center.

Solomon Sheet Steel, themselves a locally owned company were keen to work with local solar energy provider, Superfly Limited, in the design, procurement and construction of the solar system for the facility. The process of quoting and bidding for this work was iterative, and Superfly will be forever indebted to Solomon Sheet Steel for their persistence in working with the procurement team on the project to get our eventual design across the line.

The project commenced in early 2020 when COVID threw a spanner into Superfly's plans. Superfly had a choice to delay the install until it was safe for Gavin Pereira, its expat founder and PV engineer to fly over; or for the on-the ground team to take on the challenge to install the system. We bravely took the latter decision, and the result was amazing. Hybrids don't get much more complicated than this. Narrow East-West roof with obstacles; integrating AC and DC bus PV into the Victron 3 phase system charging a 128kWH Pylontech lithium battery bank, as well as integrating an auto-start diesel genset.

Caption: Battery racks of the Aola System

All done by Solomon Islanders with very little remote support. We commissioned it 10 months ago and we monitor it every day via Victron remote monitoring app. You can check out the performance on the VRM app: https://lnkd.in/gWEMtGx (Password is AolaHC).

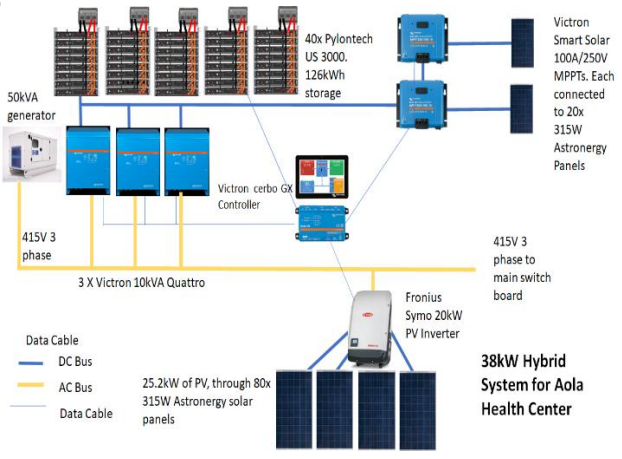
Superfly is proud of the result and wishes to share this post from Simon Burggraaf from World Health Organization:

"Superfly Limited thank you for your team's great work and in helping technically to specify and install this amazing solar platform that we hope can be adopted as standard for all AHCs. Looking forward to installing all the medical equipment and seeing how it all works under full operation - and we're confident that Superfly system will perform well!"

Superfly owes a debt of thanks to Clay Energy in Fiji. Clay Energy worked with Superfly's engineers to bring the high-level design to a fine-tuned level. Clay Energy provided Superfly with the bill of quantities and the line diagrams for the job to ensure that no parts were missed in the design and procurement.

Superfly hopes this is a new dawn for solar projects in Solomon Islands. We too can take on complex hybrid projects like our SEIAPI compatriots from Fiji and Vanuatu!

a) PV array for Aola System



b) Block diagram for the Aola System

Joint Venture: NWP Project benefits four Pacific nations

One of the sites of the North West Pacific Project

Clay Energy, Sunergise and Infratec have completed a multi-million-dollar project delivering five renewable energy plants spanning four Pacific nations — Nauru, Federated State of Micronesia, the Marshall Islands, and Palau.

The North West Pacific project represents a significant step forward in improving energy sustainability and supply resilience for the four countries, which currently rely heavily on expensive and polluting diesel fuel for energy generation and is saving 750,000 litres of diesel fuel per annum, equivalent to 2000 tonnes of CO2 each year.

Clay Energy commenced work on the New Zealand Ministry of Foreign Affairs and Trade (MFAT) contract in 2018, with grant funding from the NZ Aid Programme and the European Development Fund. All five sites are now fully operational.

Each of the countries had been relying on diesel fuel as their main source of energy production and th implementations not only reduce diesel fuel consumption but also significantly improve energy reliability and a strengthened grid utility - providing clean, reliable and cost-effective power solutions for communities at the frontline of climate change.

The JV partners installed 1.7MWp of solar PV systems across five sites, ranging from a 1.1MW solar farm in Nauru to a 65kWp/165Wh solar+battery mini-grid in the village in Kayangel, Palau. The system at Palau alone will save approximately 2000 tonnes of CO_2 over the project's lifetime thanks to displaced spending on diesel fuel. Education workshops and training were provided to those within the Kayangel community including employment for 50 locals. The skills acquisition has long-term benefits for income provision in communities which otherwise may have few employment opportunities.

Clay Energy founder Bruce Clay says, "Understandably, each of these Pacific Island nations has ambitious renewable energy targets. We are pleased that the implementation of these solar projects is already contributing significantly to their goals, and along with our JV partners, we are proud to be able to lend our expertise and support."

The North West Pacific project has been recognised for its positive impact in the region with an Energy Globe Award.

The Kayangal system in Palau was awarded a Sustainable Energy Association of New Zealand (SEANZ) Award for Best Off-Grid Implementation as a best practice example for addressing the three pillars of sustainability, economic, environmental and social.

As a whole, the initiative is an example of how government and enterprise can work together to find sustainable ways to help ensure a prosperous future for generations to come.

Grid Tied Solar System for Fiji Police HQ in Progress

Article By: Narhari Electrical Co Pte Ltd

Nakasi (Fiji) Solar Project in Progress

Newly joined SEIAPI Member, Narhari Electrical Company based in Fiji is currently installing a small 90KWp -Grid Tied Solar Power System for New Nakasi - Fiji Police HQ Project.

New Nakasi Fiji Police Solar Project on-site work started in December, 2019. The solar system capacity was proposed by the client – Fiji Police Project Lead Consultant HLK.

Narhari Electrical Company then designed the solar project product integration, installation delivery and commissioning of the project.

The detailed engineering for the project has been done by "Narhari Electrical Co Pte Ltd" as per client requirement.

Jinko Solar Panels with latest Mono Facial TR technology + Half Cell technology has been placed for the project. SPV has 9BB terminology with circular ribbon which increases the mechanical strength of the panels. Also, 9BB technology reduces the gaps between the bus bars and finger grid line leading to higher generation.

Solar Panels are integrated with Delta electronics 3 x 30 kW RPI-M30 PCE which has 2 MPPT inputs with 3 strings on each MPPT which gives a wide asymmetric SPV loading flexibility.

Installation of solar panels on the roof has been done as per the standard cyclone terrain and zone area classification.

Commercial Victron Off Grid Solar System for Ministry of Fisheries Rabi Island, Fiji

Article By: Solar Fiji Limited

Solar Fiji engineered, supplied, and installed a 24.75kWp JA Solar system with 57.6kWh Narada Tubular Gel battery storage, for Ministry of Fisheries Rabi Island, Fiji, Fiji Islands.

Rabi Island now boasts a $230,000 solar powered ice plant which will benefit 794 households living on the island and another 500 households living in surrounding islands and communities. The solar powered ice plant is another project by Government in a bid to cut down on carbon emissions through the limited use of fossil fuel, venturing into clean energy and still supportive of the livelihoods of people who depend on fishing for a living.

The current ice machine capacity is 750kg and requires 15kVA of maximum power with a surge of 21kVA for the start-up.

From the short duration since the solar-powered ice plant was installed on 4 December through to 22 December, the amount of ice produced and sold to both licensed and non-licensed fisherfolk was 3,588.32 kg with a revenue of $466.80.

Project brief:

- 24.75kWp of PV using 75 JA Solar 330W Modules and is DC coupled by 5 Victron Smart Solar

Charge Controllers 250/100.

- 57.6kWh of Battery Storage using the Narada 2V 600Ah Tubular Gel Batteries.
- 3 Victron Quattro 48/8000 inverters.

The system utilizes the Colour Control GX for live system performance data and allows the system to be monitored remotely via the free Victron VRM.

The system is designed to deliver three phase power to the ice plant.

Off grid Solar Project on Rabi Island, Fiji

SEIAPI Website Update

The SEIAPI website is under development to facilitate a members only page for SEIAPI members that will contain tenders, webinar links and other training and professional development resource. More benefits for SEIAPI members are being planned.

Tell us what important technical topics you wish to see in the next newsletter and we will try to get them to you.

Email your topics on secretariat@seiapi.com or info@seiapi.com or admin@seiapi.com

Technical Article

AS/NZS 5033:2021 Update – What You Need to Know

As part of the solar industry, you're probably accustomed to the 2014 version of the standard, which had two amendments published in 2018. In November 2021, this standard was updated to reflect the rapid growth of this industry and provide updated safety practices. Knowledge is power, and these changes could impact your business as you transition over to the new standard.

This standard is now the current version, but installers and designers will need to check with their state/country regulator to determine if they will be enacting a transition period of six months from the date of publishing as stated within the standard. During the transition period, installers and designers can opt to use AS/NZS 5033:2014 or AS/NZS 5033:2021, but not parts of each. The updated version of the standard can be purchased from Standards Australia, SAI Global or Techstreet.

What's new in the 2021 PV array installation and safety requirements standard?

To start, the 2021 version of this standard is slightly longer than the previous 2014 version at 142 pages compared to 125. Although that may seem tedious to read, the 2021 version has addressed this concern with a more reader friendly and simplified layout. Many of the extra pages come in the form of extended appendices which provide helpful examples and explanations useful for understanding the standard. In addition, several clauses have been removed, rewritten or restructured to reflect this new approach.

Why are these changes necessary?

In short, the updated standard aims to tackle key issues which have arisen due to technology changes and shifting industry expectations since the previous version. The most important changes for designers and installers are:

- Scope of the standard
- Maximum system voltage
- PV circuit current calculations
- Changes to d.c. rooftop isolator requirements
- Disconnection points
- Conductor sizing and selection
- Installation of cables in the ceiling space
- Other cable and DC isolator installation changes
- Signage and documentation

For information on the changes, please visit the technical article by GSES:

https://www.gses.com.au/deepdive-on-as-nzs-50332021-update/