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SEIAPI Sustainable Energy

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Increasing Access to Renewable Energy Project (IAREP)

Article by: Tuvalu Electricity Corporation

Currently, 19% of the energy mix in Tuvalu is derived from solar sources (16% in Funafuti and 60-70% in the outer islands)

The Government of Tuvalu through the Tuvalu Electricity Corporation (TEC) received funding from the Asian Development Bank (ADB) for the implementation of the utility renewable energy project title "Increasing Access to Renewable Energy Project (IAREP).

The project is to install 500kW$_p$ rooftop solar photovoltaic; 3MWh storage; and associated modern control systems on Funafuti. The output will enable Funafuti to reach 32% renewable energy penetration.

For the Outer Islands, the installation of climate-resilient ground-mounted solar photovoltaic system to achieve >90% renewable energy contribution. The output includes: (i) 44.8kW$_p$ solar photovoltaic capacity for Nukulaelae; (ii) 78.4 kW$_p$ solar photovoltaic capacity for Nukufetau; (iii) 100.8 kW$_p$ solar photovoltaic capacity for Nui; and (iv) associated modern control systems.

The project is expected to displace 6.7 million litres of diesel fuel over the project lifetime and avoid 17,800 tons of carbon dioxide equivalent (CO_2e) GHG emissions over its lifetime.

The project is under construction by CBS Power Solution Pty Ltd, a Fiji based company. The construction work is about 70% complete and it is envisaged that by May/June 2024 the construction work will be completed.

Solar Waves: Vision Energy and Fiji Ports Team Up for A Cleaner Port Experience

Article by: Vision Energy

Fiji Ports, a vital hub for trade in the Pacific Region, has embarked on a transformative journey towards sustainability through its Green Port initiative. Recognizing the urgent need to address climate impacts, Fiji Ports launched its Green Port Master Plan 2019-2023, with a clear vision of becoming the Smart, Green Gateway for trade in the Pacific Region.

We are immensely proud to partner with Fiji Ports on this groundbreaking Green Port initiative, together, we are pioneering a paradigm shift in the way ports operate, demonstrating that environmental responsibility and economic growth can go hand in hand.

The cornerstone of this collaboration is the deployment of cutting-edge solar panel technology across key locations within the port infrastructure. Through careful planning and execution, we have installed solar panel systems at three critical sites:

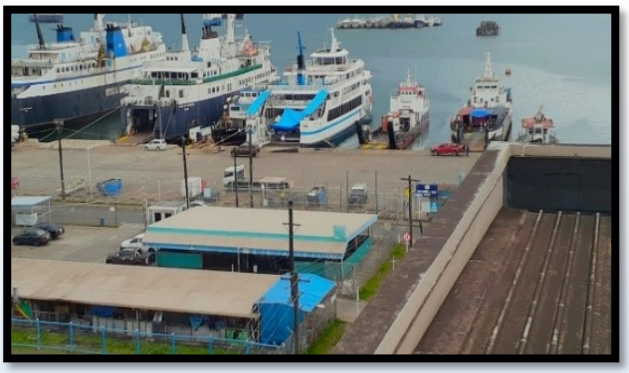
Phase 1 saw the installation of a 6.15kWp Container Roof Top System, harnessing solar energy to power essential operations within the port. Since its inception, this system has generated an impressive 5.95MWh of clean energy, significantly reducing reliance on traditional power sources.

Building upon this success, ***Phase 2*** introduced a 22.14kWp Waiting Shed Roof Top System at Narain Jetty, further bolstering Fiji Ports' renewable energy capacity. With an energy output of 21.88MWh as of 2023, this installation has proven to be a beacon of sustainability, illuminating the path towards a greener future.

The culmination of this collaboration is ***Phase 3***, featuring a 28.29kWp solar panel system atop Fiji Ports Headquarters in Tofu Street, Walu Bay. Expected to generate 35.50MWh of clean energy.

Central to the success of these installations is the utilization of Trina 410Watt 144 cells Monocrystalline panels, renowned for their efficiency and durability. Coupled with SolarEdge inverters, these systems ensure optimal performance and reliability, even in challenging environmental conditions.

We are dedicated to assisting Fiji Ports in reaching its sustainability objectives. By collaborating, we believe that we can combat climate change and contribute to the development of a Fiji that fosters pride for all.



Nauru's 6MW ADB Solar Development Project Update February 2024

Article by: Nauru Utilities Corporation

INTRODUCTION

The Republic of Nauru, referred to as "Nauru", is a Pacific Island country, has approximately 13,000 residents. It predominantly sources its energy through diesel power generators. About 8% of its current energy demand is sourced from renewable energy - solar Photovoltaic (PV) installations. The Government of Nauru has a target to increase the annual energy renewable penetration within Nauru to 50%. Based on the Nauru Solar Power Expansion Plan, the construction of 6 MW solar farm coupled with 2.5MWh/5 MWh of battery storage is designed and is currently under construction. The demanded facilities include a 6 MW (nominal installed AC capacity) Solar Farm. A Battery Energy Storage System (BESS) with a capacity of 2.5 MWh / 5 MWh and an 11 kV Substation, including all switchgear, power transformers and connection to the existing NUC 11 kV distribution system. The completion of this project assumes 48% solar contribution to Nauru's energy demand.

PROJECT AIM

The aim of the Nauru Solar Power development project is to

- Increase the supply of reliable, cleaner electricity for Nauru.
- To decrease the cost of power supply through replacing diesel-generated power with solar generated powers.
- Reduce greenhouse gas emission through development of renewable energy.
- Provide stability of power supply throughout the day.

PROJECT STATUS

Key milestones dates identified in the baseline program and most recent program are shown in the table below:

Milestone	Baseline Program	Current Program
Project commencement	August 3, 2020	January 13, 2021
Completion of detailed designs	October 7, 2020	February 30,2023
Procurement commences	August 10,2020	May 11, 2021
Equipment arrival in Nauru	December 20, 2020	December 9,2023
Works commence at site	December 10, 2020	December 3,2021
Commissioning commences	April 13, 2021	November 1,2023
Practical completions	August 3, 2021	31 July, 2024

The project contractors and all stakeholders are working persistently for a practical completion date set at 31 July 2024.

CONSTRUCTION

Civil works has been completed. The only remaining construction activity at the site is the installation of the BESS inverters, installation power transformers and installation of electrical switchgears.

We have now completed 67% of the project and aim to complete the remaining 33% by July 2024.

PICTORIAL VIEW

Taloa Celebrates Lifeline: Solar Water Pump Project Transforms Lives for 700 Islanders

Article by: Department of Energy, Vanuatu

A solar water pumping system in

In a landmark ceremony, the Taloa Solar Water Pump Project on Nguna Island, was officially handed over to the Taloa Community by the Global Green Growth Institute (GGGI), marking a turning point for over 700 islanders who have long struggled with water scarcity.

Funded by the government of Luxembourg through GGGI, the VT2,417,000 million initiatives, with additional support from the Vanuatu National Green Energy Fund (NGEF), saw a VT120,000 loan repaid by the community during the grand handover.

This transformative project, realised in collaboration with the Department of Water Resources (DoWR), NGEF, Department of Cooperative, and Department of Local Authority (DLA) through Area councils, aims to address the chronic water issues of the Taloa community. Home to over 400 residents and more than a hundred households, the Taloa community faces acute water shortages during dry seasons, compelling some to migrate to Port Vila for survival.

The solar-powered water pump system promises a sustainable solution to their decades-long struggle for access to natural, clean, and safe water sources.

Paramount Chief Mariwota Matau Nasu conveyed heartfelt gratitude to GGGI and the government for their unwavering support. “This project is an answer to our pleas”. We no longer must trek up hills or into the jungle for water. “Our laundry, cooking, and drinking needs are now met right in our yards,” he shared.

Netty Edwin, a relieved mother in the community, reflected on the laborious daily routine of fetching water and doing laundry in the hills. “Now we are very glad that we fetch our waters just in our yards.

“We do our laundry just near the house…we are grateful to the government for answering our needs by assisting us to set up our water supply system,” she expressed.

Notably, this water system not only caters to the Taloa Community but also extends its reach to the Junior Secondary School on the island, accommodating a total population of 313, including staff and students.

Nobert Maass, the GGGI Country Representative for Vanuatu, Fiji, Tonga, and Kiribati, revealed that the project, initiated in 2019, has successfully delivered solar-powered water pumps to over 20 thousand beneficiaries and communities in Vanuatu.

Expressing optimism, he stated, "We hope these projects will have a major impact on the communities, helping them to access water more easily and reliably." The Taloa Solar Water Pump Project stands as a beacon of hope and progress for islanders who can now embrace a life enriched by a consistent and accessible water supply."

Joshua Nari, the NGEF Vanuatu Program Supervisor, clarified that this is Phase 2 of this project, known as Scaling- up Climate Resilience through Solar PowerDriven Access to Water.
According to him, there are 15 sites altogether, 4 on Tanna, 1 on Ambae, 1 at Erakor Half road, 1 on Nguna, 4 on Santo, and 4 on Malekula.
He stated that if any community aspires to implement a comparable water system; the most effective approach is to collaborate with Area administrators.
By doing so, they can channel their requests to the provincial headquarters, facilitating subsequent communication with the DoWR. This streamlined process ensures that negotiations and necessary work can be initiated, mirroring the success achieved in this endeavor.

How Extreme Weather & System Aging Affect Photovoltaic Performance?

(Extracted from https://cleantechnica.com/)

Small changes in energy production are frustratingly difficult to measure, especially in the noisy and often incomplete data of a PV system's production. The National Renewable Energy Laboratory (NREL) has assessed data from 25,000 inverters across nearly 2,500 commercial- and utility-scale PV sites in 37 American states and territories.

Although the study was limited to US-based PV systems, results are of interest to tropical installations. Overall, PV systems are degrading at a modest rate of about 0.5% per year, within expectations. Systems in hotter temperature zones exhibited about twice as much performance loss as those in cooler climates (0.88%/year and 0.48%/year loss, respectively). The mean age of systems in the data set is 5 years. Short-term outages caused by extreme weather — PV modules being disturbed by strong winds or inverters being damaged by flooding—have been minimal, 1% median loss in annual performance.

Systems damaged by winds above 90 km/hour (56 mph or 25 m/sec) also displayed an interesting trend, with parts of some systems avoiding damage, possibly due to site-specific phenomena such as wind shadowing from adjacent structures, which helps reduce wind speeds. The analysis did not suggest that PV systems are unreliable or especially vulnerable to extreme weather. For more information, please click here: How Extreme Weather & System Aging Affect the US Solar Photovoltaic Fleet

Solar energy and climate change are killing future hydro plants in Africa. (Sept 2023)

(Extracted from: https://www.zmescience.com/ecology/renewable-energy-ecology/solar-energy-and-climate-change-are-killing-future-hydro-plants-in-africa/)

This is a summary of an article arguing that solar energy is becoming so cheap it's potentially making hydro power obsolete, at least for Africa. The arguments may be relevant to the Pacific Islands and thus of interest to SEIAPI members. The full article is at the above link.

At least on paper, the case for hydroelectric energy seems very strong in Africa. Abundant rainfall, massive rivers, and huge waterfalls — the geography seems to be an excellent fit for hydropower, and many countries are using expanding it. Africa is only exploiting around 10% of its hydropower potential, and there are plans for considerable expansion.

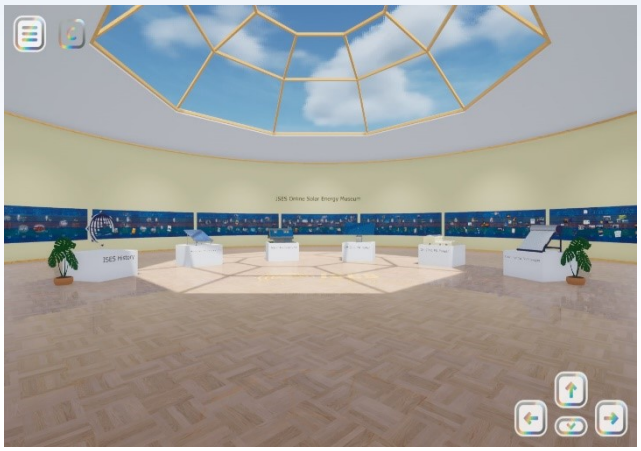
However, a new modelling study suggests that investing in more hydroelectric projects may not be the wisest approach.

Solar is cheaper. The researchers assessed the most cost-effective way for Africa to meet its energy demand by 2050. They compared the costs of hydropower, solar, wind, nuclear, natural gas, coal, and others. They also estimated the cost and benefits of every possible future hydropower project in Africa. The study's complexity is unprecedented, including everything from population growth to river flow and interplay between different plants. Ultimately, in many cases it's better to simply not build the hydroelectric plants: 67% of possible future hydropower plants are probably not worth the investment. Solar is expected to become the cheapest form of electrical energy for Africa.

Climate change. We're already seeing the effects of climate change, but in the next several of decades, these will almost certainly intensify. Drought is among the most prominent effect and is a game changer for hydropower, makings river volume less reliable, and requiring more investment in maintaining the plants. This is another reason why solar will emerge as the more attractive technology in the long term.

ISES ONLINE SOLAR ENERGY MUSEUM NOW OPEN TO VISITORS!

Earlier this week, representatives of the ISES Online Solar Energy Museum committee and members of the ISES solar community came together to celebrate the launch of the updated ISES Online Solar Energy Museum.



Initiated in 2020 to celebrate 50 years of ISES Solar World Congresses, the museum highlights and celebrates the many individuals, research institutes, companies, NGOs and many more who made solar what it is today - a booming global industry. This online museum allows research institutes, companies, and individuals to tell their stories about how they helped develop an industry that has grown from watts to gigawatts.

Starting all the way back in the 1950s, the online museum presents important actors, research, inventions, historical events, displays of early products and solar records from every decade as well as the many individual solar and renewable energy pioneers that pathed the way for the industry to grow to what we know it to be today. During the launch, Geoff Stapleton (Chair of the Museum Committee) welcomed the audience and provided a first tour through the virtual museum. Larry Kazmerski (NREL) set the stage with an introduction into the history of both solar and ISES and Museum Committee Member and past ISES Board Member Paulette Middleton provided further background on the museum's development.
The event concluded with discussions on what future developments are planned for the museum and how to become a supporter or friend of the museum and/or how contribute to the museum by submitting material. In case you missed the launch event, a recording is available here.

The museum is now open to visitors - enjoy a walk-through solar history and together, let's look ahead to many more decades of spectacular solar growth!

Technical Article

SOLAR INSTALLATION: COMMON MISTAKES AND BEST PRACTICES

Courtesy of GSES Technical Team

GSES has been part of the Clean Energy Regulator's inspection program for many years and has seen all sorts of good, bad and ugly systems. This article will explore the most common issues found during our inspections and how to improve installations so that installers can rest easy knowing that they won't have compliance issues but also that their customers are happy and safe.

ROOFING PENETRATIONS

Where the PV array cable and conduit passes through a tile or steel roof, a fit for purpose collar flashing, such as dektite should be installed.

IMPROPER ROOFING PENETRATIONS

In this instance below, we can see that the cabling is passing through a tin roof, however no dektite or flashing is installed. This improper installation could lead to water ingress into components and can cause severe damage to the system and surrounding components. To correct this, the installer must reinstall using a dektite (or similar) and a UV stabilised sealant. Adding additional silicone to the penetration will ensure that it provides a waterproof seal. The installer should also install a suitable cable gland on the end of the conduit leading to the roof penetration to avoid this issue.

CORRECT ROOFING PENETRATIONS

The below image illustrates the correct utilisation of dektites and flashing for roof penetrations in a rooftop PV system. The system is fully sealed against water ingress, ensuring the longevity of the system.

EARTHING LUGS AND WEEBS

Proper design and installation of the earthing system is crucial to the system's operation. Earth faults can pose several risks to the system and to people around it including: electric shock, fire hazard, damage of other components, and voltage drops that lead to reduce performance.

Earthing lugs and WEEBs must be used to connect the equipment to the earth. It is also important to use an anti-corrosion spray on the lug to avoid it corroding.

IMPROPER EARTHING

In the image below right, a WEEB is not correctly installed which risks the grounding of relevant panels. The WEEB should be attached firmly on the panel to ensure that it bears the electrical current.

The image below left, an earthing lug is sprayed, but it is in contact with the panel surface itself. This could potentially cause a short circuit and even hotspots to appear on the panel, severely damaging the system and harming performance.

PROPER EARTHING

A well-earthed system has every module earthed. Importantly, removing a module won't compromise the earthing of any other module. All lugs and WEEBs should be installed as per manufacturer specifications and should be protected from moisture using anti-corrosion coating.

We recommend using earthing (WEEB) washers with all mid clamps to ensure that none are missed. It is also important to be careful when laying the modules as the metal frame can scratch the WEEB washer and make it less efficient when conducting currents.

CABLING AND CONNECTORS

Improper cabling terminations and connectors are a common point of failure for PV systems. Cabling should be installed with sufficient conduit protection, and appropriate glands. A multi-hole gland shouldn't be used for a single cable if it means leaving a hole exposed.

The connectors between the panels must always be of the same make and model to ensure a perfect fit. Connectors that do not match have a high risk of coming apart, possibly leading to dust and water ingress, which can cause faults on the system and arcs to form.

IMPROPER CABLING

The image below demonstrates an improper connection between a conduit and a gland, leaving the potential for water ingress into the conduit. Even with an appropriate drain at the lowest point in the conduit the exposed cabling poses a risk.

This image has no conduit at all, leaving the cabling itself hanging loose and exposed to the elements.

PROPER CABLING

A good cabling will be organised, sealed, labelled and well-terminated. Some good practices include ensuring that:

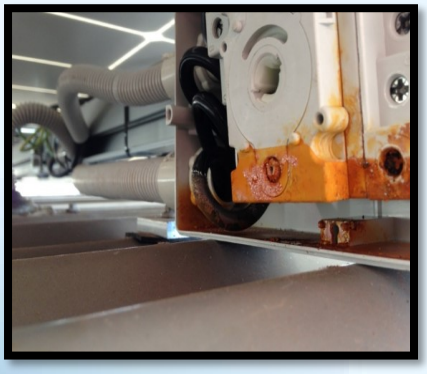
- The conduit is labelled every couple of meters
- Drains are installed at the lowest point of conduits, and their lowest point isn't the switchboard or any sort of conductor termination
- Module cabling on the roof isn't loose and isn't resting on the roof surface
- New holes haven't been drilled into enclosures, even the bottom. This is a common mistake that compromises the weather resistance of an enclosure
- There aren't more cables run through the gland than holes provided in the gland, and spare holes are sealed with a manufacturer-provided plug

ISOLATORS

Isolators should be installed in accordance with the relevant manufacturer guidelines, their relevant ratings and in accordance with AS/NZS 5033:2021.

IMPROPER ISOLATOR INSTALLATION

Failure to do so can result in water ingress, even if the isolator is located under the panel like in the image below. Water ingress could lead to failure of the components, and in worse cases cause fires that can damage the entire system. Installers should also check the seals between the isolator and conduit – the isolator entry shouldn't be the lowest point of the conduit as this could result in water ingress. The isolator should also be properly resealed after removing the cover when installing the system.



PROPER ISOLATOR INSTALLATION

A good (and compliant!) isolator installation is in the shade (often beneath panels, but a cover as described in AS/NZS 5033 is also acceptable) with precautions taken to prevent weather ingress. It needs to be easily accessible and well labelled. The below is an example of a correctly installed isolator.

SIGNAGE

It's easy to think signage isn't necessary, but it's very important not just for residents, but also for the next tradespeople at site and emergency services. A PV reflector clearly signals the presence of a system to isolate if necessary, and a DC cabling warning placed as required by relevant standards could prevent a bad accident for anyone working in the roof space.

IMPROPER SIGNAGE

The 70mm green PV reflectors commonly sold do not meet the requirements set out in AS/NZS 5033:2021 5.4. The below left reflector is missing an indicator of isolation method (e.g. "DP"). The reflector on the right cannot be expected to last the lifetime of the system, and would require a replacement from the installer very quickly.

PROPER SIGNAGE

There's a lot of signage that's required in Australia, and it can broadly be found in the up-to-date editions of AS/NZS 5033, AS/NZS 4777 and AS/NZS 3000. It's also a very common area where installers are pulled up. Whether it's the neutral wire being unlabelled in the switchboard, disconnection point indicators being in the wrong place or the site plan missing key information such as the address, there's a lot to keep track of. However, an exemplar system will have all signage necessary which will ensure any future work on or nearby the system is as safe as possible. The below picture is an example of good signage.

INVERTER INSTALLATION LOCATION

The inverter should be installed in an appropriate location for its IP rating and should not be exposed to direct sunlight for the majority of the day. Installation in a spot exposed to direct sunlight would result in a faster degradation of the inverter to the point where water resistance could be compromised or maintenance can't be performed without damaging the enclosure. The inverter should be installed in a well-ventilated area, away from direct sunlight as indicated in the picture below.

CONCLUSION

When shortcuts are taken in solar installation, things can get ugly quickly. Whether this is just needing to replace a component or widespread ceiling damage from an improperly sealed roof, avoidable repairs and replacements are costly and compromise the efficiency and longevity of systems. Repeated issues with installations can also risk the loss of accreditation, so being rigorous on your installation practices is critical, saving you time, money and reputation in the long run.

UPCOMING CONFERENCES

- **31st PACIFIC POWER ASSOCIATION CONFERENCE WILL BE HELD FROM 30th September – 3rd October 2024 AT THE FALEMASIVA HALL - KINGDOM OF TONGA. PLEASE VISIT PPA WEBSITE FOR MORE INFORMATION. (https://www.ppa.org.fj/)**
- **5TH EDITION OF THE INTERNATIONAL CONFERENCE ON SOLAR TECHNOLOGIES AND HYBRID MINI-GRIDS TO IMPROVE ENERGY ACCESS.**

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